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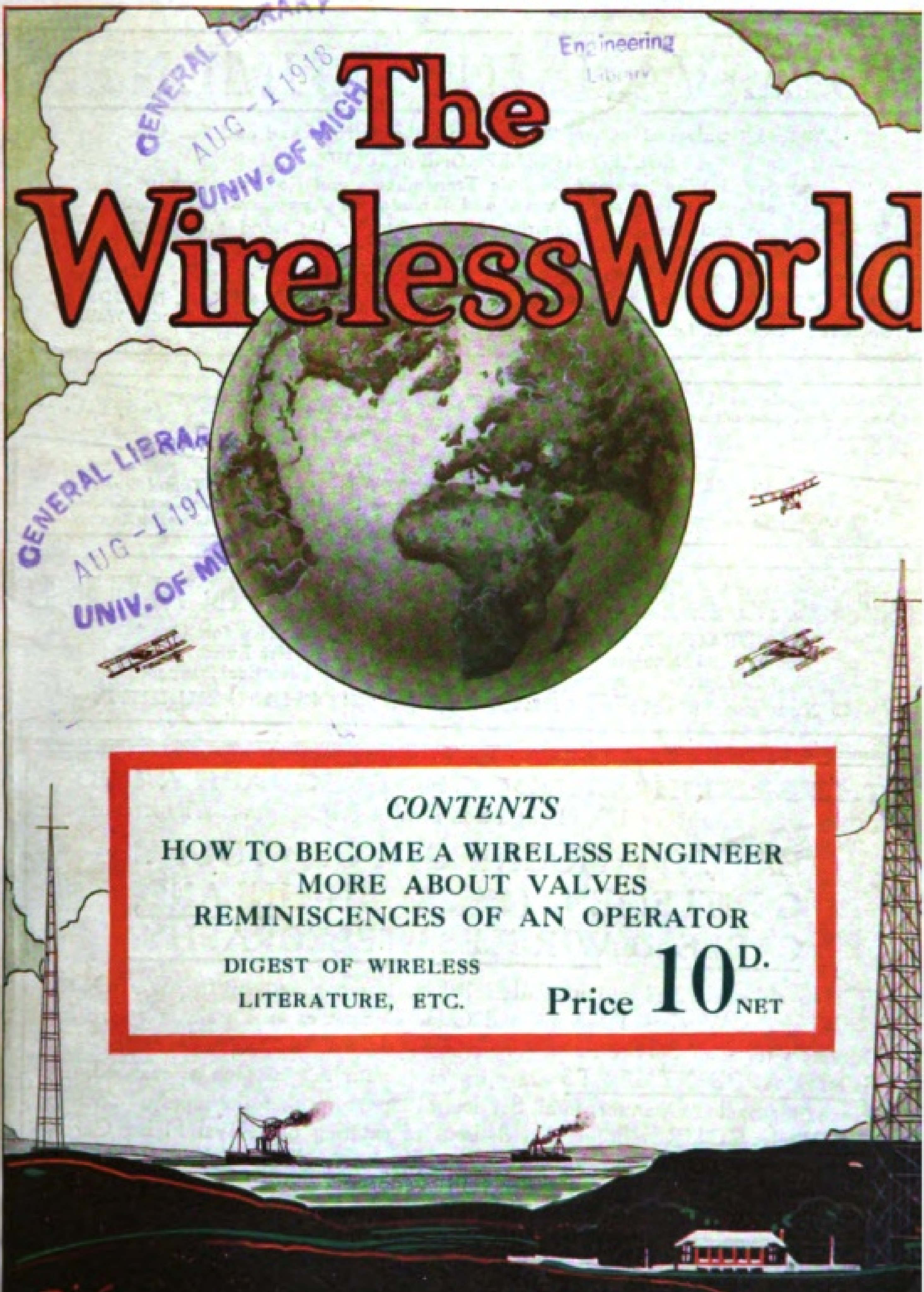
The Wireless World



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The WIRELESS WORLD

Volume VI. No. 62. MAY, 1918.

Reminiscences of an Operator

By W. D. OWEN

How the Skipper was Converted

FROM the very beginning the skipper made it perfectly plain to me that he resented the introduction of wireless telegraphy on his boat. Had he not spent forty years of his life on ships without it, and never been inconvenienced by its absence ? Had he not sailed the Seven Seas and helped to make Britain's prestige what it was before wireless was invented ? He considered it " darned impertinence " on the part of foreign Governments to " require apparatus and operators for radio communication " on British vessels that honoured their seaports by calling at them. Moreover he strongly objected to having a " passenger " on his articles for the sake of a few paltry signals, when all his officers were skilled in the use of flags, Morse-lamp, semaphore, and so on *ad nauseam*.

It may have been due to the latent conservatism of a sailor past middle age, or perhaps it was just a case of mental inertia, but the fact remained—I and my gear were not wanted. This, of course, was before the *Titanic* disaster had wiped out all such prejudices and demonstrated the advantages of wireless telegraphy beyond all possibility of dispute. In pre-*Titanic* days shipowners were inclined to regard wireless as an unproductive expense, and skippers looked upon it with suspicion because it was probably the one thing on board that they knew nothing of. But Uncle Sam's laws must be obeyed by those who use his ports, particularly when $5,000 is the penalty for default. So, as the lesser of two evils, I was permitted to remain.

The officers took their cue from the skipper and froze me out. The engineers might have taken kindly to me but for the fact that I used their "juice" and could demand to have the dynamo started up if required for wireless purposes. The idea of generating electricity for some other bounder to use was all the more distasteful because the bounder in question did not know the difference between a thrust-block and a spragging-iron, but probably knew more about their own dynamos than they did themselves.

So by the time we got round to "Gib" I was heartily sick of my own company, and would have kissed the bo'sun's mate if he'd spoken a kind word, but even he regarded me as "one of the blinking gold-lace brigade."

I amused myself by watching the scenery when there was any, and, failing that, by hanging over the bows and watching the flying-fish dispersing in all directions.

Driven to the seclusion of my cabin one day by a sharp shower, I found a decrepit copy of Haeckel's "Riddle of the Universe" stuffed into a ventilator to keep the draught out. The fact that I essayed to read it, and eventually got quite interested, indicates the state of my mind at the time. I must confess that I skipped "embryonic development," "psychic gradations," and "phylogeny of the soul," and had struck some really clever stuff about matter and ether. In my circumstances no wireless enthusiast would have resisted these pages.

While thus engaged I had my first visitor. It was the purser. He was a kindly soul, but there were other reasons for his visit, as I found out later. After a few banal generalities he picked up Haeckel and was visibly impressed. I poured silent blessings on to the head of the unknown owner of the book for the kudos he had bequeathed to me. I rather fancy that Haeckel saved me from certain vague unexpressed duties relating to the tallying of cargo and the copying of manifests. However, he told me in casual conversation as it were that the old man shied every time I got into his line of vision, and had said to him only that morning: "Can't you find that wireless chap something to do?"

Following up my advantage, I generously offered to "help him out" if he found himself "up against it," well knowing that he'd sooner die of overwork than ask me for help after that.

The s.s. *Neuralgic* was a pretty big cargo boat built on modern lines, with accommodation for a few passengers, who dined with the captain and officers in the saloon. Conversation was always brisk at the table, and covered every subject under the sun. So far they had totally ignored my presence, and did their talking past me, over me, and through me—a proceeding that interested me immensely, for it gave me the opportunity of discovering that the average man is a poor debater. My first few days at sea taught me that, although a few voyages might broaden a man's mind, a lifetime of it has just the opposite effect.

TYPHOON BAY, HONG KONG—THE CHINESE JUNKS' AND SAMPANS' REFUGE WHEN TYPHOON WARNING SIGNALS ARE DISPLAYED.

I was not at the captain's table, in fact I had my back to him, but his voice dominated the table talk. Curiously enough, wireless telegraphy was frequently mentioned one way and another, but I was not a party to these discussions, until one day the question of automatic calling-up apparatus was raised. A passenger had the temerity to question a statement to the effect that the wireless gear was useless unless "someone was glued to it all the time," and for the first time I was appealed to. Consciously or unconsciously the skipper had so worded his question as to constitute what was virtually an invitation to dig my own grave. "Suppose," said he, "the *Rheumatic* was within range and sent out distress signals in the middle of the night when you were in your bunk, would that box of tricks of yours enable me to render service ?"

Momentarily I was nonplussed by the form of the question, and answered meekly enough that it would not. "What did I tell you ?" he said, turning to the passenger. "It's just a fad, and nobody realises its limitations better than those who operate it."

"Excuse me, sir," I said, butting in, "but you based your argument on a supposition. Allow me to suppose that I was not in my bunk at the time, but was on duty, and the chances are in my favour, for I am never in my bunk more than seven hours out of the twenty-four ; the story would have a very different ending, would it not ?"

"Oh, I'm not saying it's altogether useless," he replied ; "my contention is that its limitations are greatest in just those directions which offer the largest sphere of usefulness."

"But we haven't reached the zenith yet," I pointed out. "The story of wireless telegraphy is still in its opening chapters, and even now I make bold to say that there's not a single thing that you can do with your flags, semaphore, Morse-lamp and rockets that I can't do infinitely better with the wireless gear. The limitations to which you refer apply to your own signalling devices to at least the same extent, and I doubt if you'd care to sail without them."

The skipper seemed tickled by my spirited defence, and was by no means annoyed at being bested in argument; he merely said as a parting shot while folding up the serviette, "Very well, it's up to you to show us what you can do."

Some weeks afterwards I found that we had arrived in the typhoon region, and naturally the conversation frequently drifted to this topic. I heard many tall stories of the violence of these cyclonic storms peculiar to this part of the globe, and was firmly convinced that my leg was being pulled. So I remarked that I'd very much like to experience one, as it would give me something to write home about. The abuse I suffered convinced me that they were in earnest, and the typhoon as a topic of conversation was thereupon dropped.

The weather was champion, and we left Manila behind us, spent a few days in Hong Kong, and then headed for Kobé. I found Kobé a delightful place, and did not share the skipper's anxiety to get away, but the "autocrat of the saloon table" had his own way, and we were soon at sea again. Meanwhile a breeze had sprung up—a nasty jerky breeze that would almost take a door off its hinges one moment and fizzle out just as suddenly the next. The sea, too, had a peculiar motion, and the atmosphere was oppressive. These things were of no significance to me at the time, for this was my first voyage.

There was little wireless traffic about at the time. A Japanese station was busy with its monstrous code, and some U.S. Revenue cutters up north were exchanging signals. One of them made reference to a typhoon, and gave us some meteorological data, but it was addressed specifically to a certain ship, and it did not occur to me to mention the matter to the skipper. So, for a change of scenery, I went up on deck.

By this time the sea was running pretty high, and the horizon seemed perfectly inebriated. I found much interest in watching Dame Nature in a threatening mood, but I did not expect to see her lose her temper as she did. The motion of the ship became more and more accentuated, and the bo'sun got his men busy shifting all the loose tackle before any got lost overboard. And then the wind came! It howled and whistled and shrieked. At times the roar was like a prolonged explosion. Usually our boat had a slow roll, but she had now become quite frisky. Great waves broke over us and swished about from side to side. The weight of them was enormous; one of the port lifeboats crumpled up like matchwood. Every man on the ship got busy shifting or lashing down movables. We rolled about like skittles. One got his arm broken.

The captain ordered the bows to be brought round to the wind and rang down for half speed. Everybody was busy for a while—the officers in their respective departments, the engineers preparing for a busy night, crew battening down hatches, lashing tackle, etc., and the passengers all busy with urgent private affairs.

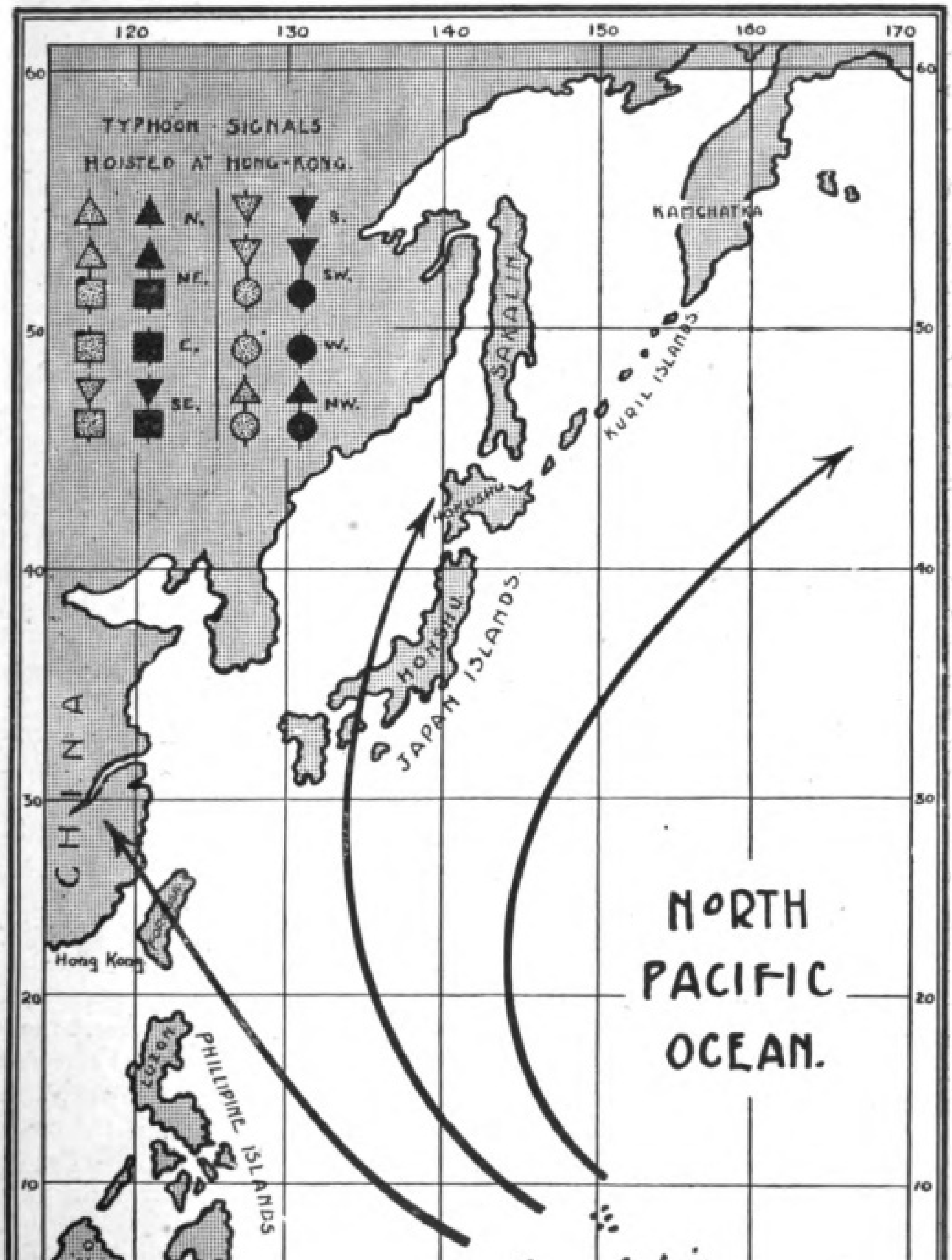

CHART SHOWING THE REGION AFFECTED BY THE TYPHOON.
POINT OF ORIGIN AND DIRECTION OF ITS TRAVEL.

My inexperience cost me rather a bad ducking, for one wave caught me and brought me to my knees. The water trickled out of my sleeves and trousers-legs, and the wind seemed determined to strip me of my clothes. So I moved round to the leeward.

Since we came round to the wind the motion of the vessel had altered. The roll from side to side was less marked, but she would duck her head and the propellers would come out of the water, then the racing of the engines would shake the whole boat. Once when she ducked the whole of the fo'castle-head disappeared in the water, and then rising again the water poured off like a miniature Niagara. The wind was so fierce that the crests of the waves were whipped off and driven before it with a force that made drops of water feel like leaden bullets.

One would see a mountain of water advancing, and watch it fall with a crash over the deck and deck-houses, pour through the alleyways to the scuppers. Number 1 hatch was stove in, and the mate fairly raved. In the cabins boots and shoes, stools and oddments swished about in the water.

I went to my cabin to send word ashore that the typhoon had struck us, but couldn't work as all the insulators were wet. The chief was alarmed at the sparking across the insulators and begged me to desist. So I shut up shop. For five solid hours were we submitted to this buffeting, and about half-past ten at night there was a lull. The wind vanished and the sea became reasonably calm, so we went to our bunks. But shortly before midnight it came on the starboard side with renewed vigour. The strain on the ship must have been tremendous. One could hear the bulkheads creaking, and through it all the great syren moaned as the wind tugged at the lanyard. Sleep was out of the question, for not only was the noise terrific but one had to hang on to the bunk or be pitched out.

Not until five o'clock in the morning did we run out of it, and then we settled down to a couple of hours' nap.

We had come clean through the centre of the typhoon!

It was a sore-headed and grumpy crowd that met at the breakfast table that morning, and the purser said to me: "Now you know what a typhoon's like I guess you won't be anxious for an *encore*." I agreed that I'd spent a restless night and had a marked objection to losing my beauty sleep, and mentioned incidentally that I'd intercepted a message about it the day before. "What?" he exploded, "you got a typhoon warning and kept it to yourself?" I nodded.. "Well, if the old man ever gets to hear of it he'll make you feel like five cents in the dollar. You've missed the finest chance you're ever likely to get of showing him what you can do." Realising the significance of this remark, I felt at a discount right there, but I made a mental resolve to grab Mr. Opportunity by the forelock next time he came my way, and make him help me to redeem my slip. It was not until several weeks later, however, that I got another chance.

We were returning to the Orient after spending some time in ports on the Pacific coast of America and Canada, and once again the skipper found the barometer of more than usual interest. Apparently he had learnt something in the States, for he sent a quartermaster along with a message telling me to get a weather report from Choshi, in Japan. Although this was well beyond the normal range of my set I was able to get a message through and copy the reply. This I sent to the skipper, who was now on the bridge. He sent it back, saying that it was no good, the particulars he wanted were not given. So I called up Choshi again, but this time there was no reply; seemingly the operator had been struck deaf and dumb.

The second officer (who usually looks after meteorological matters) now came along and said the skipper was "cussing a treat." "For God's sake," he added, "get some more dope, or he'll bust his bellows." So I did my best to get through, but all to no purpose. While re-tuning my receiver I caught a feeble signal, and recognised my own call letters. It was the s.s. *Sherbet*. The operator had heard my efforts to get through to Choshi, and wanted to know what kind of weather we were having. I told him in unofficial parlance what I thought of it, and asked how things were his way. "It's hell with the lid off down here," he replied. "Get me an official weather report from your navigating officer and I'll do the same."

This cheered me up a bit, so I asked the second officer to "do the needful." After a brief interval the messages were exchanged, and, as luck would have it, I got all the skipper wanted, and more. The two references fitted together admirably, and clearly showed the skipper that we were on the track of a typhoon once again; so our course was altered accordingly. We managed to dodge it nicely, and got nothing worse than a bad blow.

The chief came along to my cabin and said, "Sparks, if ever you want a testimonial about that wireless you go to the old man. He's up there chuckling and rubbing his hands and can't find anything too good to say about it."

Next day we were doing a good fourteen knots when the look-out spotted a signal of distress to port. We veered round to investigate, and found a Japanese schooner with her masts broken and all her tackle overboard. She hadn't missed that typhoon!

We couldn't tow her at fourteen knots, and with 360 bags of mail we couldn't delay; so we sent a message to the nearest coast station and got assurance that help would be sent.

We got to Yokohama twenty-three hours late, but we'd dodged the typhoon, and converted the Skipper—so did I worry? Not a bit!

SIGNAL HILL, HONG KONG. WEATHER WARNINGS ARE HOISTED FROM THE SUMMIT.

PERSONALITIES IN THE WIRELESS WORLD

DR. NICOLAAS KOOMANS

THE progress of wireless telegraphy in the Netherlands owes much to the support of Dr. Nicolaas Koomans, who from the first days of Senatore Marconi's great invention has followed its progress and maintained a firm belief in the usefulness of this form of communication.

Born on December 18th, 1879, at Delft, Dr. Koomans studied mechanical and electrical engineering in his home town, receiving his certificate for these subjects at the age of twenty-one. During the next two and a half years he held positions as Assistant Instructor in Geometry and Assistant in Physics and Electrical Engineering at the Technical High School at Delft, subsequently entering the Government Telegraph Service as an Engineer.

In 1908 he graduated at the Technical High School at Delft, as Doctor in Technical Sciences, on the strength of a dissertation "Regarding the Influence of Self-Induction in Telephone Conducting-Wires." Dr. Koomans is joint founder and editor of the monthly *Review of Telephony and Telegraphy*, which, originally intended to be international in its scope, has been limited to the Netherlands by reason of the war. He is also joint founder and member of the Managing Board of the Dutch Society for Radiotelegraphy and a member of the International Electro-Technical Commission. Dr. Koomans further holds an appointment as Instructor in Physics and Theoret cal Electiical Engineering at a school conducted by the Dutch Post and Telegraph Administiation for the instruction of higher officials.

The Evolution of the Thermionic Valve (II.)

By R. L. SMITH-ROSE, B.Sc., A.R.C.S., D.I.C., Student I.E.E.

Read before the Students' Section of the Institution of Electrical Engineers on January 22nd, 1918.

NOTE.—The first part of this valuable paper appeared in our April issue, pp. 10 *et seq.*

THE FLEMING OSCILLATION VALVE.*

PROFESSOR J. A. FLEMING in 1904 was the first to apply these phenomena of thermionics to the rectification of alternating electric currents, whether of high or low frequency.† The device which he made to effect this may take one of several forms, some of which are shown in the sketch, Fig. 3, and the photograph, Fig. 4. It consists of an ordinary carbon filament incandescent lamp provided with a separate insulated electrode, in the shape of a flat or cylindrical metal plate, or another carbon filament, sealed into the bulb. When the carbon filament is rendered incandescent by a source of electric current it will be found that a single cell will pass a current through the vacuous space between the insulated electrode and the hot filament, provided that the negative pole of the cell is connected to the negative side of the filament. If the connections of the cell are reversed, practically no current passes, the small amount of current obtained being due to

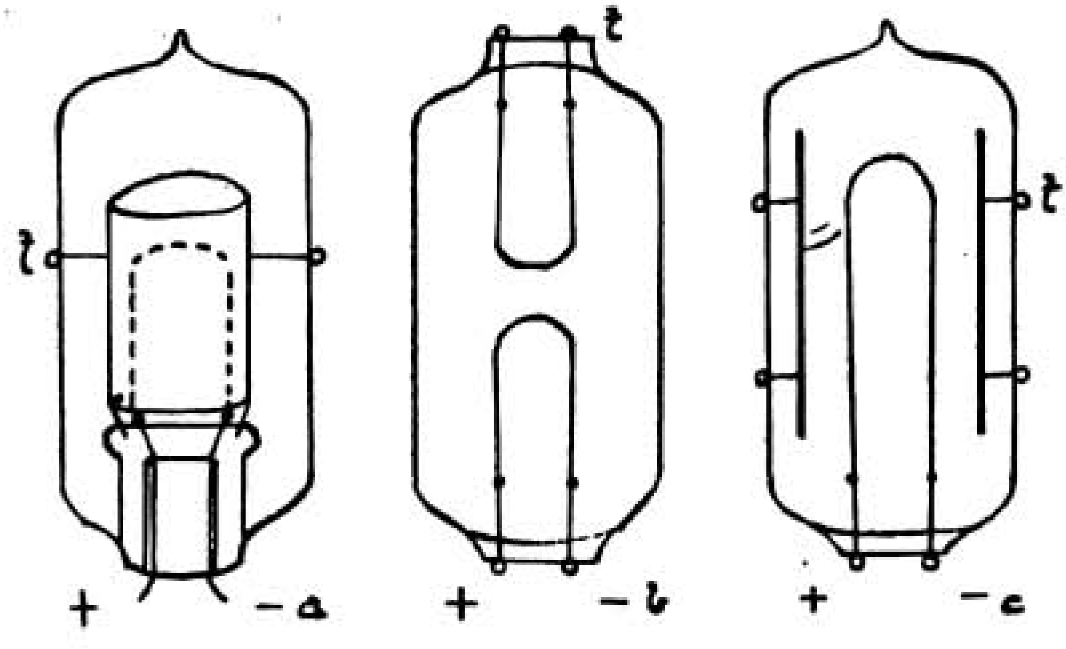

FIG. 3.

* J. A. Fleming, *Principles of Electric Wave Telegraphy and Telephony*, 2nd Edition, p. 476.
† See British Patent 24,850, 1904.

positive ions formed from the residual gas in the bulb. This is what we should expect from the fact that the hot filament is emitting negatively charged particles, and in order to draw these across the gas space to the cold electrode the latter must be raised to a positive potential with respect to some portion of the incandescent filament.

The space between the cold and hot electrodes, therefore, possesses unilateral conductivity, and the arrangement acts as an "electrical valve," passing electric currents in one direction but not in the opposite direction. Fleming next found that this device could be used, on this principle, to convert electric oscillations into unidirectional currents, which may then be detected by means of an ordinary galvanometer.

The arrangement of connections for effecting this is shown in the diagram, Fig. 5.

The oscillation valve O has a sensitive galvanometer G, placed in series with the secondary coil S, of an oscillation transformer, connected between its metal plate or second electrode and the negative terminal of the carbon filament. If electric oscillations are induced in this secondary circuit by a primary coil *p*, then, when the carbon filament is rendered incandescent by the battery *B*, only one half of the oscillatory current is allowed to pass through the gas space, viz., that in which the movement of the negative electricity is from the carbon filament to the

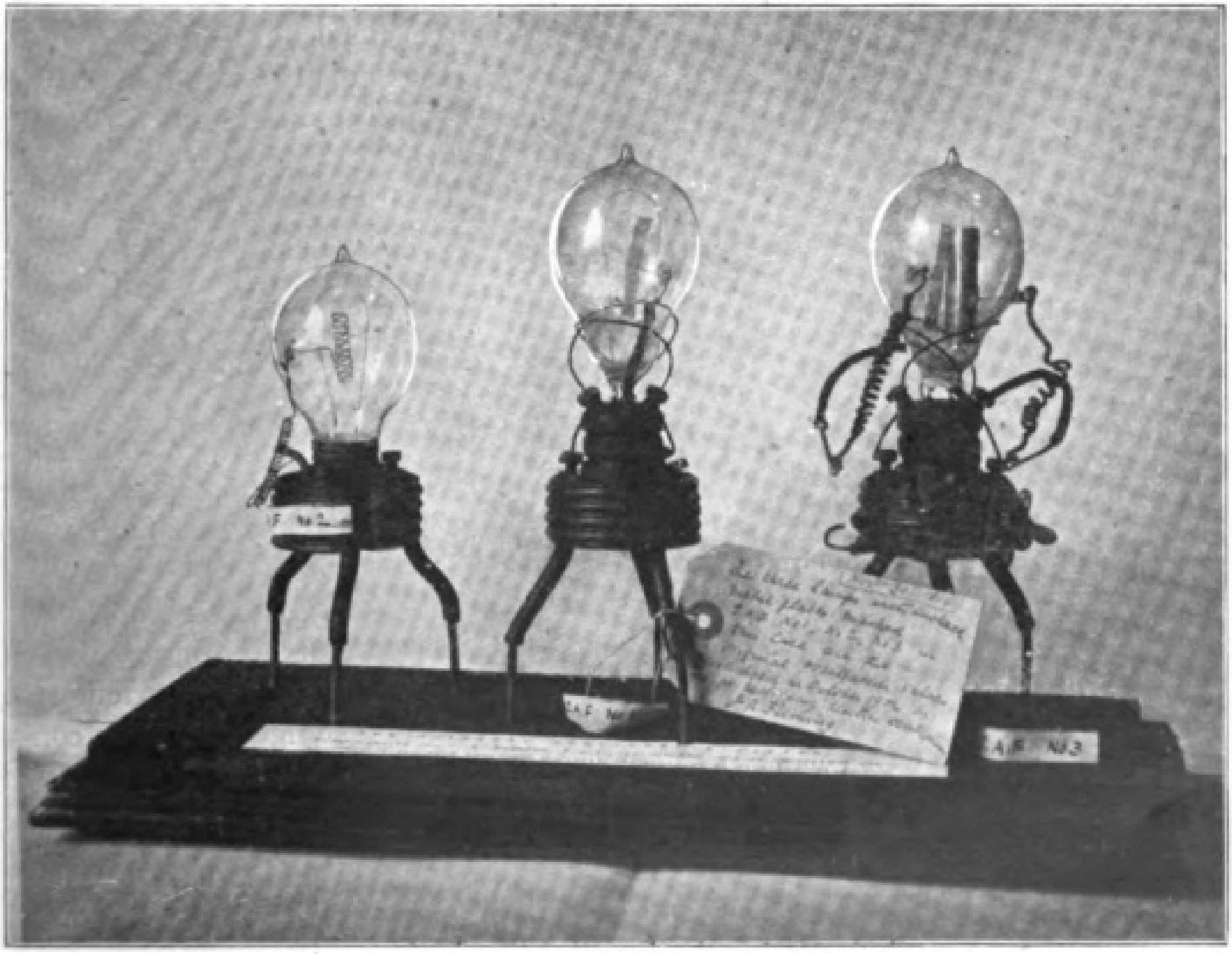

FIG. 4. ORIGINAL OSCILLATION VALVES USED BY DR. J. A. FLEMING, F.R.S., IN 1904.

second electrode. The galvanometer has passing through it a flow of electricity in one direction, and its coil or needle will, therefore, be deflected.

For use as a receiver in radio-telegraphy the primary coil *p* is connected in the antenna circuit between the aerial wire *A* and the earth connection *E*. The secondary circuit of the oscillation transformer is closed by a condenser *C*, adjusted to give resonance with the frequency of the incoming waves. The valve is connected as shown in the diagram, a telephone being inserted at *G* to give audible reception of signals.

The incoming electric waves excite oscillations in the antenna which are transferred to the secondary circuit *sc*. These oscillations are rectified by the unilateral conductivity of the vacuum valve and each train of oscillations produces a single unidirectional rush of electricity through the telephone receiver, producing a click.

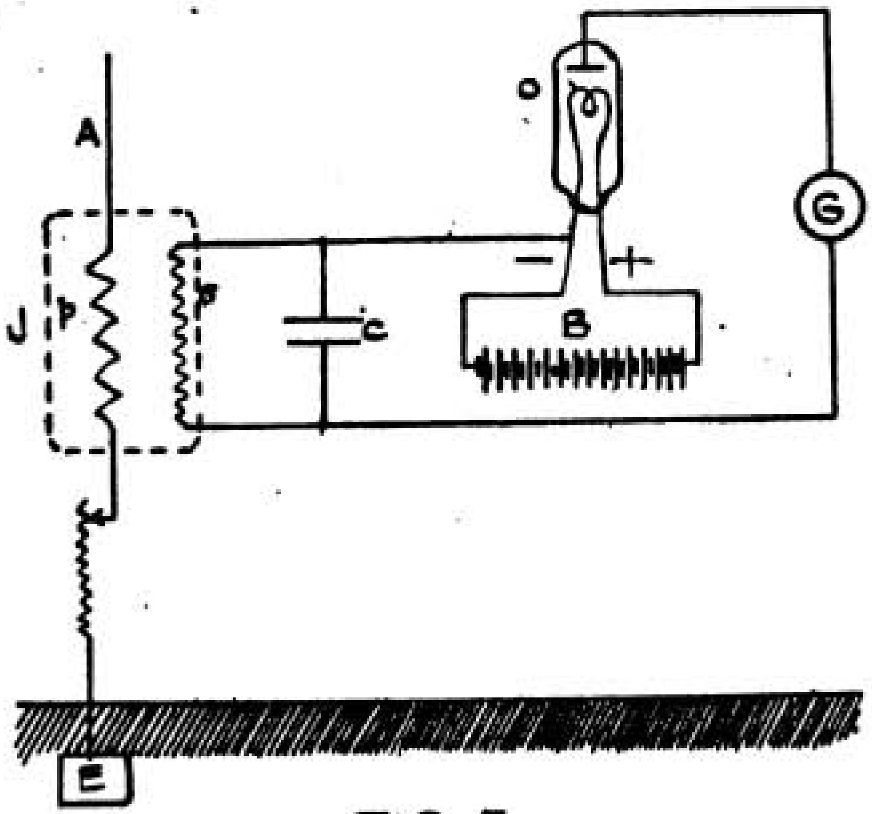

FIG. 5.

The receiver diaphragm, therefore, will vibrate at a frequency equal to that of the trains of oscillations received, that is, equal to the spark frequency of the wireless telegraphic transmitter from which the signals are being received. The sound heard in the receiver will, therefore, be a low buzzing tone or a high musical note, according to this spark frequency, and the tone will be cut up into the dots and dashes comprising the signals, as sent out by the transmitting key.

While this property of *unilateral conductivity* enables us to use the Fleming valve as a rectifying detector of electric oscillations, we may also make use of it in another manner, depending upon the fact that the gas space inside the bulb does not obey Ohm's Law as a conductor.

If we apply a steadily increasing electromotive force between the second (cold) electrode and the filament (cathode) we find that the current does not increase uniformly, but rises fairly quickly to a maximum value (the saturation current for the gas space), after which it falls off very slowly. Corresponding to this, the conductivity or the ratio of current to voltage of the gas space rises to a maximum and then falls off.

Fig. 6 shows the current and conductivity curves taken by Professor Fleming, for an oscillation valve with a metal cylinder surrounding the carbon filament, the latter being heated to different temperatures. The valve is more completely unilateral the colder the metal cylinder is kept, for obviously, if we allow this cylinder

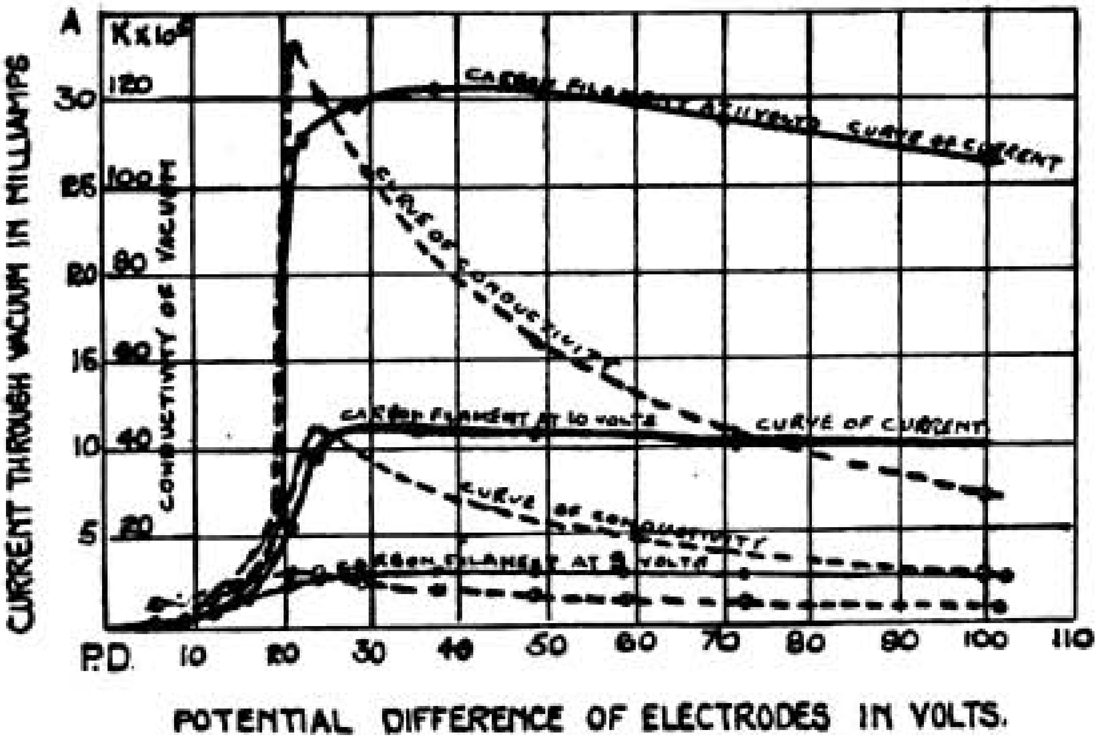

FIG: 6.

to become heated by radiation from the filament, it will itself commence to emit ions and the current between the filament and the second electrode will not be entirely in one direction.

Now, it will be seen from the current - voltage characteristics that the curvature is not constant, and we can find a point near the "knee" of the curve at which the slope of the curve on one side of the point is much greater than on the other side. This point corresponds to a certain steady voltage applied between the plate and the filament, and a corresponding steady current flowing through the valve, and the difference in slope of the curve on the two sides of the point indicates that if the *PD* between plate and filament be alternately increased and decreased by a small amount, the corresponding increase in current through the valve in the one case will be much greater than the decrease in current in the other case.

If this alternate increase and decrease in voltage is effected by superimposing an alternating voltage on the steady voltage, then the corresponding currents have a mean value which is greater than the current corresponding to the steady voltage alone. Hence, if we have a telephone receiver in series with the valve plate circuit under these conditions, a click will be heard in the receiver every time the alternating voltage is applied to the valve electrodes.

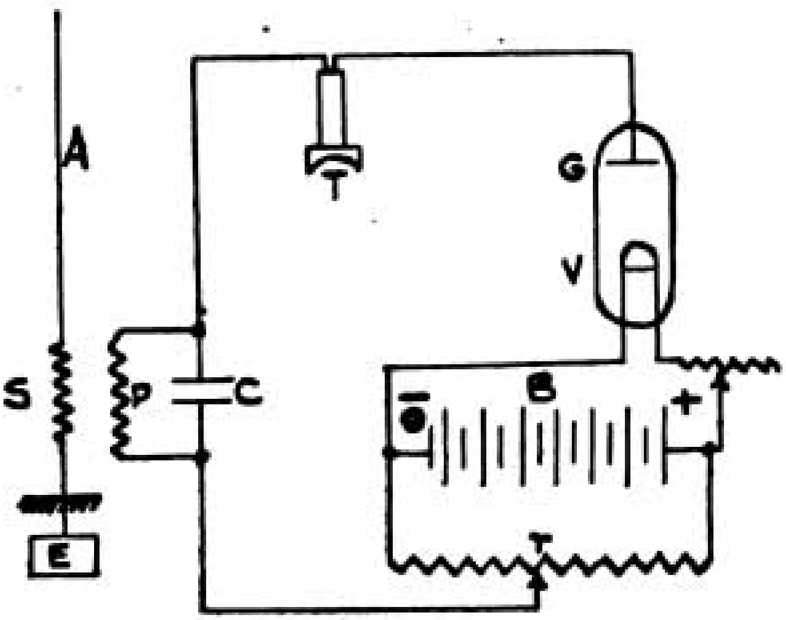

FIG: 7.

We can, therefore, apply this property of the valve having a non-linear characteristic for the detection of electric oscillations, the circuit arrangements being as shown in Fig. 7. One side of the oscillation circuit *PC* is connected in series with a telephone *T* to the second electrode of the valve, while the other side is connected to the sliding contact on the resistance *r* shunting the battery *B* which supplies the heating current for the filament. By this means we are able to apply an adjustable steady voltage across the gas space in the valve and also, from the oscillation circuit, superimpose on this an alternating voltage of frequency equal to that of the oscillations set up in the coupled antenna circuit.

If, then, we adjust the slider on the resistance *r* so that the voltage applied to the valve corresponds to the point on the characteristic curve at which a sudden change of curvature takes place, then every time oscillations are set up in the circuit *PC* the effective value of the current through the telephone will be increased and a click will be heard in the receiver. Thus, when the complete circuit is adjusted to receive radiotelegraphic signals, the tone heard in the receiver will be of a frequency equal to that of the trains of electric waves received, *i.e.*, equal to the frequency of the spark at the transmitting station.

With a good valve and by carefully adjusting the conditions under which it is operating, Fleming found that this arrangement provides a more sensitive detector than that employing the unilateral conducting property of the valve.

Fleming found later that greatly improved results were obtained when the valve was constructed with a tungsten filament and an insulated copper cylinder surrounding it.* This is due to the fact that the tungsten can be raised to a much higher temperature than carbon without volatilisation and gives a much greater electronic emission, and, as will be seen later on in the paper, this type of thermionic valve is almost universally constructed at the present time with either a tantalum or tungsten filament.

The "Audion" Detector and Amplifier.

The next step in the evolution of the thermionic valve was made by Dr. Lee de Forest, of the United States of America, and consisted in the introduction of a third electrode into the evacuated bulb. Lee de Forest had been working on the simple rectifying valve containing a metal or carbon filament and one insulated electrode (already described) at practically the same time as Fleming, and his results were first described in a paper before the American Institute of Electrical Engineers in October, 1906.† Considerable controversy has since then ensued as to the relative priority of the inventions of the Fleming valve and the "Audion," the name assigned to the valve by de Forest; but this has now been settled in favour of Fleming for the original valve, Lee de Forest having the credit of introducing another insulated electrode into the bulb, thereby transforming it from a rectifying valve into a kind of gas relay, having an amplifying effect on the received oscillations.

This modification was described by de Forest in 1913 before the Institute of Radio Engineers.‡ This third electrode consists of a metal strip or wire bent into the form of a "grid," and situated between the filament and the second electrode or "plate," and it serves as an independent path by which the electric oscillations are introduced into the vacuous space within the bulb.

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* British Patent 13,518, 1908.
† Lee de Forest, *Electrician*, 58, p. 216 (1906).
‡ Lee de Forest, *Electrician*, 72, p. 285 (1913).

In studying the action of this "grid" we may consider the diagram shown in Fig. 8, which shows a simple method of connecting up the audion for the reception of electric oscillations.

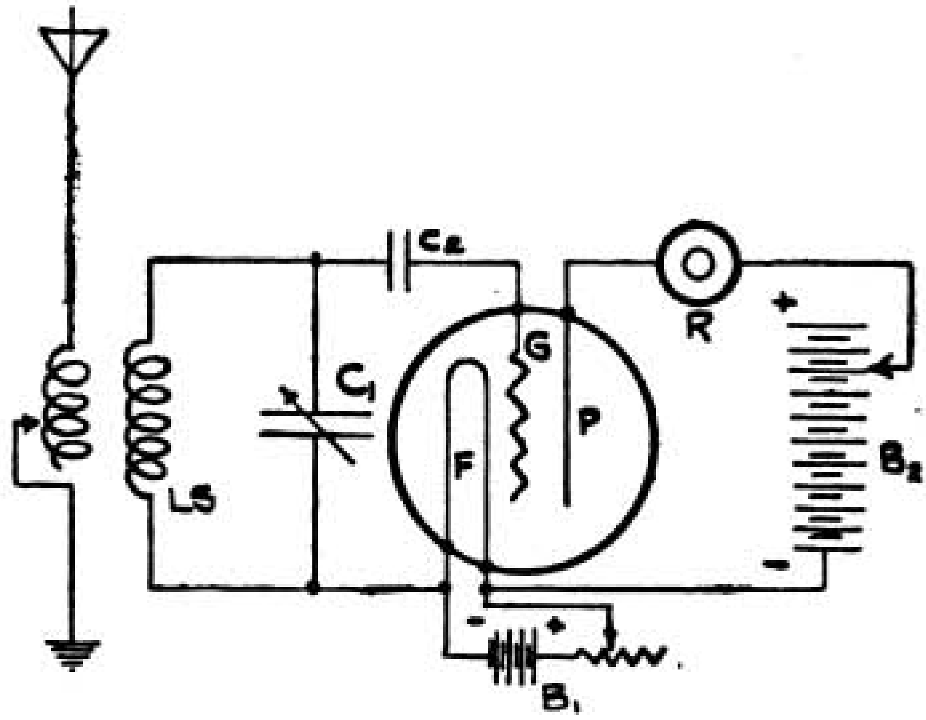


FIG: 8

The incandescent lamp bulb contains a tantalum filament F, which is lighted by a battery B_1 of 4–15 volts. Close to one side of, and parallel to the plane of, the filament is mounted a small rectangular nickel plate P. This plate is connected through the telephone receiver R to the positive terminal of the dry-cell battery B_2, giving from 15–40 volts, the negative terminal of this battery being connected to the positive side of the filament. Between the filament and plate is mounted the third electrode, G, a grid-shaped wire or perforated plate of nickel, at approximately one-sixteenth of an inch from both the plate and filament. Leads from the condenser C_2 in series with the grid G, and the negative end of the filament, are connected to the terminal of the variable condenser C_1, which is adjusted to place the circuit LSC_1 in resonance with the received oscillations induced in the coil LS.

Now when no signals are being received the grid will be practically at the same potential as the negative side of the filament, which we will regard as our "zero" of potential, and a certain steady current will be flowing through R in the plate circuit, the value of the current depending upon the dimensions of the valve and electrodes, the temperature of the filament, the nature and pressure of the gas, and the voltage of the battery B_2.

If now the grid be raised to a positive potential with respect to the negative end of the filament, the intensity of the electric field between G and F will be increased, and more negative ions will be drawn across this space than previously. Some of these will be drawn into the grid giving a small current in this circuit, but the majority of them will pass through the perforations in the grid and will subsequently be attracted to the plate under the field created by the battery B_2. The net result, then, of imposing a positive potential on the grid will be to increase the current in the plate circuit, and within certain limits the greater the potential on the grid the greater is the increase in current. Similar reasoning will make it evident that the effect of raising the grid to a negative potential with respect to the negative side of the filament will be to decrease the current in the plate circuit.

A typical characteristic curve for an "audion" valve, showing the variation of current in the plate circuit with the potential applied to the grid, is shown in

Fig. 9. Normally, the grid is practically at zero potential indicated by the point P on the curve.

Now, when electric oscillations are induced in the circuit LSC_1 from the receiving aerial circuit, these are rectified between the grid and the filament and accumulate a negative charge on the grid and the connected plate of the condenser C_2. This decrease of the grid potential causes a corresponding decrease in the plate current, as indicated by the above curve. As the train of oscillations dies away, the charge on the grid leaks away relatively slowly by means of the positive gaseous ions within the bulb, thus allowing the plate current to return to its normal value. This function takes place for every train of damped oscillations received, and hence the current in the telephone receiver alternately decreases and reassumes its normal value, at a frequency equal to that of the spark at the transmitting station, and the telephone diaphragm will therefore vibrate at this same audible frequency.

This three-electrode valve may also be used as a detector without employing the grid condenser C_2. In this case the grid potential is maintained normally at one of the bends A or B of the curve in Fig. 9 by means of a separate adjustable battery. Then, as the incoming oscillations cause the grid potential to vary alternately on either side of this value, the resulting changes in plate current, on account of the asymmetry of the curve, are not symmetrically alternating about the normal value, but have a direct current component. Hence each train of oscillations received produces a unidirectional impulse through the telephone receiver, and the diaphragm of the latter will vibrate at the spark frequency of the transmitter.

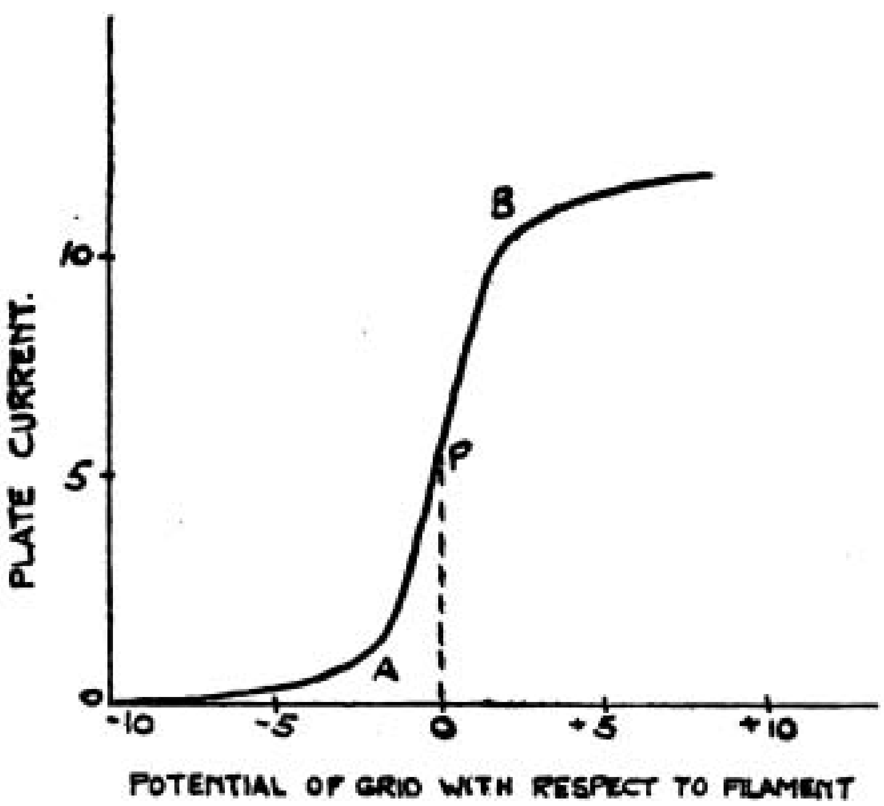


FIG: 9.

Whichever arrangement is used, the result will be the same in that a note of audible frequency will be heard in the receiver cut up into dots and dashes in accordance with the signals sent out by the transmitting key.

(*To be continued.*)

ACCORDING to the *Journal Telegraphique*, the number of wireless stations opened on December 31st, 1917, was 6,113, of which 687 were coastal stations, and 5,338 on board ship, the remaining 88 being inland.

Digest of Wireless Literature

Kelvin as a Teacher.

At the Ninth Kelvin Lecture, delivered by Professor Maclean at the Institution of Electrical Engineers, many interesting facts were brought to light concerning the great scientist. Lord Kelvin, as many of our readers will remember, was the first to send a paid wireless message, and Professor Maclean happened to be the recipient.

In the opening words of his lecture, Professor Maclean stated that during the fifteen years he acted as Lord Kelvin's chief official assistant he attended every lecture he delivered, both to the Ordinary and to the Higher Classes, and always took notes. The lecturer then went on to give many interesting particulars regarding Kelvin's methods as a teacher. There was no systematic course of instruction in the laboratory, said the speaker. A number of Thomson scholars were always engaged in experimental research, and new students were attached singly or in pairs to each scholar, and had to help in making observations and devising new apparatus. In this way the students got practice in woodwork, sawing, planing, and fitting. Nothing was done for them. If a student had to solder he was required to do it himself, and with resin, no chloride of zinc being allowed. True, he had an opportunity of seeing how it was done by a senior student or scholar, while he was at the stage of looking on and helping. The Kelvin attitude to beginners is quite explicitly enunciated in a letter, wherein he says, "Let any students, if there be any, stand by and learn, and help when they can." Since then, said Professor Maclean, he had had 18 years' experience in the Royal Technical College, Glasgow, where students are put through their regular course of laboratory practice. Sheets of instructions are given them beforehand, apparatus laid out to be connected up by the students themselves, rules given for entering results and drawing graphs, all of which must be entered in special laboratory books which are examined and criticised by the teaching staff at frequent intervals during the session. Kelvin's method, or should he say, want of method, went on the speaker, had many disadvantages, but the more modern methods prevalent in every British laboratory are by no means free from defects also.

In the course of his lecture, Professor Maclean mentioned that during the session 1897–98 Mr. V. J. Blyth and he conducted experiments on coherers and spark discharges. The main object of the experiments was to determine whether the transmission was more effective in the direction of the spark, or at right angles to the direction. On June 3rd, 1898, Lord Kelvin visited the Needles Station and sent from there to Professor Maclean the first paid Marconigram as follows :— "Maclean, Physical Laboratory, University, Glasgow. Tell Blyth this is transmitted commercially through ether from Alum Bay to Bournemouth and by postal telegraph thence to Glasgow. Kelvin." A photograph of the original telegram and some notes regarding the occasion were reproduced in THE WIRELESS WORLD for December, 1915.

RADIO TELEPHONY.

Dr. Alfred N. Goldsmith, Director of the Radiotelegraphic and Telephonic Laboratory of the College of the City of New York, continuing his series of articles on Radio Telephony in the *Wireless Age*, deals in a recent issue with a number of points connected with reception. Speaking of selectivity, Dr. Goldsmith says that there is a fairly sharp conflict between the requirement of loud signals and extreme selectivity. The first of these generally requires sensitive detectors and powerful amplifiers used with close coupling to the antenna system, while the second tends in the opposite direction. Nor does beat reception solve this problem, as will be evident below. All that can be said is that a rational compromise must be effected in every case, this to be determined by the operating conditions in the neighbourhood of the receiving station. Thus the amount of interference in the vicinity of the receiver is an extremely important factor in determining the amount of power required at the transmitter to cover the desired distance. This is a factor which is often overlooked in the design of stations.

Interference from spark stations disturbs radiophone reception less than might be expected, partly because the dots and dashes constitute a more or less intermittent disturbance through which portions of the words can be heard, and partly because of the resulting " assistance of context " effect. Sustained wave station interference is, however, very serious, since this causes a continuous musical note by the beats with the incoming radiophone frequency, and this continuous musical note cannot be tuned out either by ordinary or beat reception, being a physically present phenomenon caused by two frequencies *external* to the receiving station In the neighbourhood of a large arc radiotelegraphic station, this may become a very grave matter, particularly if compensation waves are used by the arc station in transmission. In this latter case, there will generally be produced a long series of overtones of both the sending and the compensation waves, and there is very likely to be continuous beat interference. The author is very much of the opinion that radiation at non-useful frequencies should not be permitted, since the growth of the radio art will be much hampered thereby. Furthermore, provision should be made in all sustained wave stations to avoid the production of these series of overtones (which, it may be mentioned, are frequently not harmonics, but fall at non-integral multiples of the main and useful frequency).

With regard to telephone receivers, it might be expected that there would be no great difference between the various telephone receivers used in radio sets, so far as speech reception was concerned, but this is far from being the case. In addition to marked differences in intrinsic sensitiveness, the receivers show differences as to the extent to which they distort speech and the relative extent to which they respond to the sudden shocks caused by heavy strays. Generally speaking, the receivers with diaphragms of moderate thickness give good articulation, moderate sensitiveness, no inordinate response or " singing " when stray impulses are received, and are robust. More sensitive receivers with very light diaphragms tend to give " tinny " speech, and more than proportionate response to impulses.

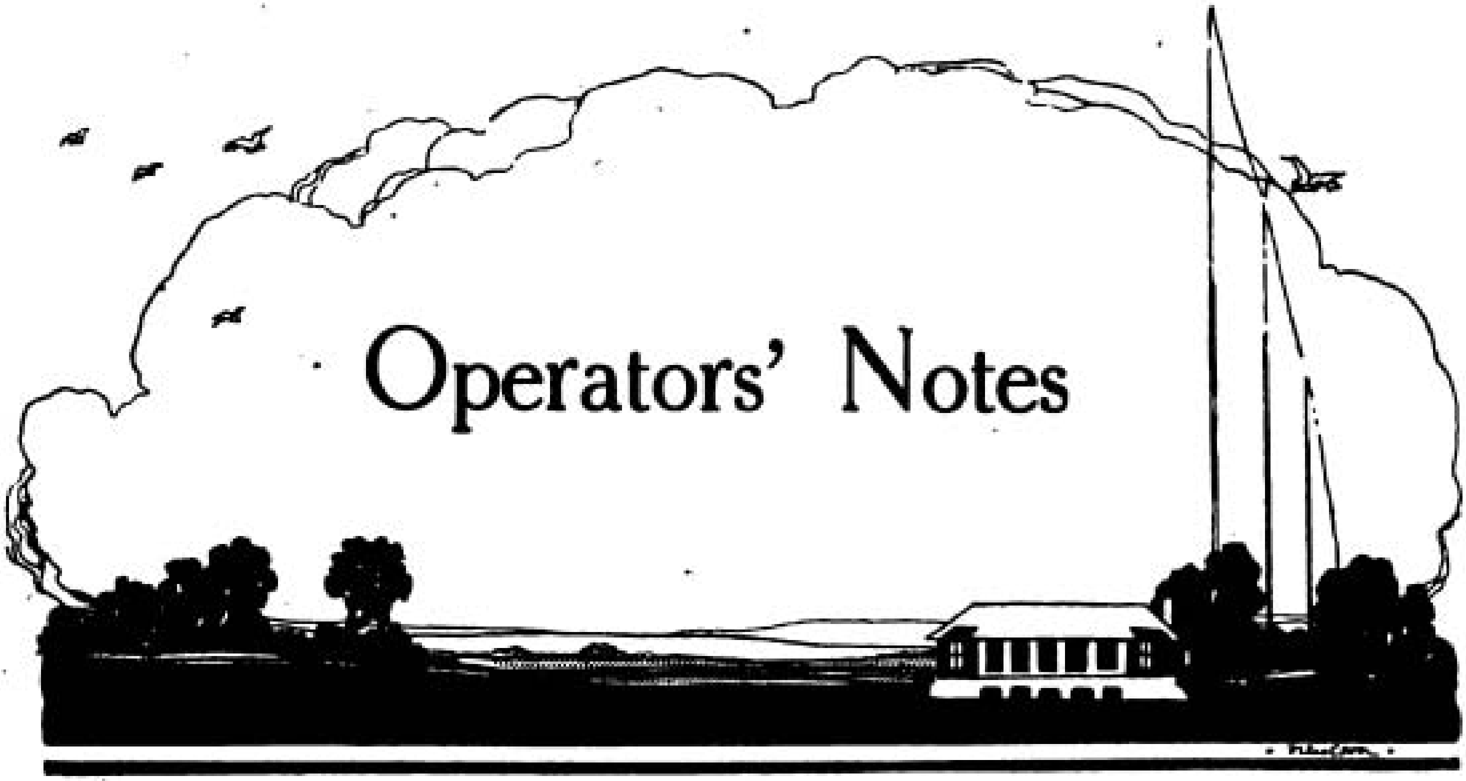
Electrical Physics of the Atmosphere.

A paper on the above subject was read recently by Mr. J. E. Taylor before the Institution of Post Office Engineers.

Mr. Taylor remarked that a knowledge of electrical effects in the atmosphere is very necessary to telephone and telegraph engineers, in order that the harmful effects of such phenomena on electrical communication might be guarded against and overcome. Effects due to electric stress, ionisation, lighting and other atmospheric sources of disturbance, are of great consequence in wireless telegraphy. The general constitution of the atmosphere was discussed in some detail, the constituents of the lower atmosphere being of special importance. Evidence based on meteor trains, auroræ, etc., was quoted to show the great height of the atmosphere, differences in constitution being confirmed by spectroscopic observations. The effect of radium emanations in the atmosphere and experiments showing the decomposing power of sunlight next received attention. The effect of temperature gradients and the isothermal layer were explained, and curves obtained at Kew were presented, showing the nature of electric atmospheric stresses and their dependence on weather conditions. Ionisation of gases as an index of chemical activity, changes in gaseous conductivity accruing from slow or rapid chemical action, and the effect of the degrees of gaseous conductivity met with in the lower atmosphere are most important. The causes of atmospheric ionisation in the lower regions were discussed. It was pointed out that *permanent* ionisation involves maintaining a constant supply of energy. An interesting analysis of thunderstorms and lightning phenomena followed. Various theories of thunderstorms, such as the " breaking drop " theory of G. C. Simpson, were given, but it was pointed out that the phenomena are not fully explained ; a suggested cause of thunderstorms and the formation of hailstones, based on the decomposition and recombination hypothesis, was put forward. The conditions conferring immunity from lightning effects, the functions of lightning rods and other protective devices were explained, and the standard methods of protecting telegraph and telephone lines were subjected to some criticism. Finally, an analysis was made of the vexed question of wireless strays and disturbances, and an account was given of the Dieckmann antenna screen. The Paper concluded with some account of magnetic storms, and methods of recording meteorological data.—*The Electrician.*

The Detection of Undamped Waves.

With reference to our note in the " Digest of Wireless Literature " for April, entitled " The Detection of Undamped Waves," this idea is covered in England by the Patent number 11453 of 1913, granted to Marconi's Wireless Telegraph Company, Limited, and C. S. Franklin.



Operators' Notes

Tools and How to Use Them.

By HAROLD WARD.

INITIATIVE, ingenuity, neatness and accuracy are the four essential qualifications which go to make a good craftsman, and only experience can teach the correct and proper use of tools, as practically all repairs require different handling. To those without any previous practical experience, the following hints should prove of use. It behoves all operators to familiarise themselves at once with the tools in their charge, and not wait until the necessity to use them arises.

Blow Lamps.—When heating up a blow lamp, do not hold the flame underneath that part of the jet which contains the wick. A scorched wick will not "feed" the spirit properly. Two or three turns of thick copper wire round the nozzle of jet will give a slightly better flame. If no methylated spirit is available, do not imagine the lamp is useless. It will work with almost any form of alcohol, the writer on one occasion having successfully employed brandy, there being no other suitable spirit on board!

Centre Bits.—These are only intended for boring holes in wood, and must on no account be used for metal.

Wood-handle Chisel.—This must not be used as a screwdriver. Do not hit the handle of chisel with a hammer, as boxwood splits. A block of wood, or, better still, a mallet made from a piece of hard wood, should be used. This tool is not for cutting metal, a cold chisel being supplied for that purpose. A chisel is of no use for cutting ebonite, as this material splits too readily.

Cold Chisel.—A cold chisel is constructed entirely of metal and has no handle. It is primarily intended for cutting fairly soft metal, such as copper strip, and is useless for hardened steel. It is often quicker and better to use the cold chisel in place of the pliers when cutting thick copper wire.

Counter-Sink.—This is a small conical drill used for finishing off holes intended for flat headscrews or rivets, so that their heads may lay flush with the surface.

Drilling.—When drilling holes in material it is advisable to give the drill a start by using a punch first. A useful punch can be made by hardening the tip of a fair-sized steel nail, to do which the point should be heated and plunged into cold water several times. Care must be taken to hold the drill steady, as a very slight jerk will snap it.

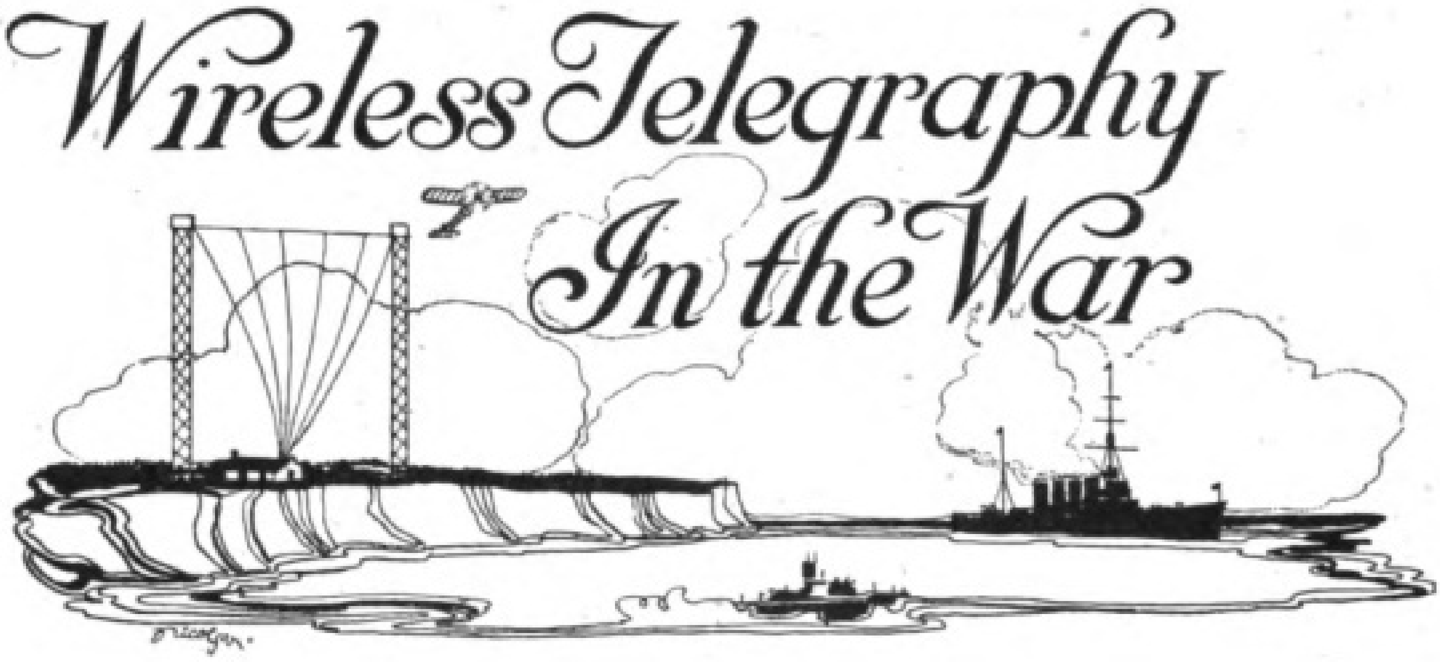
Files.—Filing is an art which can only be acquired by constant practice, and a considerable amount of judgment is necessary to produce satisfactory results. The greatest difficulty in filing is to file flat. The article to be filed should be held securely in the vice about on a level with the elbow, care, however, being taken not to exert too much pressure with the jaws for fear of doing damage to the surface of the material. Stand with the left foot a little to left of the vice and with the right foot a little to the rear. Hold the file in right hand with the knuckles down and the elbow close against the side. The other end of file is steadied with the left hand. Start with firm, steady strokes, allowing the body to move with the file, taking care to keep the pressure even and the direction of each stroke as uniform as possible. Only the forward stroke should cut, so slightly relax the pressure on the return stroke without lifting the file. When filing contacts, bear in mind that platinum is more valuable than gold, so file away no more than is absolutely necessary. Use an old file for ebonite, as it quickly clogs. Flat files are used for flat surfaces, and most have one smooth "safety" edge to permit of their being used close up to a corner without doing damage to the side of the article. Half-round files are used for filing inside holes or curves and the strokes should be made with a sweeping motion from side to side in addition to the backward and forward motion. "Rat-tailed" round files are used for enlarging circular holes, such as the eyes of lugs. Triangular files are used for special jobs, such as clearing corners of square holes, slots, etc., or for notching a wire or rod prior to sawing or breaking it.

Hack Saw.—Though essentially a metal saw, this tool can be successfully employed in cutting wood and ebonite, provided care is exercised in using it. When cutting deeply into metal or wood a little grease applied to blade lightens the work considerably. Previous to commencing a cut see that the blade is tightly fixed with teeth pointing in a forward direction. Use in a manner similar to a file—*i.e.*, exerting the cutting pressure on forward stroke only and steadying the saw with the left hand. It is advisable to make a small notch with a file before starting to saw a piece of metal. This ensures a clean start being made. Take great care to preserve an even motion, as a very slight twist will often break a blade. Relax the pressure when the cut is nearly completed.

Pliers.—These are supplied for use in twisting and cutting wires when jointing, and for holding small articles during filing or soldering. It is not advisable to use pliers for holding contacts during filing, as the hand is not sufficiently steady. Do not use your pliers as a hammer, nor for tightening up terminals, or the milling will become burred and unsightly. Thumb tightness is all that is required. Never use the cutting edges of a pair of pliers on hardened metal, as the knife edges are only made for comparatively soft wire.

(To be continued.)

Wireless Telegraphy In the War



Spies and the Journalist.

Spies and spycraft are an ever-fruitful source of inspiration to the newspapers, probably because on this subject it is possible to wiite so much with so little foundation. A good story can always be made by equipping the spy with wireless telegraphic apparatus, and as now and then a genuine case comes to light, the tale generally proves acceptable.

There are fashions in "spy writing" as in everything else, and, as in the early days of the war every alien had concrete foundation for a gun in his back garden, so at the present time the same person is equipped with his transmitter and receiver for communication with "Berlin."

Always Berlin, you will notice, not Norddeich, or a German coastal station very many miles nearer, with which it would be much easier to communicate!

A great deal of unnecessary scaremongering is done by "popular" writers, who, referring to what is alleged to be said by experts, cover their writings with a false appearance of authenticity. As an example of the pseudo-scientific nonsense served up for the delectation of the masses we would quote the following passage from a weekly journal of large circulation: "Personally I have no technical know- "ledge of such things, but I am told by those who are more scientific than myself "that the sending of a wireless message is not so conspicuous an affair as the "receiving of one. For this latter purpose a considerable installation is necessary— "a mast or other high erection to catch the message in its flight, whereas the sending "of one requires no such eye-arresting apparatus, and might be done from a box "like a large camera or accordion, which a man could carry under a cloak and "instal in a room with an outlook towards the sea."

Now this is exactly the reverse of the actual facts. The receiving of a message requires far less apparatus than the sending of one, and is far more difficult to trace. Any wireless transmission can be immediately detected. Perhaps the obliging and more scientific friend of the author will oblige us with particulars of the wireless concertina which, if nothing else, should be capable of fine tuning.

As mentioned above, genuine cases occasionally come to light, such as that reported in a recent message from Paris. A wealthy foreigner was discovered to be in possession of a wireless receiving plant in his villa on the right bank of the Loire. With his valet he was promptly arrested and placed in prison at St. Nazaire.

PROGRESS IN FRANCE.

Writing of France reminds us that wireless progress in the land of our gallant Ally has not been slow during the war. The Eiffel Tower station—well known to amateurs in peace time by its daily transmission of time signals—is now infinitely better equipped than was the case prior to the outbreak of hostilities.

Great credit is due to the organising genius of Commandant Ferrie, in charge of French military wireless, for the work he has done to improve the radiotelegraphic equipment of the French installations.

Press reports from the United States have now revealed the existence of a new giant wireless station, erected by the French Navy, on the coast of France near one of the American naval bases. The size of the station may be gauged in some measure from the fact that the metal pylons supporting the aerial are each 600 feet high, while the generating plant is said to be rated at 600 horse-power. The station will mainly be used for keeping in touch with America and American ships on the way to Europe with troops and supplies. Our Allies are proud of the fact that the whole plant took but six months to erect. Test messages have already been received in Australia, and it has been widely proclaimed that the new installation is the "world's greatest wireless"—a statement, by the way, to be taken with a pinch of salt.

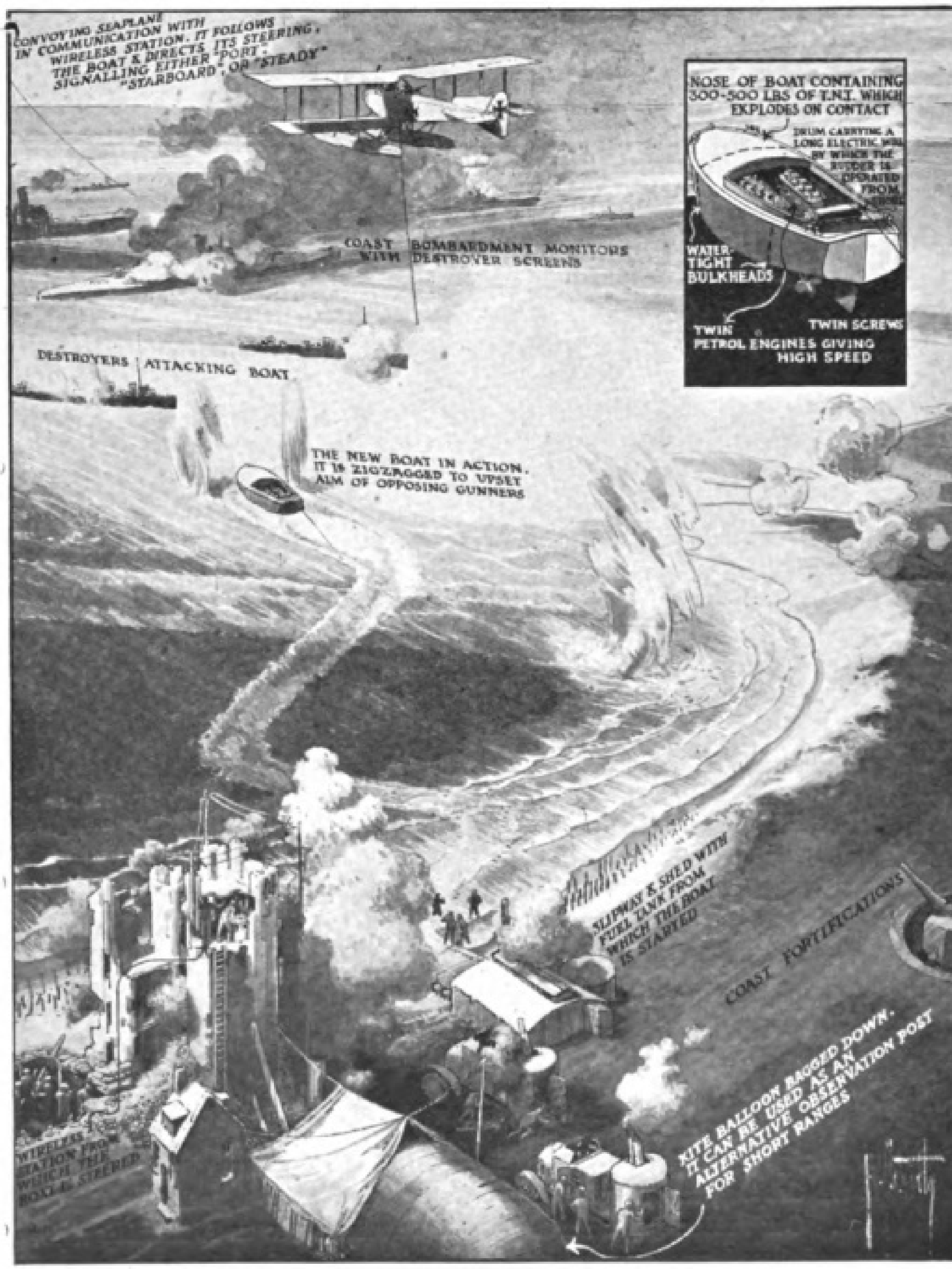
This is not the first instance of signals from European stations being received in the Antipodes, several other cases having recently come to light. The cause of reception of wireless signals over such phenomenally long distances is not so much due to the increase in power of transmitters as to the enormous advance made recently in wireless reception.

Jules Verne, himself a Frenchman, missed great opportunities by being born before the days of Marconi, and we can imagine how he would have been inspired by the opening of this great electrical station for the communication of intelligence by invisible waves.

AN ENEMY FREAK BOAT.

On our next page we give an interesting and detailed drawing, which recently appeared in the *Graphic*, showing the construction and method of working a German crewless boat. Our readers will remember that we referred to an Admiralty report regarding one of these boats, some months ago, and it was at first thought by many that the vessel was controlled by wireless. This belief was strengthened by the fact that such vessels are practicable, the United States having purchased, some while ago, the inventions of John Hays Hammond, Junior, who had demonstrated such a vessel on the American seaboard. However, it afterwards transpired that the mechanism

A German Freak Vessel



CREWLESS HUN BOAT LOADED WITH T.N.T. AND CONNECTED TO THE SHORE BY CABLE THROUGH WHICH IT IS ELECTRICALLY STEERED. THE COURSE IS SIGNALLED TO THE SHORE BY WIRELESS FROM A CONVOYING AEROPLANE.

was controlled from the shore by a long cable, an aeroplane fitted with wireless serving for "spotting" purposes. Such vessels have a very limited range of usefulness, and for this reason are not often heard of.

THE TRACK OF THE "WOLF."

In our April issue we wrote of the exploits of the German raider *Wolf*, and mentioned that few if any of her victims seemed to have been fitted with wireless. A thrilling story has now been related to the Australian Press Association by two Australian officers who were captured by the raider and were liberated by the stranding of one of her victims off the coast of Denmark. From this account we learn that two vessels at least had radio apparatus, their messages being tapped by the *Wolf's* own operator. One, the *Matunga*, was tracked by her wireless and captured in order to obtain her coal, of which the *Wolf* was desperately in need. Parts of the account read like a Guy Boothby novel of the Southern Seas. Listen to this, for example :—

"The Germans had their plans carefully prepared in advance. With the "prize crew in charge, instead of our own navigators, and a German wireless operator "in the seat vacated by our own 'Sparks,' we followed the *Wolf* to a prearranged "destination. This proved to be a natural harbour on the north coast of Dutch "New Guinea, an ideal place for the purpose, as well as being the most beautiful "haven imaginable. At the entrance, less than a quarter of a mile wide, the "Germans placed a couple of small guard boats. On the higher of the two hills "that screened it from the sea they established a wireless plant and signalling "station. The seaplane carried by the *Wolf* meantime scoured the neighbouring "land and sea for a hundred miles around, while the transference of passengers "and cargo proceeded, the two vessels being lashed together."

And again, later in the story, we read: "After remaining several days off "Singapore and in the China Seas, the *Wolf* entered the Indian Ocean, and pro-"ceeded sufficiently far north to be able to pick up wireless messages from Berlin "and Constantinople. The officers were chagrined, however, that these included "no fresh instructions for them to follow. Although the *Wolf's* wireless was con-"stantly at work picking up messages it could not, of course, be used to send them "out without grave risk of detection. . . . The *Wolf*, after making various excur-"sions in which among others an American barque was sunk, rounded the Cape "of Good Hope, accompanied by the *Igotz Mendi*, and made for the Trinidad "Islands off the Brazilian coast. A wireless message was, however, intercepted "stating that Brazilian men-of-war had arrived there. Both vessels promptly "turned and went full speed south-east."

And so the account proceeds, the narrators describing how the *Igotz Mendi* and the *Wolf* eventually reached Europe; the former grounded on the Danish coast, and the latter managed to slip back to Germany. Thus ends a true tale, unsurpassed for dramatic interest by even the best pirate stories of fiction.

C

How to Become a Wireless Engineer

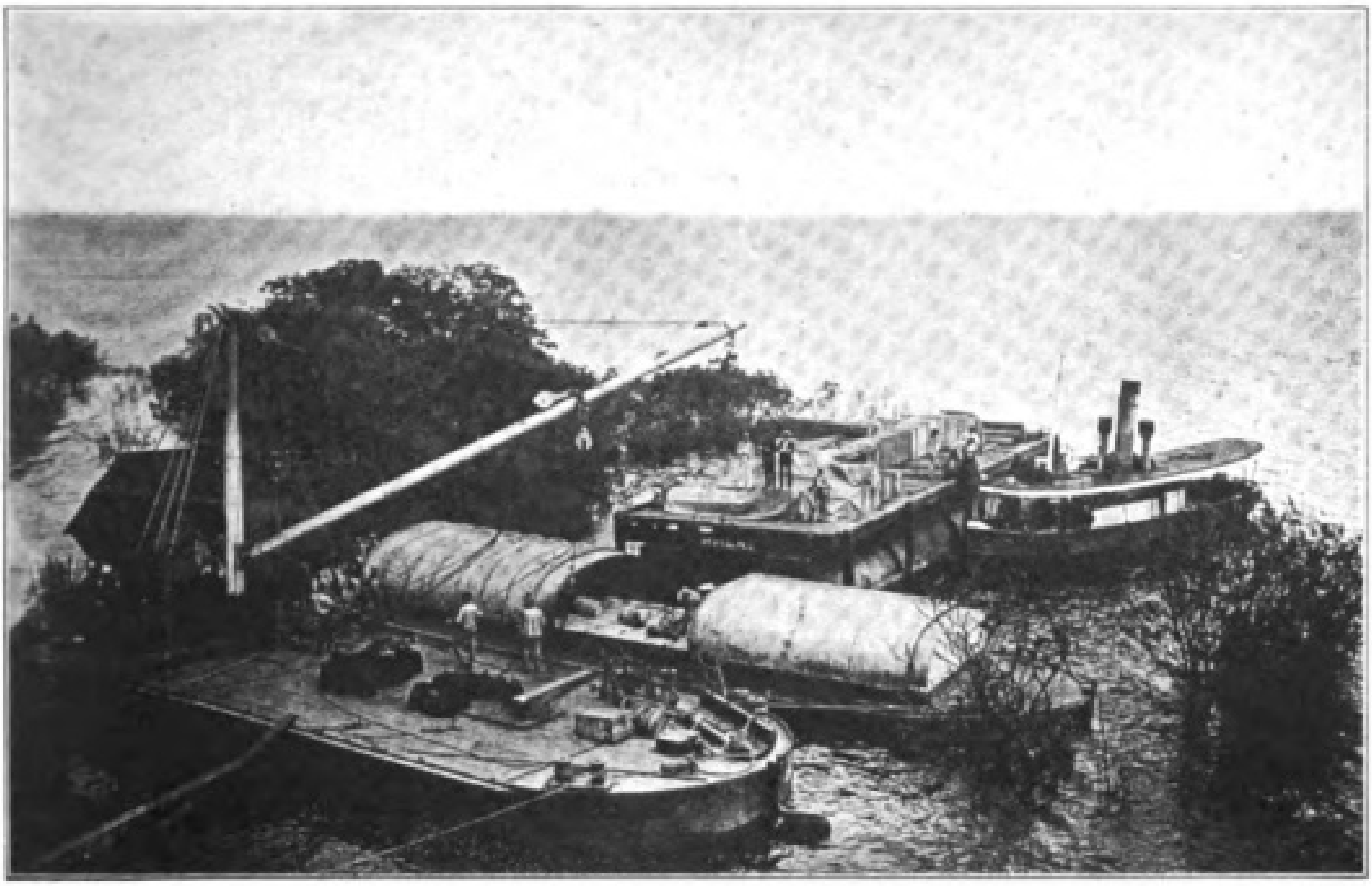
Preparation for an Interesting Career

ALTHOUGH the life of a wireless telegraphist is highly interesting and attractive, that of the wireless engineer is even more so. While the operator spends most of his time on board ship, or in one particular land station, the engineer is required, in the course of his duties, to visit all parts of the world, frequently spending many months in wild and almost uninhabited parts of the globe, thrown on his own responsibility, and perhaps seeing no other white man from the beginning of the work to the end.

In view of the steadily increasing number of letters to the Editor asking for information regarding entry into the engineering staff of the Marconi Company, we have gathered together the following particulars, which will, we think, supply our readers' wants.

Firstly, it should be understood that the character and general education of the applicant are of the utmost importance, careful inquiries being instituted into both

A CLEARANCE IN THE JUNGLE AND THE FIRST STEP TOWARDS ERECTING A STATION.



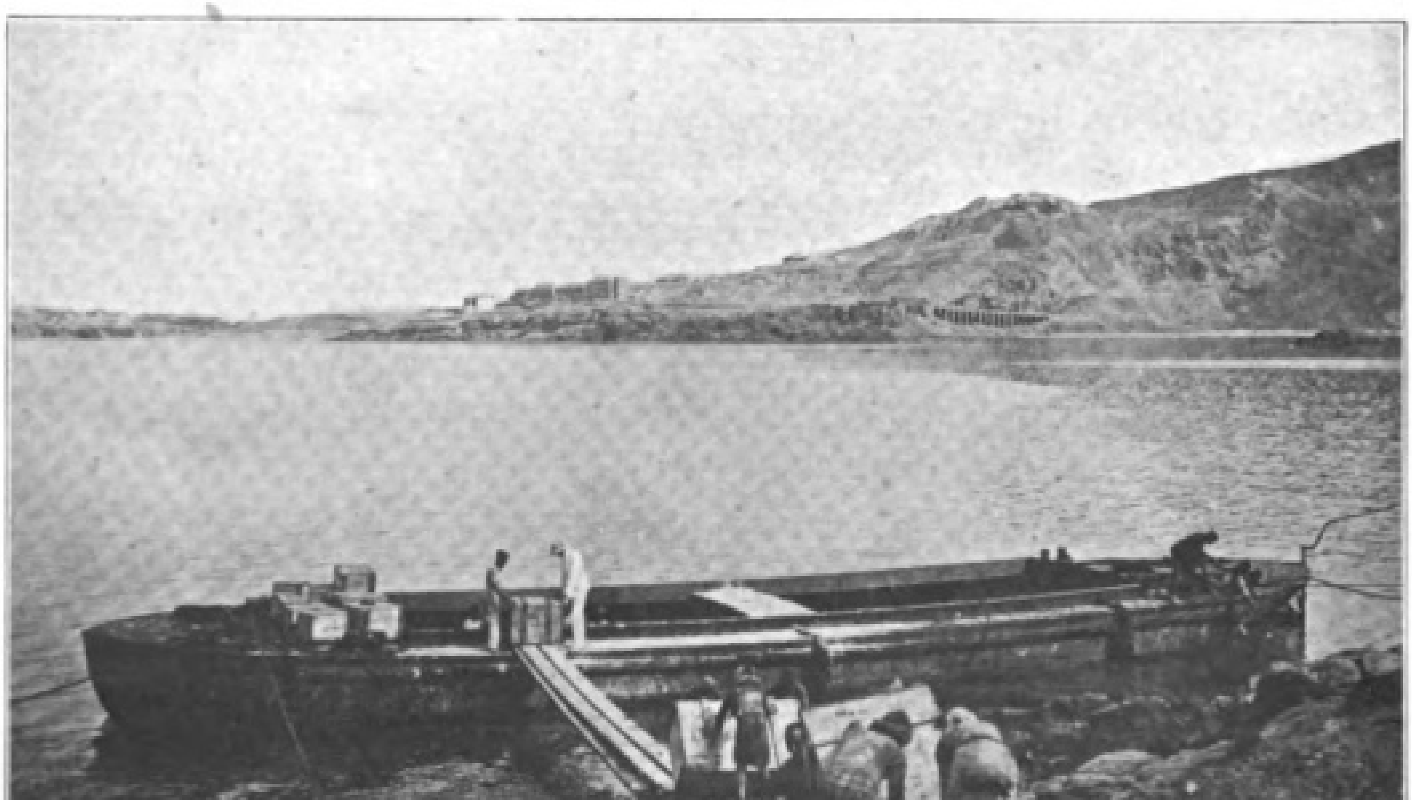
UNLOADING "WIRELESS" MATERIAL FOR A TROPICAL STATION.

of these subjects before the would-be engineer is accepted on probation. Secondly, it is essential that the applicant should be thoroughly trained in general engineering and qualified to acquire, from the particulars available during the early months of employment, the special knowledge of the Company's methods and practice, which he will need in his future work. The age of joining as a probationer varies from 21 to 25 years, and unless the applicant is of robust health, and willing to proceed on the Company's business at any time, to any part of the world, he will stand little chance of admission.

In view of the fact that engineers are employed in distant parts of the world, in many instances far from advice and assistance, they require to have a good working acquaintance with the many different branches of engineering. These include the construction of buildings, masts and machine foundations; the erection of masts, and installation of boilers, steam engines, oil engines, dynamo-electric machines and high-tension alternating and direct current electrical plant. They must, of course, in addition, understand the erection and tuning of wireless transmitting and receiving circuits. Experience has shown that for proper training it is necessary to devote at least two, and preferably three, years to college training in mechanical, electrical, and civil engineering subjects, and a further two years to mechanical engineering training in the workshops. A diploma in electrical engineering is necessary as evidence of competence. An engineer with only a college training has but a limited field of employment and little prospect of advancement. It is true that he may find occupation in research work, but even here the absence of practical experience will be a handicap in developing ideas for practical application. Equally, an engineer with shop training alone is just as limited in his employment, for his training will not permit of his designing of new types of apparatus and, in fact, his field is limited to carrying out the rule-of-thumb operations which he has learnt by previous practice.

A suitable training for service with the Marconi Company's engineering staff can be obtained by attending the Degree or Diploma Course provided by many Universities and Technical Colleges, in combination with two years' whole-time employment in a good engineering works, either during or after the college course. Such a training is, of course, equally satisfactory for many other branches of engineering. The following is a list of some of the institutions providing a suitable engineering course :—

INSTITUTION.	COURSE.
	London.
City and Guilds (Engineering) College	Diploma or Second Division Certificate in Electrical Engineering.
City and Guilds of London Institute	A Pass in the Final or Honours Grade in Electrical Engineering.
Faraday House	Diploma in Electrical Engineering.
Finsbury Technical College ..	Day Course Certificate in Electrical Engineering.
King's College	Diploma or Certificate in Electrical Engineering.
Northampton Polytechnic Institute	Four Years' Engineering Course Certificate.
University College	Diploma in Electrical Engineering.



NATIVES UNLOADING CASES OF MARCONI APPARATUS IN EAST AFRICA.

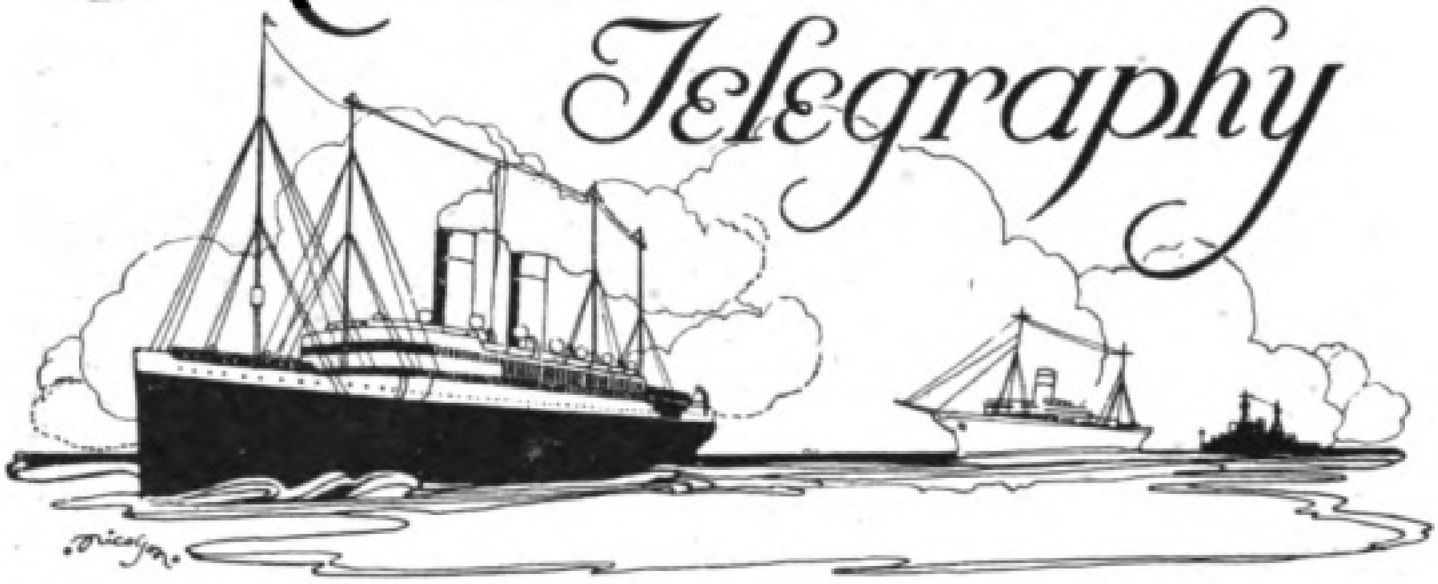
CARRYING A MAST SECTION TO THE STATION SITE.

	Dublin.
Royal College of Science for Ireland	Diploma in Engineering.
	Edinburgh.
Heriot-Watt College	Diploma in Electrical Engineering.
	Glasgow.
Royal Technical College	Diploma in Electrical Engineering.
	Liverpool.
University	Diploma in Engineering in the Honours School of Electrical Engineering.
	Manchester.
Municipal College of Technology ..	Certificate of Technology in Electrical Engineering.
	Newcastle-upon-Tyne.
Armstrong College	Diploma in Electrical Engineering.

In addition to purely engineering work, wireless engineers, before being placed in charge of contracts, whether large or small, must have some experience of the engagement and control of labour, the transport of goods, including customs arrangements, and must possess a working knowledge of accounts and correspondence. A certain amount of experience in these matters will be obtained by the engineer while serving as assistant ; nevertheless, any previous training which adds to such experience is bound to count in the long run and accelerate promotion.

To illustrate this article, we have picked at random a few photographs, taken by wireless engineers while engaged upon their work in various parts of the world. These pictures will, perhaps, help the reader to realise the skill required in superintending the construction of foreign wireless stations.

Maritime Wireless Telegraphy



Convoys and Wireless.

It is not long since we had in the House of Commons a statement by Sir Eric Geddes showing how successful has been the convoy system. Nothing was said regarding the part played by wireless telegraphy in the elaborate organisation of this system of ocean crossing, but those acquainted with the facts would not hesitate to pay high tribute were they questioned on the subject. A writer in a recent issue of *The Daily Mail* lifted the veil a few inches when speaking of the work of the young lieutenants in charge of navigation. " 'Number One,' " he says, " carried " steadily along with his ' watch,' answering the wireless messages, turning on the " signalman to flash short, concisely worded messages to consorts now and again, " and attending to the dozen and one other things that keep him busy."

It is the co-ordination of wireless and lamp or flag signals which is so valuable in the convoy system.

The telegraph guardship, with a keen young operator on watch, receives from sundry stations those orders on which so much depends.

Lamp or flag signals, with their limited range of visibility, serve for inter-communication between the ships of the convoy and, " fed " by the wireless, do everything that is required. So are the old and new combined.

Let those who think that the life of a wireless operator is one of comparative indolence remember the splendid and tireless service rendered by the " wireless men " on convoys.

With the safety of not one, but a number of vessels depending on their vigilance, with the telephones glued to their ears, ever listening for the faint signals of a coded message which may mean a complete alteration of course, they quietly serve their country in the steady defeat of the pirate craft on which the enemy so falsely banked their hopes.

A Little-Known Committee.

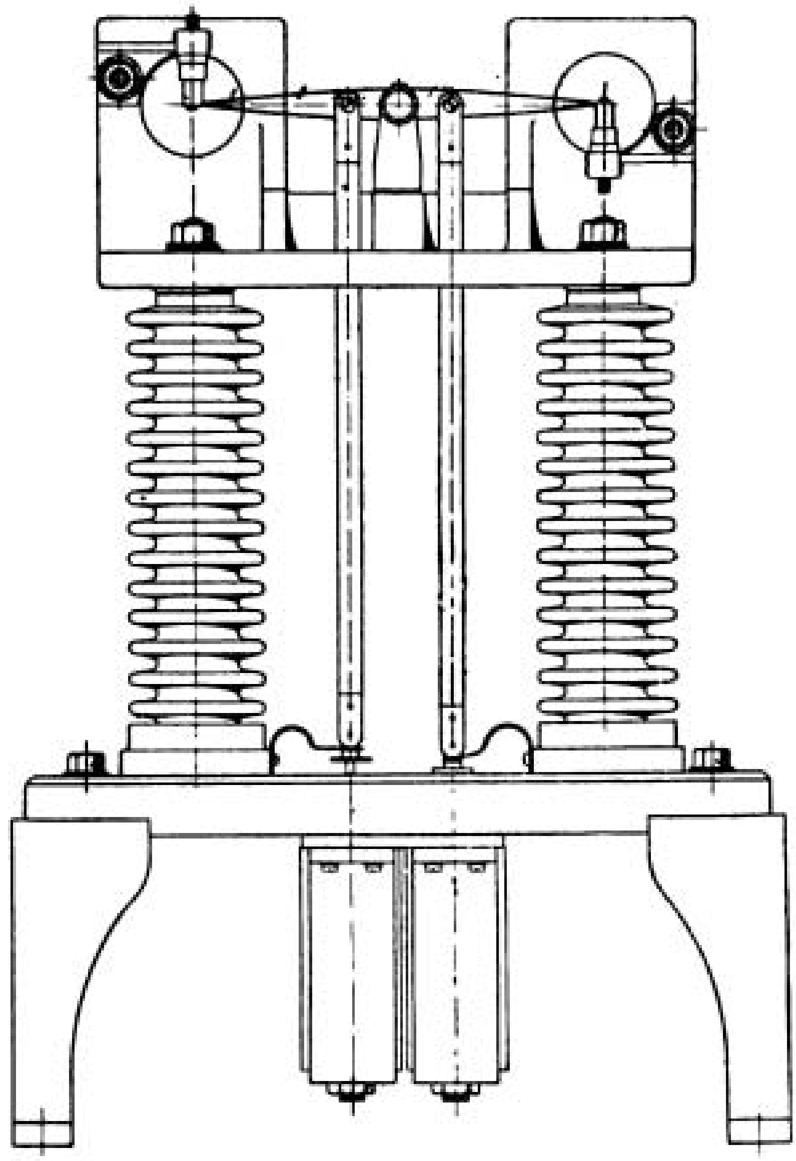
It may be news to many of our readers to learn that there sits at the Admiralty a "Merchant Ships' Gratuities Committee," which awards sums of money to merchant officers and seamen for devotion to duty when in action with enemy forces. Already to date, awards have been made to some thirty Marconi operators, whose names we hope to publish in a forthcoming issue. Besides these cases which have come to the notice of the authorities, there are, of course, numerous others, known only to those whose lips are sealed in death, and numbers more which, unwitnessed and unspoken of by the main actors, will never come to light. And yet there are still some who, if they had the power, would not allow the wireless man the status of an officer !

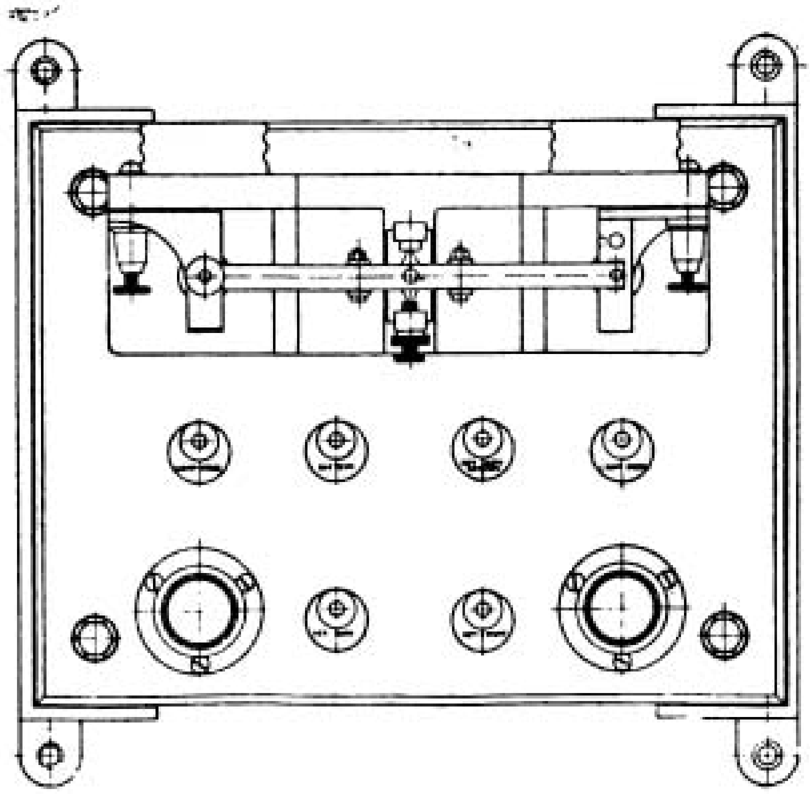
AMERICANS IN TRAINING.

The Allies in Europe are watching with keen interest the preparations by the United States for entry into the conflict which has now reached such a vital stage. Of the assistance to be rendered by the great Western Republic, not the least valuable will be in connection with the Mercantile Marine. Large numbers of young men are now in training for the wireless service of the U.S. Navy, both for service on warships and on merchant vessels, the radio communication of which is controlled by the Naval Authorities. The merry bluejackets shown at their studies in our photograph below are learning to send and receive wireless messages in the Philadelphia Naval Wireless School. Before long these young men will be taking an active part in the fight to defeat enemy submarines.

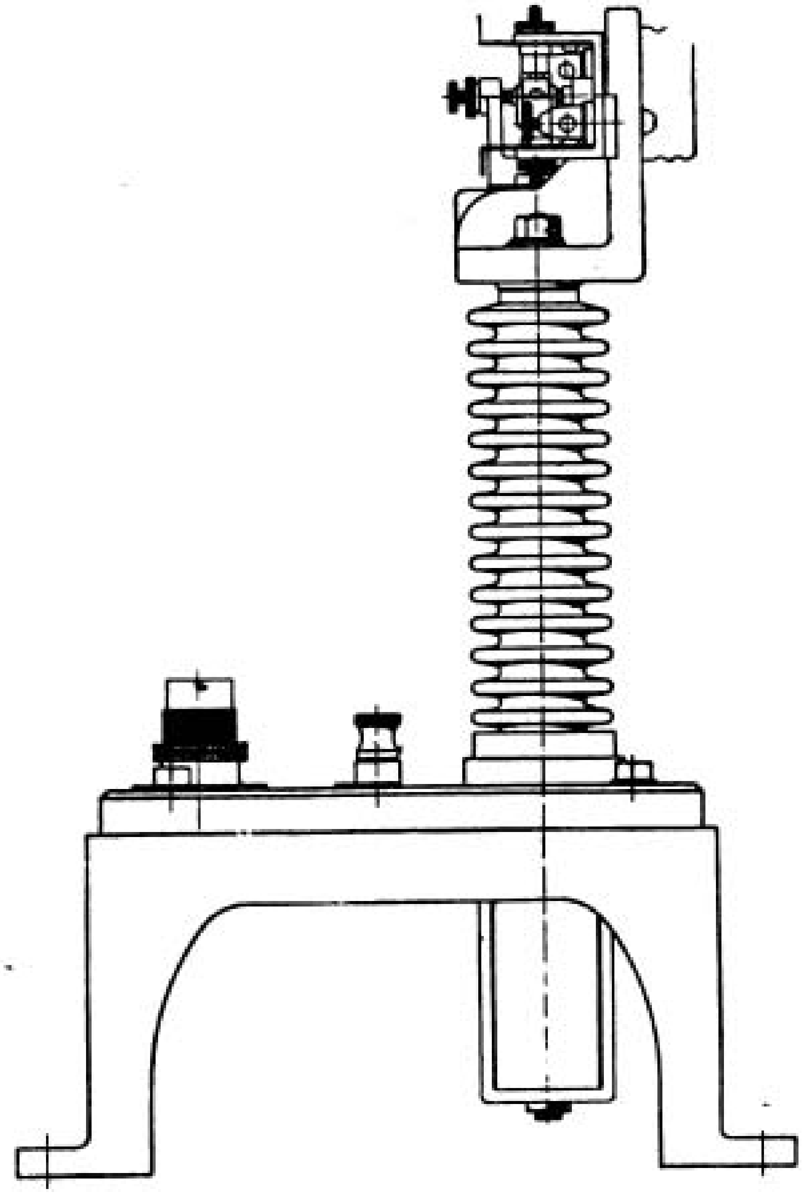
[Topical Press Agency.

AMERICAN NAVAL RADIO OPERATORS AT THE PHILADELPHIA NAVAL WIRELESS SCHOOL.





High Tension Signalling



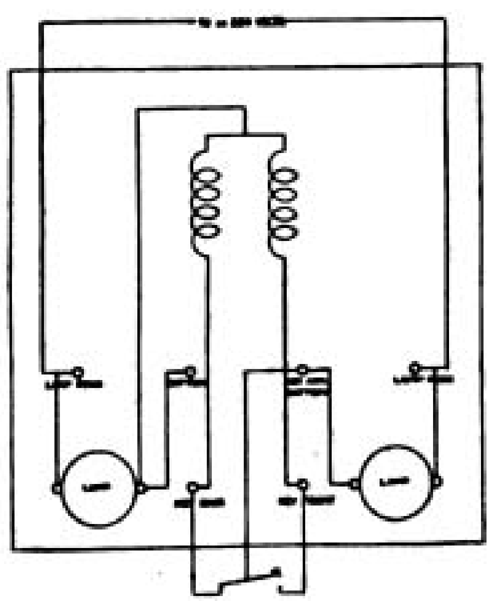


DIAGRAM OF CONNECTIONS

Switch, Plunger Type

New Wireless Companies

Some Recent Commercial Developments

OF the many recent commercial extensions of radiotelegraphy one of the most important is that of the Pan-American Wireless Telegraph Company, which seeks to establish communication between the United States, Mexico, Central and South America.

This new company is incorporated in the State of Delaware, with offices in New York, and has acquired the right to use all patents and concessions of the English and American Marconi Companies, as well as those of the Federal Telegraph Company (owning the Poulsen-Pedersen rights in the United States), for wireless telegraphic communication between the United States and the South American Republics. The Marconi Wireless Telegraph Company of America and the English Marconi's Wireless Telegraph Company, Limited, are each interested in the new company to the extent of 40 per cent. Mr. Edward J. Nally has been elected President of the Pan-American Wireless Telegraph Company, and the Hon. John W. Griggs, Chairman of the Board. The other officers are :—Washington Dodge, of California, Vice-President ; David Sarnoff, of New York, Vice-President ; C. J. Ross, of New York, Secretary ; and John Bottomley, of New York, Treasurer. The Directors, in addition to those mentioned above, are :—James R. Sheffield, Edward W. Harden, Frank N. Waterman, all of New York, and J. L. Deahl and Edward H. Hopkins, of California.

Steps have already been taken for the immediate erection of a chain of high-power stations by which the various Republics will be brought into most intimate touch with the United States of America, and, in the words of our contemporary, the *Wireless Age*, " If better knowledge is the basis of better understanding and better " understanding of better friendship, the Americas may become more united than " ever, through the unifying influence of wireless communication."

Recent developments in France have resulted in the formation of a new Company entitled the Compagnie Générale de Télégraphie sans Fil, which was incorporated on February 5th last, with its head office in Paris. The Directors are H. Bosquet (President), Baron de la Chevreliere (Vice-President), A. L. Aithalin, M. Bloch, A. Dupont, Godfrey C. Isaacs, E. May and M. Pietri. M. Ernest Georges Sins is General Manager.

The Company, which has a capital of frs. 12,500,000, divided into 25,000 shares of frs. 500 each, has purchased all the rights and interests of La Compagnie Universelle de Télégraphie et de Téléphonie sans Fil.

Marconi's Wireless Telegraph Company, Limited, and the Compagnie des Cables Télégraphiques (known as the " P.Q." Company) are both largely interested in the new concern, which will do much to extend the use of wireless telegraphy in France, its Colonies and Protectorates.

Correspondence

The Editor of THE WIRELESS WORLD.

DEAR SIR,—I have received from M. Blondel a letter with reference to my notice about the late Mr. Duddell. He says that he had not abandoned as hopeless the bifilar oscillograph, which Duddell improved so successfully. M. Blondel's pioneer work on oscillographs is so well known that it is only fitting to express the greatest appreciation of it which is felt by all who have experimented on methods of delineating the wave-shape of an alternating current. I regret that I have appeared to cast some reflection upon the skill with which M. Blondel developed this instrument. I may perhaps be allowed to quote the tribute which M. Blondel pays to the late Mr. Duddell :—

" Je profite de l'occasion pour payer un juste tribut de regret à votre éminent " collaborateur, M. Duddell, qui a fait dans d'autres domaines, assez d'admirables " découvertes, notamment en ce qui concerne l'arc musical, pour acquérir une gloire " durable et mondiale. On a appris en France, avec une sincère sympathie, sa morte " prématurée qui est une réelle perte pour la science."

Yours, etc.,

E. W. MARCHANT.

SIR,—With reference to the article " Some Remarks on the Morse Alphabet," by J. St. V. Pletts, appearing in the March issue, may I call attention to one or two facts of which the author is apparently unaware ?

The statement " The introduction of the earth return and central battery made the reversing of the current impossible . . . " is not wholly correct.

Up till a few months prior to the outbreak of war I had occasion, at times, to work both Single Needle and Double Plate Sounder instruments which were using an earth return and common battery. The connections admittedly were not so simple as those of the original Single Needle and Double Plate Sounder, but the functions and usage were identical. Common Battery with earth return is now used in a much wider sphere than that of Central Battery. Further, the majority of Central Battery systems of telegraphy are entirely dependent on current reversal.

Referring to signalling speed and economy, has not the writer heard of the Baudot system of telegraphy now in extensive use on very busy lines ? This system, which uses a metallic circuit, has a capacity of 2,160 letters per minute, *i.e.*, six duplex channels, each channel capable of 30 words or 180 letters per minute.

The " letters " include the alphabet and figures plus nineteen punctuation marks and working signals. It is to be noted that all signals are of equal duration.

Should the writer of the article in question require any further information, a book entitled " The Baudot Printing Telegraph System " (Whittaker and Co.), written by Mr. H. W. Pendry, explains the working of this system.

This system, of course, is not suitable for other than very busy lines, but in cases parallel to those quoted toward the end of the article, viz., less busy circuits which are required to be worked by more or less unskilled operators, the telephone has been successfully introduced.—Yours faithfully, " SEACTOC."

Some Curves and Nomograms for Wireless Calculations (II.)

By P. BAILLIE, L.Sc.

NOTE.—*The first instalment of this article appeared in our April issue, pp. 41 et seq.*

SINCE capacity calculations, in connection with antennæ, oscillating circuits, or with any other subjects, may involve working with following formulæ :

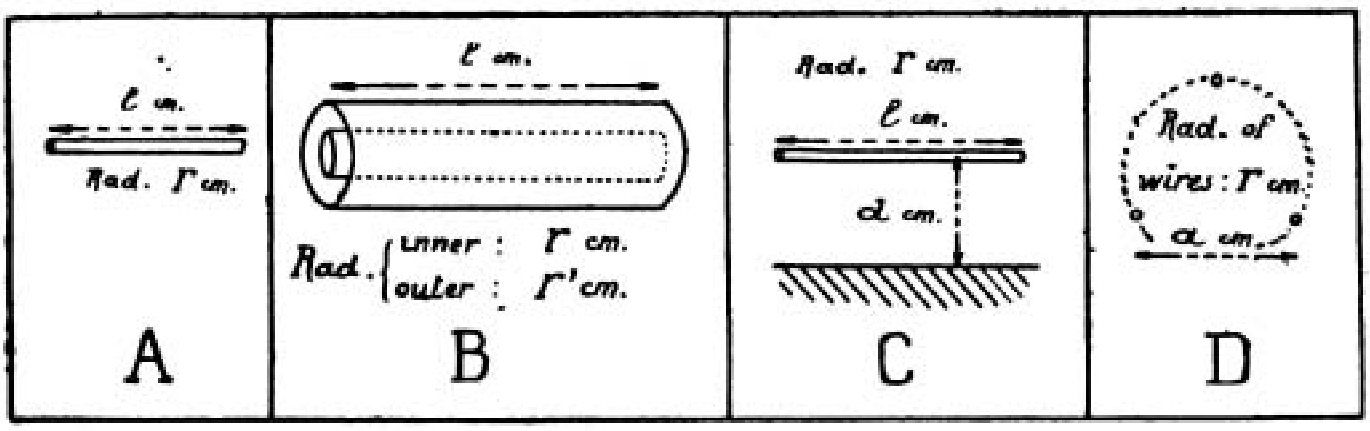


FIG. 7.

$$C = \frac{K\,l}{2\,\text{Log}_e \frac{l}{r}}$$ giving capacity of an insulated cylinder (Fig. 7, *A*) . (6)

$$C = \frac{K\,l}{2\,\text{Log}_e \frac{r'}{r}},$$ capacity of two concentric cylinders (Fig. 7, *B*) . . (7)

$$C = \frac{K\,l}{2\,\text{Log}_e \frac{2\,d}{r}}$$ capacity of a cylinder parallel to a plane (Fig. 7, *C*) . (8)

a nomogram (Fig. 8) has been drawn which solves those three formulæ. It may be noted that it solves, also, the formula

$$C = \frac{K\,l}{18\,\text{Log}_e \frac{a}{r}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

which gives the apparent capacity of a three phase air line, with the wires at the summits of an equilateral triangle.

Its use is clearly evident from small figure on nomogram (Fig. 8).

Mechanical calculations will be encountered in connection with masts and stays. It is hoped that the design of stays will be facilitated by use of curves (Fig. 10 and Fig. 11). Notations are as shown (Fig. 9). Dotted curves on Fig. 11 give values of ratio $\frac{\text{length of cable}}{a}$.

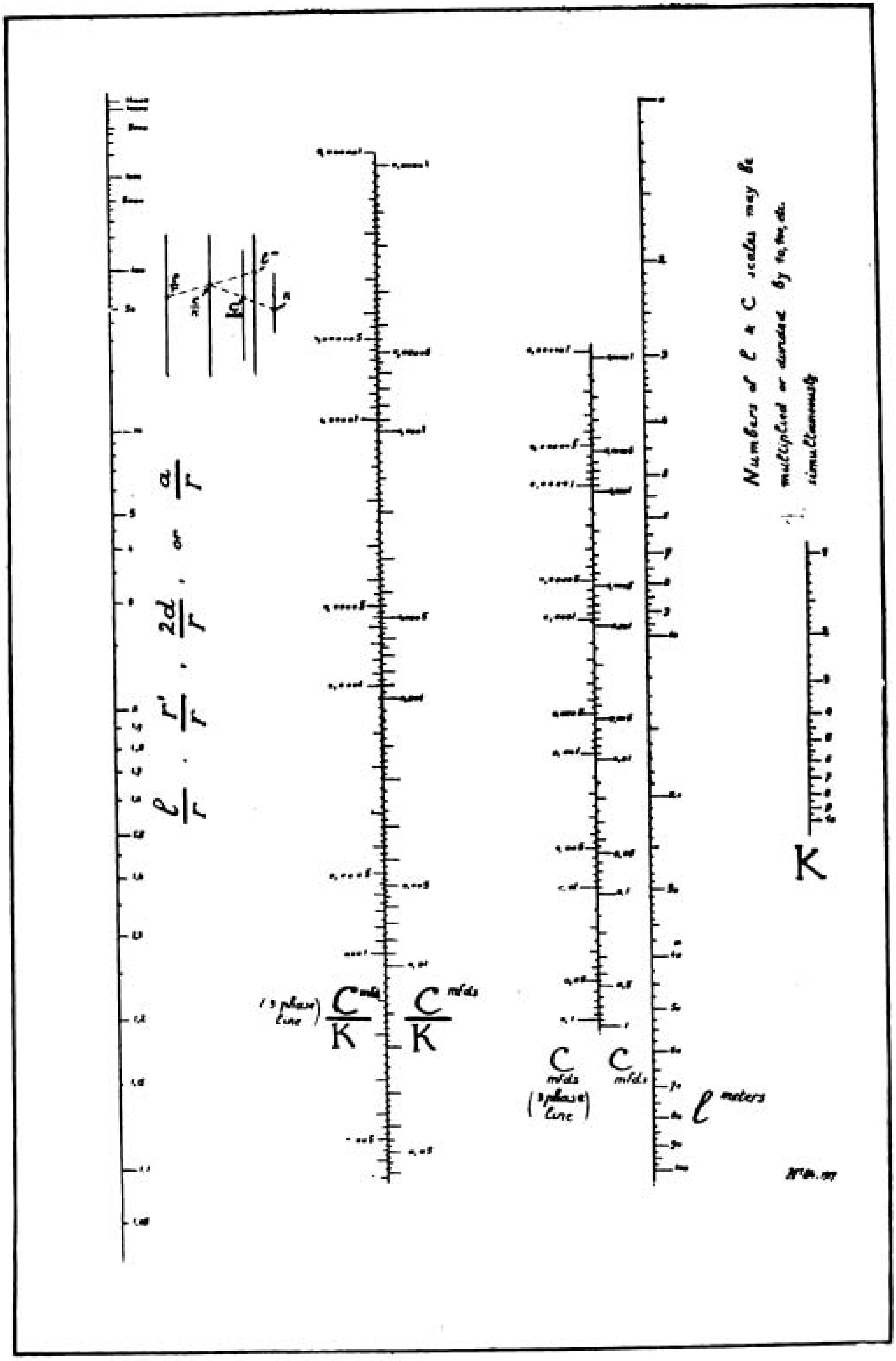


FIG. 8.

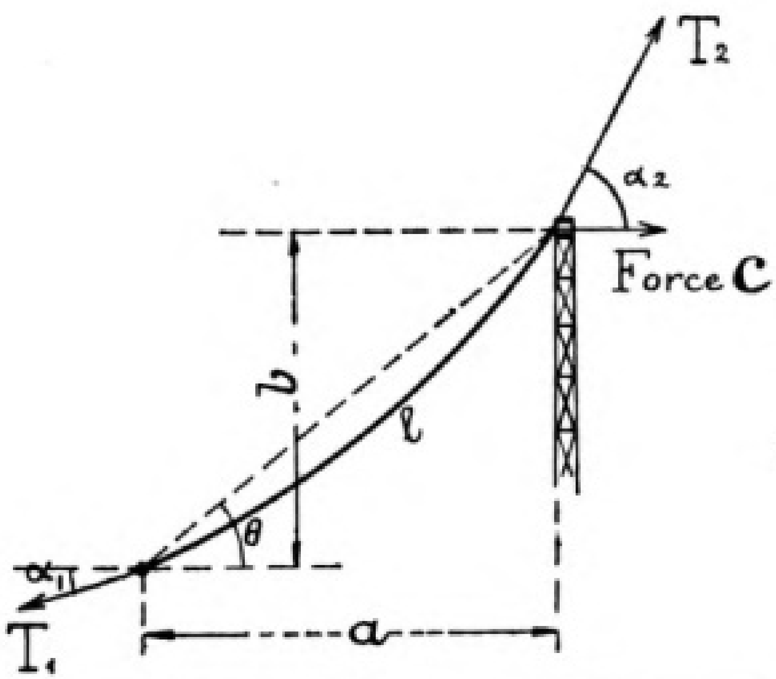


FIG. 9.

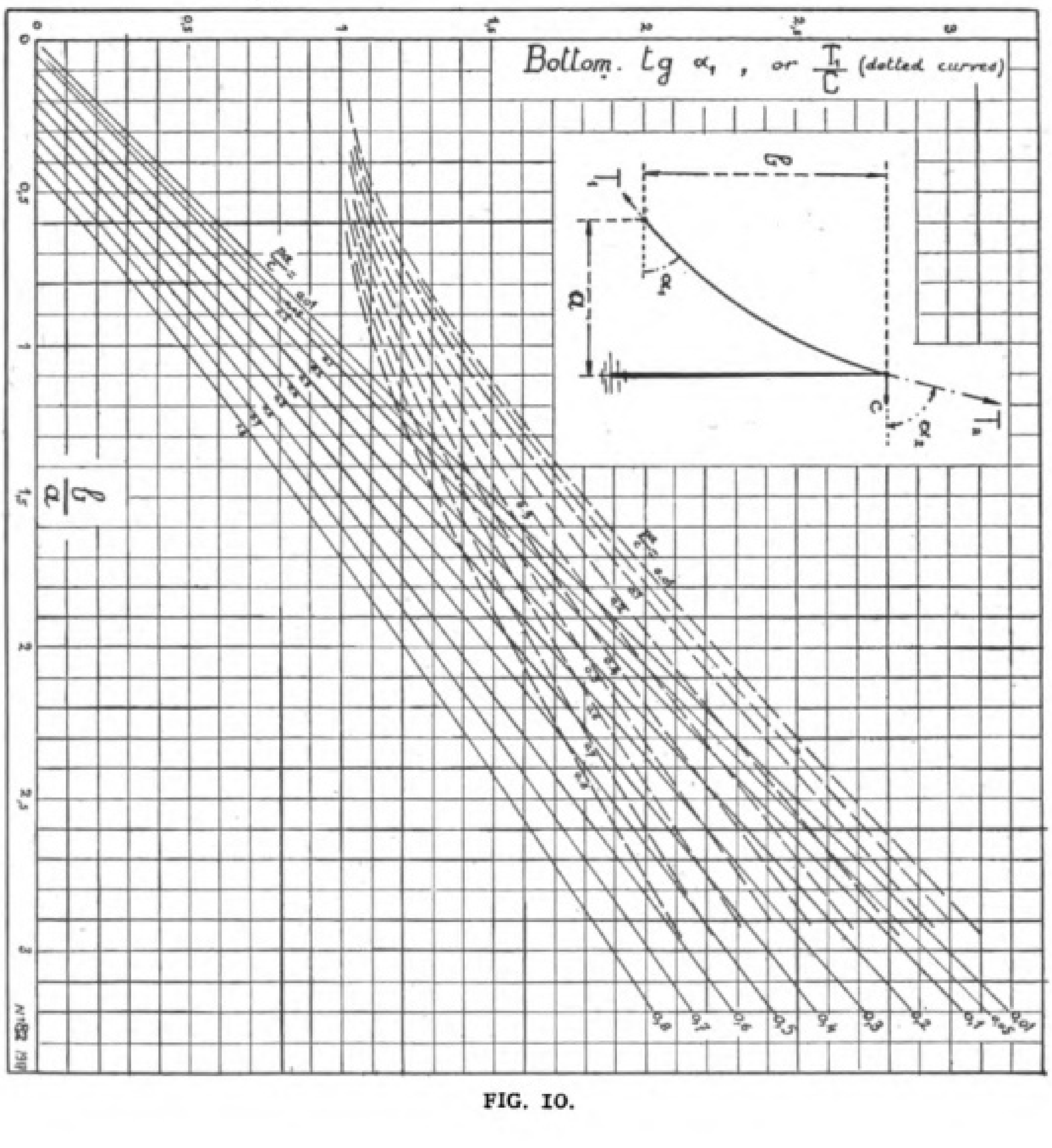


FIG. 10.

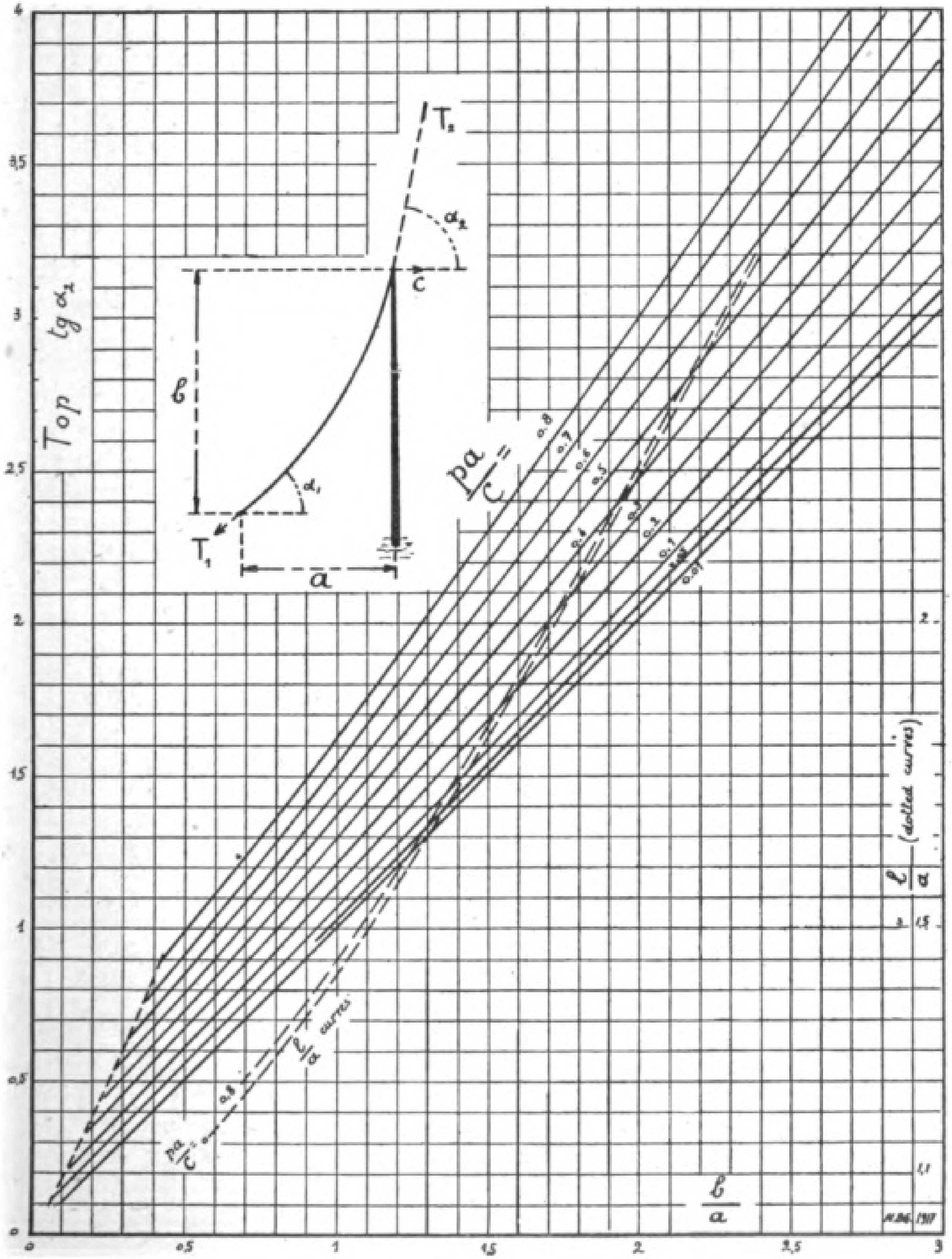

Top
tg α₂
T₂
α₂
c
b
α₁
T₁
a
pa/c =
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.01
b/a (dotted curves)
b/a curves
b/a
0
0.5
1
1.5
2
2.5
3
3.5
4
1.1
1.5
2

FIG. II.

The section of the cable should be calculated (roughly and on the safe side) in order to support a strain $T = \frac{c}{\cos \theta}$.

The curves give in terms of $\frac{pa}{c}$ (p and c Kg., and a meters) the correct directions and consequently magnitude of top and bottom strains T_2 and T_1.

The inductance of antenna circuit (distributed and localised) should be calculated from values of λ and C. A nomogram has been published in this magazine * which may be of some use.

For inductance design the reader is referred to a contribution of Lieut. Bertram Hoyle,† or to curves given by M. P. R. Coursey, in *The Electrician* (September 10th, 1915). Tables are also given in the excellent book of Mr. W. H. Nottage.‡ When inductances having coupled flat coils are to be used, the reader may be referred to a paper of the author in *The Electrician*.§ Curves (Fig. 13) give the coupling coefficient in per cent. of two coaxial flat spiral coils (see Fig. 12).

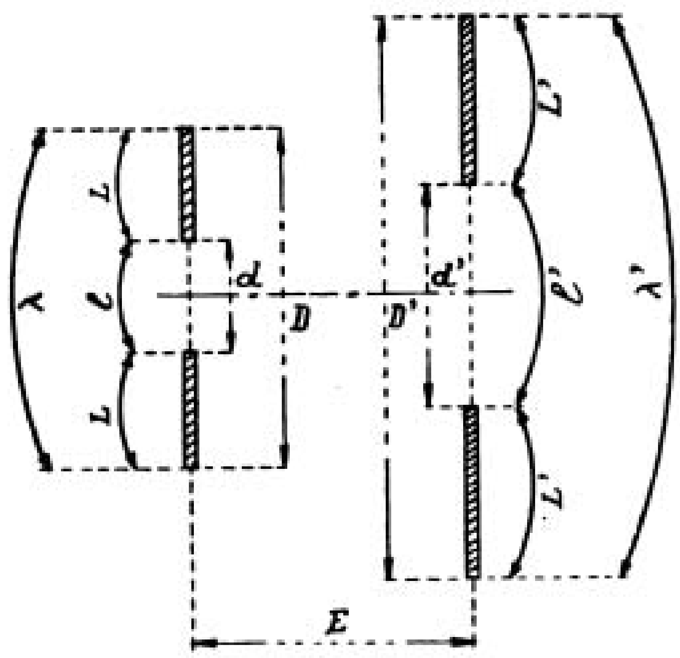


FIG. 12.

The use of these curves is as follows:

1. *Coils Wound to the Centre.*—Internal diameters = 0; external diameters, D and D'; space between coils, E. Calculate D'/E and D/E and read off K (in per cent.) from curves (Fig. 13).

2. *Coils with any Internal Diameters d and d'* (see Fig. 12).

Calculate $\frac{D}{E}\ \frac{D'}{E}\ \frac{d}{E}$ and $\frac{d'}{E}$, and take from curves (Fig. 2) the coupling coefficient of the various wound-to-the-centre coils, according to table below.

Effect of Coil.	On Coil.	Parameters for Curves. Fig. 13.		Obtained from Curves, Fig. 13.	Parameters for Nomogram, Fig. 14.			Obtained from Nomogram, Fig. 14.
λ	λ'	D/E	D'/E	$K(\lambda\lambda')$	$K(\lambda\lambda')$	D	D'	$R=$
l	l'	d/E	d'/E	$K(ll')$	$K(ll')$	d	d'	$S=$
λ	l'	D/E	d'/E	$K(\lambda l')$	$K(\lambda l')$	D	d'	$T=$
l	λ'	d/E	D'/E	$K(l\lambda')$	$K(l\lambda')$	d	D'	$U=$

* THE WIRELESS WORLD, "Wave-length Calculations," February 1917.

† THE WIRELESS WORLD, December 1916.

‡ *The Calculation and Measurement of Inductance and Capacity*, Wireless Press, London.

§ "The Coupling Coefficient of Coaxial Spiral Coils," *The Electrician*, September 21st and 28th, 1917.

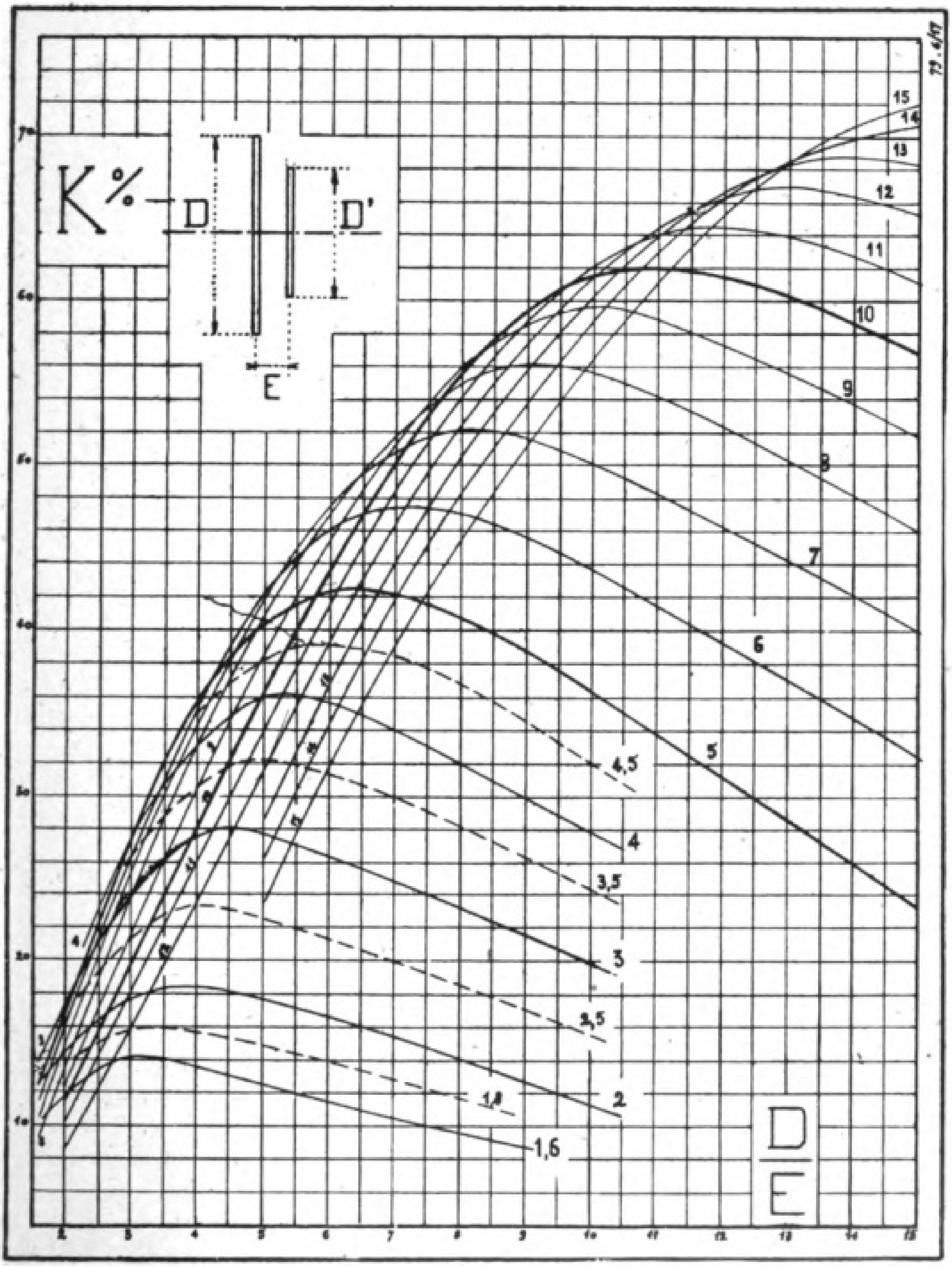


FIG. 13.

(To be continued.)

Among the Operators

It is our sad duty, month by month, to record the deaths of the brave operators who have lost their lives at sea by enemy action and other causes in the wireless service of their country. Owing to the necessity of preventing information reaching the enemy, the names of ships and localities of action cannot be published. With the exception of Mr. G. E. Robinson, whose ship was lost in a gale, the lives of the operators mentioned this month have been sacrificed through enemy action. Both for our own part, and on behalf of our numerous readers, we extend to the parents and relatives of these young men, who so nobly uphold the "wireless tradition," the deepest sympathy in their bereavement.

* * * * * *

Mr. George Edward Robinson was born in Horbury on January 28th, 1900, and educated at St. John's School, Horbury Bridge, and Southdale Council School, Ossett. He was employed by Messrs. J. Ledbetter and Co., of Dewsbury, as a clerk, and left that firm to undergo training at the North Eastern Wireless Schools, Leeds, where he qualified, and after obtaining the P.M.G. certificate was appointed to the Marconi Company's staff in September, 1917.

* * * * * *

Born in Mains, Forfarshire, on August 29th, 1893, Mr. Norman Scott Craig was educated at Harris's Academy, Dundee. After leaving school he obtained a position with Messrs. Stewart and McDonald, Glasgow, and subsequently entered the North British Wireless Schools, Ltd., in that city for training in wireless telegraphy. On gaining the P.M.G. certificate he received an appointment in the Marconi Company in July, 1915.

* * * * * *

Mr. Robert Methven Deadman was born in Reading on June 23rd, 1900, and went to school there. Commencing his career in the office of the District Valuer, Inland Revenue, he subsequently attended the Marconi House School, and there obtained the P.M.G. certificate. Mr. Deadman's service with the Marconi Company dated from the beginning of this year.

* * * * * *

Of Irish birth, Mr. Michael Peter Sinnott was 23 years old, and came from Gorey, Co. Wexford. He received his education at Blackrock College, and Skerry's College, Dublin, and was trained at the Atlantic Wireless College, Cahirciveen, where he gained the P.M.G. certificate. Mr. Sinnott was appointed to the Marconi Company's staff on September 16th, 1917.

* * * * * *

Mr. William Harold Southcott was born in Morchard Bishop, North Devon, on April 18th, 1901. He was educated at the Elementary School there, and at Crediton Grammar School. Entering Marconi House School for training in wireless telegraphy, he gained the P.M.G. certificate, and was placed on the staff on December 9th, 1917.

ROLL OF HONOUR

READING FROM TOP LEFT TO RIGHT: OPERATORS PINDER, ELLIS AND WARDROP; DEADMAN AND SOUTHCOTT; CRAIG AND BULL; ROBINSON AND LALLY; SMITH, SINNOTT AND STEWART.

Dumfries was the birthplace of Mr. John Waidrop, and he was nearly 19 years of age. After receiving his education at North Kelvinside, Alan Glens School, and the University, Glasgow, he went to the North British Wireless Schools, Ltd., Glasgow, for training. When in possession of the P.M.G. certificate he was accepted by the Marconi Company, and joined the operating staff last September.

* * * * * *

Mr. William Edward Pinder, born at Salford on December 28th, 1898, was educated at the Urmston Higher Grade School, after which he was employed as draughtsman by Messrs. Royles, Ltd., Engineers, Irlam. His wireless training was received at the Marconi House School, and on receipt of the P.M.G. certificate in August, 1917, he proceeded to sea in the service of the Marconi Company.

* * * * * *

Mr. Thomas Stewart was born on July 13th, 1900, at Bury, and received his education at St. Chad's and the Technical Evening Schools. After leaving school he was employed by the Lancashire and Yorkshire Railway Company, and Messrs. Mellor, Ltd., Warth Mills, Bury, respectively, leaving the latter to take up wireless. Trained at the City School of Wireless Telegraphy, Manchester, Mr. Stewart qualified for the P.M.G. certificate, entering the Marconi Company's service in January last.

* * * * * *

Born on September 3rd, 1896, at Ballyconnell, Mr. Michael Lally was educated at Kilbeacantry, Ballyturin, and Loughcutra, and trained in wireless telegraphy at the Irish School of Telegraphy, Cork. After obtaining the P.M.G. certificate, Mr. Lally was appointed to the Marconi Company's staff on May 31st, 1917.

* * * * * *

Formerly clerk to the Professor in Civil Engineering, University of Liverpool, Mr. Henry Osborn Smith was born at St. Helens, Lancashire, on August 18th, 1899, and educated at the Higher Grade School there, and Kelvin College, Liverpool.

Greatly interested in wireless telegraphy, he took a course of training at the Liverpool Wireless Training College, and received the P.M.G. certificate. Mr. Smith entered the Marconi service in December, 1917.

* * * * * *

Mr. Charles Ellis was born on August 28th, 1899, at Heywood, and attended the Reddish Council School where he was educated. For a time he was employed by the Broadstone Spinning Company, Reddish, after which his wireless training was received at the Manchester Wireless Telegraph Training College, where he qualified for the P.M.G. certificate. Mr. Ellis was placed on the Marconi operating staff on September 16th, 1917.

* * * * * *

Mr. Jabez George Bull, a Gloucestershire man, was born at Hanham on February 15th, 1895, and received his education there and at Bristol. He was employed as a collector in the Post Office Telegraph Department at the latter city, where he learned telegraphy with a view to becoming an operator. Accepted as a student at Marconi House School, he soon qualified for the P.M.G. certificate, and was placed on the sea-going staff. Mr. Bull has been spoken of in high terms by the several commanders under whom he served since February, 1913.

Imperial Wireless Chain Litigation

Marconi Company's Petition of Right

On March 14th a Petition of Right by Marconi's Wireless Telegraph Company Limited came before the Court. The Company claimed a Declaration that the Postmaster-General was not entitled to repudiate an agreement dated July 30th, 1913, for the erection of a chain of wireless stations.

The case, which had been expected to extend over many weeks, concluded on the third day, when the Attorney-General intervened admitting breach of contract by the Government. Mr. Justice McCardie said that the course proposed on behalf of the Crown was a right one, and the result would be that there would be declarations that the Postmaster-General was not entitled to repudiate the agreement of July 30th, 1913, and that the agreement was wrongfully repudiated by him. The suppliants were entitled to have the damages assessed by some expert to be appointed.

Of the many comments which have appeared in the Press, perhaps the best is that published under the heading of "Chapters in Wireless History" in our enterprising contemporary, *Electrical Industries*. The position is so clearly stated that we take the liberty of reprinting the article in full.

The writer remarks that it is difficult to say, at present, whether the history of wireless telegraphy in Great Britain ought to be written by, say, Dr. Erskine Murray or by William Le Queux. There is, indeed, enough material for two histories, one by the man of science and another by the author who revels in spies, plots, intrigues, secret documents, startling revelations, and all the other elements in melodrama. Most phases of the electrical industry have had a rather stormy career, but not one of them can show anything like the tempests of personalities, accusations and counter-accusations, scandals and litigation which have raged around wireless telegraphy almost since Mr. Marconi demonstrated his apparatus to the Post Office. The latest outburst is characteristic in the suddenness with which it rose and the violence it displayed. During the hearing of the case for breach of contract brought by the Marconi Company against the Post Office a letter was read from two directors of the Telefunken Company to Mr. Godfrey Isaacs referring to an alleged offer by Sir Charles Hobhouse (then Postmaster-General) and Sir Henry Norman of support for Telefunken competition with the Marconi Company in Great Britain. Sir Charles made a speech in Parliament denying the statements in the letter; Mr. Isaacs asked him to "come outside" to settle the question; and Mr. Isaacs has now obtained a writ against Sir Charles for libel.

Apart from this case, we are surprised that anybody should be indignant over the accusation that he sought to introduce foreign competition against a British "monopoly." Only since August, 1914, has such conduct become heinous. Previous to that date it was the correct thing. During 1912, when the Post Office was arranging for the erection of the Imperial "wireless chain," the absence of any effective competition with the Marconi Company was a serious embarrassment to the Government. In the House of Commons the contract was denounced by Mr. Arnold White as "a sinister precedent," and member after member treated the negotiations as a friendly conspiracy between the Post Office and the Marconi Company. Mr. Samuel (then Postmaster-General) proved that he had beaten the Marconi Company down on many points; he had also checked the Marconi prices with the aid of a technical committee, and he had secured terms much below those which the German Government had granted to the Telefunken Company in similar circumstances. In spite of his explanations, a Select Committee was formed to examine the agreement, and many precious months were wasted in talk which left the situation very much as it was before. "The Marconi Scandal" was of infinitely more importance to Members of Parliament than the development of wireless telegraphy on an Imperial basis. These were the days when the anti-Semites revelled in the alleged stockbroking sins of Samuel and Isaacs and the brother of Isaacs.

With that irrelevant aspect of wireless telegraphy in Great Britain we do not propose to deal. Practical interest lies in the organised attempt made to discourage a British industry. The number of Members of Parliament who took a sympathetic interest in the Poulsen Goldschmidt and Telefunken systems was extraordinary. In October, 1912, Sir Henry Norman quoted with approval a remark to the effect that "after all, wireless installation is only a superior kind of gas fitting," and he denounced the agreement as constituting a Marconi monopoly. In December, 1912, when giving evidence before the Marconi Enquiry, he returned to the subject. "A commercial company," he said, "receiving from the British Government a "concession giving it the British Empire for its chief field of operations would "thereby acquire so much prestige and such vast opportunities that wireless "inventors would be almost compelled to come to it hat in hand, and if their "inventions were refused they would be gravely discouraged." He also repeated a suggestion that the Postmaster-General should use his statutory powers to get everything he needed from the Marconi Company without further payment.

From these extracts we may pass to the letter which was received by Mr. Godfrey Isaacs on July 21st, 1914, from two directors of the Telefunken Company:—

"Re Lepel.—As I told you upon the occasion of our meeting in Paris, when the "Postmaster-General and Sir Henry Norman were in Berlin they made an offer to "the Telefunken that they should start in keen competition in England with the "Wireless Company and that we could rely upon the Government's support provided "that the Telefunken would make offers lower than the Wireless. Having regard to "the arrangements which we have made, we told these gentlemen that we are "naturally competing with the Wireless in England, and that it would be practi-"cally impossible for us to make lower offers than the Wireless Company, having "regard to the fact that our expenses on account of licences, etc., would be higher "than those of the Wireless Company, besides which our patent position in England "was uncertain.

"From this Sir Henry Norman formed the opinion that there would be little "question of relying upon the Telefunken Company as a competitor of the Wireless "in England, and he therefore approached Herr von Lepel with the object of "encouraging him to form an English company and to obtain for him financial "assistance. With this object amongst others, we understand that these gentlemen "are endeavouring to obtain financial support from Mr. Beit. We did not want "to fail in giving you this information, and remain yours faithfully, GESELLSCHAFT "FUR DRAHTLOSE, TELEGRAPHIE m.b.h.—BREDOW, SOLFF.—P.S.—Mr. Hird knows 'more."

It is worth noting the terms in which Sir Henry Norman traverses this account in a letter to Sir Charles Hobhouse :—" It is of course ridiculously untrue, so far as "I know, for anyone to say that during our visit to Berlin you tried to induce the "Telefunken Company or Lepel, or anybody to start a wireless factory in England "in competition with the Marconi Company."

Nothing is said in the Telefunken letter about starting a factory, and there was no need for the Telefunken Company to do any such thing in order to do what so many Members of Parliament were anxious to see done—undercut the Marconi Company. The personal aspect of this dispute can be settled only in open court—where it will now be settled—but the Telefunken Company might have been forgiven if it treated Sir Henry Norman's visit as an invitation to come over and help the anti-monopolists. There was plenty of evidence that help—even German help—would be welcome. As we remarked in August, 1913, "the manner in which "certain newspapers have continued to advertise foreign wireless telegraph systems "and throw contempt on the Marconi Company—all, of course, without the slightest "party bias and with a pure desire to serve the public interests—has been par-"ticularly nauseating. . . . From start to finish . . . the Marconi case has proved "that a British company need not expect the slightest consideration at the hands of "Parliament."

Speaking at the subsequent annual general meeting of the company, Mr. Marconi said :—" I cannot learn of an instance where Parliament has ever before "had recourse to the sledge-hammer power which it possesses of placing a private "enterprise in such a position that its only alternative to making further con-"cessions demanded of it would be the imperilling of its reputation and business "throughout the world."

Among the tangled uncertainties of wireless history there is one indubitable certainty. German wireless telegraph interests were not indifferent to the way in which British patriots were playing the German game. Knowing the German as we now know him one can be sure that every assistance was given to the anti-Marconi agitation. Long before the question of the Imperial contract came up, it was notorious that Germany was jealous of British pre-eminence in wireless telegraphy. The visits of Count Arco to Marconi demonstrations should not be forgotten nor his subsequent attempts to make piratical use of the information he secured. When the Marconi Company began to organise a successful maritime service, the German Government engineered the International Radiotelegraphic Convention, and used all its black arts of diplomacy to give the German wireless telegraph companies the full benefit of British enterprise. At every stage of the proceedings the Marconi Company had to fight, and fight hard, for elementary rights. At no stage in its history did it enjoy anything within a thousand miles of the support which the German Government gave to companies which had, in spite of the vaunted superiority of German science and organisation, failed to draw level with the achievements of the Marconi Company. We take some credit for the fact that from the earliest days of commercial wireless telegraphy we were almost alone among our trade and other contemporaries in advocating the policy which is now a commonplace—the policy of fostering and safeguarding British enterprise. It is now easy for even the most obtuse Member of Parliament to see that if British wireless telegraphy had been given a fraction of the support which Germany lent to its inventors and manufacturers, the development of facilities for communication of immense strategical value would have been much more advanced in August, 1914, than it was in fact. But in those earlier days the representatives of the people seemed to be much more concerned in hampering a vital British industry and in encouraging German competition with a view to preventing that industry from being demoralised by prosperity. These broad aspects of wireless history are worth recalling, if only because there are still some strangely-constituted people who regard a successful British enterprise as a menace to the public and the Empire at large.

The *Investors' Review*, writing on the case in its issue for March 23rd, says :—
"Nothing could exceed the disagreeableness excited in the people's minds by the "Marconi suit against the Postmaster-General. So bad apparently was the case "of the Government, that it ought never to have been fought. If the Marconi "Company was right—as the withdrawal of the Law Officers of the Crown after "the hearing had gone on for several days seems to prove—then to whose stupidity "do we owe the raking up of this scandal into the people's sight? The Marconi "Company alleged breach of contract and claim damages. Its contention and "claim have been proved well founded."

Share Market Report

London, *April* 11*th*, 1918.

Business in the industrial market has been very restricted during the past month. Prices in the shares of the Marconi group have remained steady. The shares of the International Marine show a marked firmness. The very satisfactory report of the American Company was well received. The announcement of the formation of the new Pan-American Company, linking up the United States and dependencies with the Southern States, created a most favourable impression, and should greatly enhance the value of the present company. The closing prices as we go to press are :—Marconi Ordinary, £3 2s. 6d. ; Marconi Preference, £2 12s. 6d. ; Marconi International Marine, £2 8s. 9d. ; Canadian Marconi, 10s. ; American Marconi, £1 3s. ; Spanish and General, 8s. 6d.

Instructional Article

NEW SERIES (No. 2).

EDITORIAL NOTE.—Below we give the second of a new series of twelve Instructional Articles devoted to PHYSICS FOR WIRELESS STUDENTS. *Although at first sight the subject of physics would not seem to have a very intimate connection with wireless telegraphy, yet a sound knowledge of this subject will be found of the greatest use in understanding many of the phenomena met with in everyday radiotelegraphy. As in previous series, the articles are being prepared by a wireless man for wireless men, and will therefore be found of the greatest practical value.*

MATTER, FORCE, AND MOTION.

GENERAL PROPERTIES OF MATTER.

MOST people are familiar with the doctrine of the indestructibility of matter, or, as it is also called, the conservation of matter. It states that we can neither create nor destroy matter, the sum total of which remains invariable. That we can change the *state* of matter is a fact of everyday experience which scarcely needs illustration. When we evaporate pure water it appears to be destroyed, but every schoolboy knows that by condensing its steam he can regain practically the whole amount of water with which the experiment began. Again, if water is subjected to the action of an electric current its bulk diminishes but invisible gases are formed which can be made to re-combine to form water. The burnt or consumed portions of a piece of coal, plus the ashes left behind, weigh as much as the coal itself, and many quantitative experiments have shown that we cannot increase or reduce the total quantity of matter. It is this test which is applied by the physical scientist to ascertain whether a phenomenon has real existence; if it is conserved it is a fundamental reality; if it is not conserved it has not physical existence. As we shall see later, energy also stands the test and takes its place as one of the only two things considered by *physical* science to be entities. Light and heat are produced during the burning of a piece of coal but finally disappear, leaving us with ashes, water vapour, certain gases, unconsumed carbon and perhaps sulphur and several other products. All of these added together will account for the weight of matter we began with, so that the loss of the light and heat makes no difference to the *amount* of matter though it has something to do with its change of *form*. The result of the fire is that we have destroyed that particular *combination* of atoms which is called coal, but we have not destroyed any atoms. If, however, it were possible to take the ashes and gases and reconstitute the piece of coal, we should find that we require the *energy* of the light and heat (though not necessarily in those forms) for this was essential to the making of the coal in the first instance.

Weight.—It was stated in the last article that a property of matter which distinguishes it from all else is that it occupies space. Another of its properties, equally characteristic and more important for the student of physics, is Weight. Practically everyone knows what Weight is although not everyone can define it, and as in science we have to be quite clear and agreed about our definitions it is necessary to define certain familiar phenomena with a degree of precision which may appear to be somewhat overdone. As a matter of fact, in this instance we are confronted not with something simple but with a mystery, fundamental and inexplicable, which we can only refer to a *cause*, leaving the state of knowledge much as it was before. Hence Weight is described as the **attraction between the earth and all matter.** The particular *name* given to this attraction is the Force of Gravity, a phrase which introduces another term requiring explanation, for we have not yet dealt with the idea of Force. Gravity tends to pull matter downwards in a vertical direction towards the centre of the earth, and it is this pull which we experience when we lift a body. The attraction between the earth and a mass of matter is mutual—that is, the force of attraction acts in both directions at once, so that the earth also *tends* to move towards the mass of matter. The reason why it is the smaller body only which appears to move is that no movement of the whole earth would be observed by us, for we do not even notice, save by the apparent variation of the positions of bodies outside it, the diurnal motion of the earth or its orbital movement round the sun.

The weight of a body is not a constant quantity inasmuch as it varies for different parts of the world. As the earth is slightly flattened at the poles a body when in those regions will be nearer to the earth's centre than it would be at the equator, and consequently* will weigh more within the Arctic Circle than in Equatorial Africa.

Mass.—The **mass** of a body is said to be the quantity of matter it contains, and although this definition seems somewhat vague and unsatisfying it indicates one important truth very clearly—namely, that mass, in contradistinction to weight, is a constant quantity for any given body. A block of iron weighing a ton may weigh less if taken to another latitude, but it will contain just as much matter in one place as in any other ; in fact, were it possible to remove it from the influence of the earth and all other bodies its *mass* would not be altered at all, whereas its *weight* would disappear.

For most practical purposes mass and weight may be regarded as the same when we are dealing with any one part of the world. This will be clearer to the student after he has read about the practical units of mass and weight, but he must not forget that **Weight is a force but Mass is a quantity of matter.**

Inertia.—Every mass possesses a property, inherent in even its tiniest particles and quite as mysterious as Weight, to which is given the name Inertia. **The Inertia of a body is that property of it which opposes its movement and which, once the movement has begun, opposes its acceleration,† retardation, and cessation.** We know very little more than this about inertia and to attempt to explain what it is and how it works would be as futile as to try and explain Time. The *effects* of Inertia are so far-reaching and important that we shall return to the subject again after certain considerations of Force, Motion, and Energy.

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* Because the force of attraction will be greater.

† Acceleration is here used in the ordinary sense, meaning increase of speed.

FORCE.

Two bodies, one charged negatively * and the other positively,* either move towards each other or tend to do so. If these bodies are both charged positively they either move away from each other or tend to do so, and a similar statement applies if they are both charged negatively. *Neither of the bodies has the innate power to perform these movements*, such power being possessed only by *living* bodies, so that it is not correct to consider their movement as originating within them. Nor would it be strictly accurate to say that they exert attractive or repulsive force for this would seem to endow them with *will*, or to imply that each possesses *of itself* the power to attract and repel, an implication quite contrary to facts. We give the name of Force to *that which causes* them to move or to tend to move. It should be understood, however, that Force is not a *thing* such as Matter or Energy, for, unlike these, it is not conserved. Causes such as those to which we give the name of Force can be both created and destroyed; hence Force has no objective existence. It is clear that we can bring into play a certain set of conditions as a result of which two bodies will move together, or will, in common parlance, exert attractive force; but it is equally obvious that we can eliminate that force (or cause of movement) by altering the conditions. In other words, we can destroy the attractive force. It is perhaps best to consider bodies as being acted upon by causes (called Forces, if we please) as a result of which there is a change of motion. In the case of a body starting from a position of rest and moving towards another there is a change from the motion of its particles to a combined motion—*i.e.*, that of its particles and the motion of translation of the whole body.

If while the body is moving in a straight line another set of conditions arises, it may deviate from its direction along that line. Here, again, we must assume a cause (which we may call Force) responsible for the deviation, so that we can add to our first definition the statement that that which we call Force prevents or tends to prevent a body from moving uniformly in a straight line.

Certain conditions, arising whilst a body is moving at a uniform rate in a straight line, may result in a decrease or increase of the rate of movement. The *cause* of this variation of uniform motion is termed a Force.

Combining these ideas we define the cause known as Force as **that which starts or stops, or tends to start or stop uniform motion in a straight line.** In order to avoid repetition and circumlocution it is convenient to refer to the "force of attraction" or "the force exerted by a body," and so on; we can even measure "force" and agree upon an unit of "force," but it should be understood that we are only measuring the strength or degree of certain *effects* and not their *causes* which have no physical existence. When we speak of a "force of one dyne" we are merely referring, in terms of Time, Space and Mass, to what some *cause* can do or tend to bring about—that is, to give a *mass* of one *gram* an acceleration of one *centimetre* per *second* per *second*.

A Force is a *vector* quantity, for to describe it we have to specify: (1) its magnitude, (2) its direction—that is, the direction in which it acts—(3) its sense—that is,

* It is assumed that the student understands these terms as a result of his work on the subject of electricity.

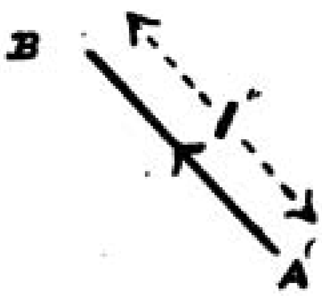


FIG. 10.

whether it acts towards or away from a given point. Fig. 10 represents a force of 10 dynes (scale: 10 dynes to 1 in.). The length of the line gives the *magnitude* of the force; the direction of the line—*i.e.*, north-westerly—gives the *direction* along which it acts, and the arrow indicates its *sense*, which in this case is away from the point **A**. By the **Addition of Vectors** (see last article) we can determine the resultant of a number of forces acting at a point. For a development of this subject let the student look up the Parallelogram of Forces in a book on Mathematics.

Notes on Units.—Any measurement of a physical quantity has to be expressed in terms of its unit, the expression taking the form of some number followed by the name of the unit—*e.g.*, five seconds. The general form of any measurement can be written nU, n being a number and U an unit.

As a foundation on which to erect a working unitary system units of Length, Mass and Time have been agreed upon and are called fundamental units, not only because nearly all physical quantities are defined in terms of them, but because the ideas of Length, Mass, and Time are fundamental.

The English **unit of length** is the **yard**, that of the French being the **metre**. Taking the first case, if we call the unit L then any length can be written nL. Thus one inch equals $\frac{1}{36}$ L and two yards equal $2L$; but L may stand for *any* agreed unit of length, such as an inch, a mile, or a centimetre, and, therefore, it obviously represents only the **magnitude** or **dimensions** of the particular unit employed. Thus $39{\cdot}37\ L$ (**inches**) $=1L$ (**metres**) $=100L$ (**centimetres**) $=1{,}000\ L$ (**millimetres**). The **dimensional unit of Length** is $[L]$.

The **Area** of a square with sides of unit length can be written L^2, because to find its area we square the length of a side. L^2 expresses the **dimensions of unit Area.** If the sides of a rectangle measure a units and b units respectively, its area is clearly $(aL \times bL) = abL^2$—*e.g.*, Consider a rectangle with sides 4 in. and 5 in. Then Area $=(4L_{inches} \times 5L_{inches}) = 20L^2$—that is, 20 square inches. In the same way the **dimensions of unit Volume** are L^3.

The fundamental unit of **Time** is the *mean* solar day, its **dimensions** being denoted by **[T]**.

The English unit of **Mass** is called the **standard pound,** which is the mass of a certain piece of platinum in the possession of the authorities. For most practical purposes this can be taken as the unit of **Weight,** as previously explained; but the distinction exists that this only holds good provided only one *place* is considered. Weight is *proportional* to mass and equal masses *in the same place* have equal weights.

The French unit of **mass** is the **kilogramme.**

The **dimensional** unit of Mass is **[M]**.

It is customary to distinguish dimensional units by enclosing them in brackets—*e.g.* **[T]**, **[L]**.

Centimetre-Gram-Second (or C.G.S.) Units.—For the purposes of physics it is the general custom to employ the **centimetre, gram,** and **second** as the respective units of length, mass, and time. Calculation in these units is very simple and the units themselves are of a convenient size. Just as the mile is more appropriate for the use of the geographer and the ton more practicable for the civil engineer, than smaller measurements, so the centimetre and gram better convey ideas of the distances and masses most commonly investigated in physics. It would be absurd to describe the length of a spark-gap as some fraction of a mile and even the description of a four-millimetre gap as a fraction of a yard would not at once be plain.

The units derived from these fundamental ones are called **absolute units.** Although the centimetre, gram, and second are of a convenient size, some of the derived units are either too large or too small. To meet this difficulty **practical units** have been agreed upon. For example, the **practical** unit of capacity, the Farad, is equal to a thousand-millionth part of the **absolute** unit, and even this is too large; hence we generally use the **microfarad,** which is a millionth of a farad. (1 mfd. $=10^{-15}$ absolute units of capacity).

Absolute C.G.S. Units.—Length = 1 centimetre (cm.).
Area = 1 square centimetre.
Volume = 1 cubic centimetre (1 c.c.).
Mass = 1 gram (1 grm.).
Time = 1 second.
Force = 1 dyne.

Other units will be given and explained as the various physical quantities are considered.

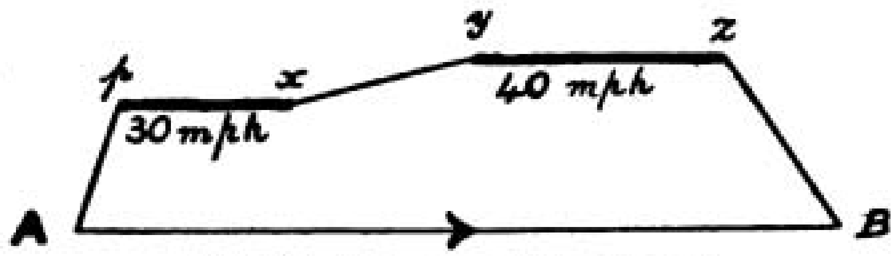
Dimensional Units

	Length [**L**]	Mass [**M**]	Time [**T**]
	Standard Yard	Standard Pound	Mean solar day
C.G.S. Units.	Centimetre	Gram	Second

Derived (or Absolute) Units
Practical Units
Specialised Units
(Such as H.P., foot-pound, etc.)

Force (continued).—The foregoing section on units was interpolated in order to clear the way to a fuller treatment of Force. The C.G.S. unit of Force has been referred to as the **dyne,** to explain which we must here introduce the ideas of Velocity and Acceleration.

Velocity.—This may be defined as the **rate at which change of position takes place in a given direction,** and should not be confused with **speed,** which is simply rate of movement irrespective of direction. Velocity may be either **constant** or **variable,** terms which need no explanation. It may occur to the reader that in many common instances, such as the movement of a train, the velocity is sometimes constant and at other times variable. During, say, the first and last ten minutes



60 miles } Average velocity, 30 m.p.h.
2 hours }

FIG. 11.

of a journey the velocity of a train will vary because the latter cannot start from a position of rest at its maximum velocity, and in order to stop (without being wrecked) it must gradually slow down. Fig. 11 represents graphically (but not to scale) the various velocities attained by a train whilst travelling from **A** to **B**. The **thin, sloping** lines show those portions of the journey during which the velocity is changing, and the **thick** lines represent the portions in which the velocity is constant. Starting from **A** the velocity gradually increases from zero to 30 miles per hour at **p** and remains at that value until the point **x** is reached, when it again increases until at **y** it is 40 miles per hour. This velocity is maintained as far as **z**, where it begins to decrease for the stoppage at **B**. The **direction** is uniform from **A** to **B**, and although the velocity, considering the journey as a whole, is variable, yet from **p to x** and from **y** to **z** it is constant. As the train takes two hours to travel 60 miles the **average velocity** is 30 miles per hour, but over the distances **px** and **yz** its velocity is constant and measurable by dividing the distance travelled by the time taken.

$$v = \textbf{Uniform Velocity} = \frac{l}{t}.$$

The distance travelled in unit time measures the velocity of a point moving with uniform velocity. Unit time being the **second**, v will be centimetres, feet, or metres per second according to how l is measured.

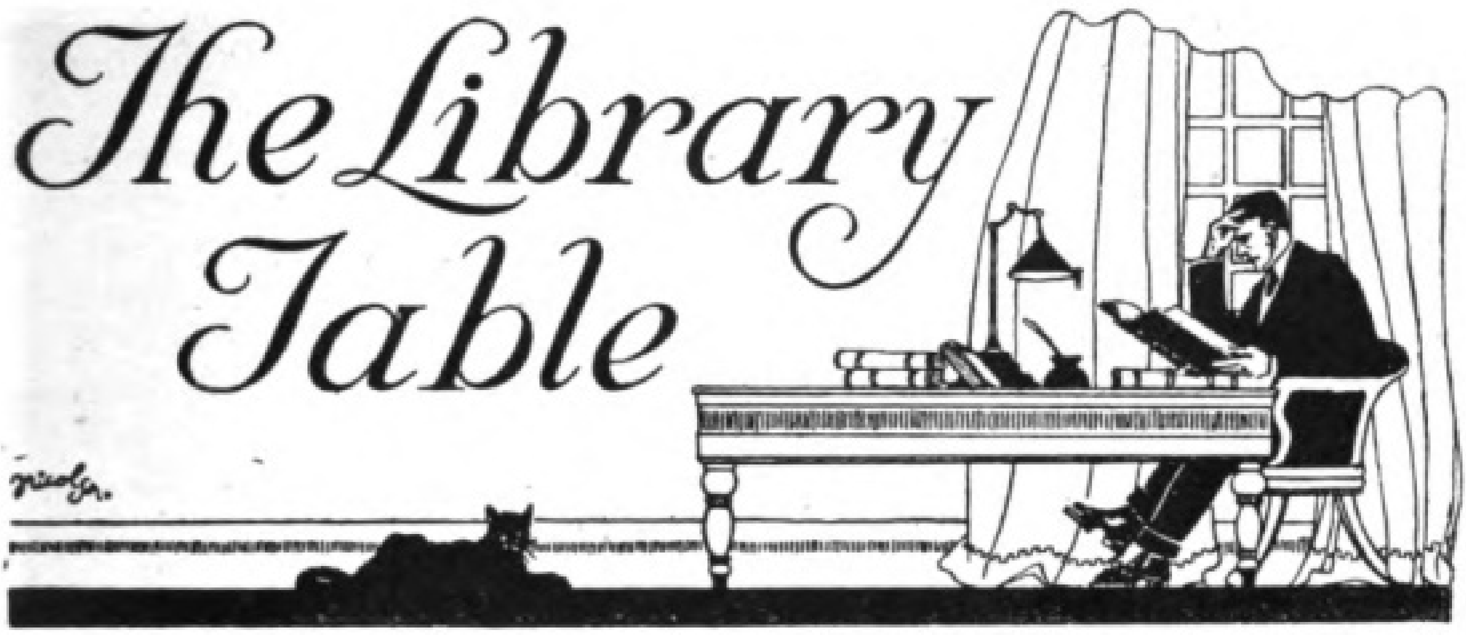
Example.—A point moves over a distance of 100 cms. in a uniform direction at a constant velocity in 10 seconds. Its velocity at any instant is found by the formula $v = \frac{l}{t}$; l in this case is 100 **cms.** and t is 10 **seconds.** Therefore, v is 10 **cms. per second**—that is to say, the point moves through a distance of 10 cms. in unit time.

The dimensions of unit velocity are written $\frac{[L]}{[T]}$ or $[LT^{-1}]$; **the C.G.S. unit of velocity is 1 cm. per second.**

(To be continued.)

Changes of Address

THE Offices of the Wireless Press Inc, New York, have been removed from 42, Broad Street, to 25, Elm Street ; and the offices of Superintendent E. T. Edwards from 25, Elm Street, to 42, Broad Street, New York. These changes make it possible to enlarge the Marconi School of Instruction, to meet war conditions.



"*THE YEAR-BOOK OF WIRELESS TELEGRAPHY AND TELEPHONY, 1918.*" *Price* 6s. *net.*

The expansion of an industry may frequently be judged by the literature which gathers round it, and the recent appearance of *The Year Book of Wireless Telegraphy and Telephony* for 1918 comes as a timely reminder of the expansion of this world-wide science. Not inaptly does the writer of one of the special articles quote the words of Emerson concerning a man "who builded better than he knew" and apply them to Marconi.

It is no small boon to those whose daily avocations bring them into contact with wireless to have at their elbow a volume which contains all the current legislation on the subject, in over one hundred different countries and their colonies, translated into English from the various languages in which the laws were originally promulgated. This section has been very nearly doubled since last year, whilst we find included for the first time some interesting and useful summaries of earlier legislation and present organisation affecting wireless telegraphy in the different countries.

The section devoted to tabular information concerning *Land and Ships' Stations* records the "Call Letters" and general particulars of wireless installations all over the world. We note that the enemy vessels interned at the beginning of the struggle, and taken over by the various governments who declared war upon the Central Powers, figure in these lists under the new names which have been assigned them.

The stress of war has a marked tendency to press harder and harder every year upon those engaged in useful scientific and industrial work; but—in the face of all difficulties—the *Wireless Year Book* for 1918 shows continual improvement over its predecessors instead of deterioration. All wireless men will learn with satisfaction that Dr. J. Ambrose Fleming, who has contributed special original articles to every issue of the *Wireless Year Book* since its initiation in 1913, is still able to maintain continuity in this respect. His article on "*Waves in Water, Air, Earth and Æther*" fully maintains the high standard we have learned to expect from this distinguished scientist. Amongst the new items likely to prove of the greatest practical assistance to wireless workers we may call particular attention to the inclusion of a series of analytical notes on the "*Valve Patents Published During 1917.*"

Dr. N. W. McLachlan's essay on "*The Magnetic Behaviour of Iron in Alternating Fields of Radio Frequency*" and that on "*The Energy Transmission in Wireless Telegraphy*" contributed by the Dutch scientist, Dr. Balth. van-der-Pol, will be found to deal comprehensively with subjects which are occupying considerable attention of technical men at the present time.

An article entitled "*Wireless Possibilities*" sets forth a series of speculations upon the future of radiotelegraphy and its allied developments. Nor must we omit to mention the record (illustrated by photographs), under the title of "*Heroism,*" of the gallant deeds of wireless operators at sea during the period covered by the volume.

Every wireless enthusiast is familiar with the time and weather signals, which are radiated on fixed programmes from important stations in various parts of the world; these arrangements have in recent years attained a world-wide development, and the *Wireless Year Book* brings this fact home very strikingly in an article on "*International Time and Weather Signals.*" "*The Achievements of Wireless Telegraphy in Life-Saving at Sea*" are dealt with in a monograph which introduces the annually published list of "Timely Rescues," brought up to date.

The secretary of the United States "Institute of Radio Engineers" contributes a brief *résumé* of the way in which wireless telegraphy in the U.S.A. has been affected by America's entrance into the present world war.

The "*Useful Data*" section appears as revised for the last issue by Dr. Erskine Murray. The "*Biographical Notices*" have received numerous additional items, whilst the bibliography of the volumes and periodicals devoted to the subject displays the effects of revision and expansion. The *Wireless Map of the World*, which is bound in with the back cover, records the position of over 800 radiotelegraphic stations.

"*SECRETS OF THE SUBMARINE.*" *By Marley F. Hay. London: Skeffington & Son. 2s. 6d. net.*

The *Secrets of the Submarine* would appear to us hardly to constitute a correct title for the volume under review. It provides, indeed, a highly interesting sketch of the features common to all under-water craft, together with some consideration of the various problems connected with sub-aqueous navigation; but—very properly—reveals no secrets concerning any of the varieties of craft dealt with.

The subject itself is, however, so interesting and novel—at all events as far as its later developments are concerned—that the little book published by Messrs. Skeffington is sure to find a large reading public. We hope that this may be so; for there are many plain internal proofs of the author's expert knowledge.

Perhaps the most illuminating chapters are those which deal with the Differentiation of Types, the Elements of Design, and the Sphere of the Submarine in Naval Policy. All these subjects, it will be noted, lend themselves readily to discussion in general terms; so that their exposition remains comparatively free from the disabilities inherent in the treatment of submarine matters at the present moment.

Mr. Hay fully sustains the claim made in his foreword, that his subject-matter is placed before the general reading public in non-technical language, a method of treatment which should enable an ordinarily educated person to form a very fair conception of what a submarine is, and how much may be expected from it.

The first item to attract the attention of wireless men is, naturally, that which affects the application of their own science to submarine practice. We find all the consideration accorded thereto by Mr. Hay on pages 57 and 58 of his volume. After a few general remarks about the superiority of wireless telegraphy over submarine bells, he goes on to state :

> Experiments have been made with various forms of telescopic and folding masts ; but a practical arrangement for mounting and dismounting the outboard part of the wireless installation, which can be operated from inside the vessel without requiring the presence of any of the crew on deck, is a problem that remains to be satisfactorily solved. Where a number of submarines are operating in conjunction, but separated by many miles, as is the case now with the German submarines operating on the coast of Great Britain, the desirability of coming to the surface, transmitting a message and disappearing again very quickly, if necessary, can easily be imagined.

When we pause for a moment to consider that every up-to-date U-boat is fitted with wireless apparatus, which constitutes one of the most important parts of its equipment, and that without this means of communication the present submarine campaign against Great Britain and her Allies would be almost impossible, such a summary treatment would hardly appear to be adequate. Of course, the exigencies of censorship preclude the publication of the most interesting particulars, but we have ourselves been able, working under the same disability, to publish in THE WIRELESS WORLD views of German under-water craft, showing pictorially more than one of the ways in which the enemy has been grappling with the problem.

As a submarine expert, and one who has devoted his whole life to the subject, Mr. Hay naturally approaches the question of "submarine antidotes" from a specialised point of view. Chapter VIII. deals exclusively with this side of the subject, and one device after the other is dismissed as ineffective. We have a general impression left, after finishing the perusal of this particular section, that the submarine is something which it is quite useless to combat ! It can cut through nets ; it can elude the observation of aeroplanes ; the shooting away of its periscopes does little more than temporary injury ; whilst the idea that one submarine can hunt another is scouted as ridiculous, save when the two craft are floating upon the surface and have, therefore, for the time being ceased to be submarines at all ! Now, in treating of this matter at the present moment we are treading upon very delicate ground ; but without going into particulars we may, at all events, enter a *caveat* against such special pleading. The submarine is vulnerable, one might almost say very vulnerable, and is becoming increasingly so every day.

Without pursuing the matter any further than this, we would like to point out to readers that we can recommend them strongly to seize an early opportunity of perusing Mr. Hay's volume ; but at the same time advise them not to forget the point of view from which he approaches his subject.

Marconi Companies' Benevolent Fund

Annual Meeting at Marconi House

THE annual meeting of the Marconi Companies' Benevolent Fund was held in the Board Room at Marconi House on April 3rd last, Mr. Godfrey C. Isaacs taking the chair. After the Secretary had read the notice convening the meeting, the annual report of the Committee of Management for the twelve months ending December 31st, 1917, was presented.

The sum of £812 2s. 6d. is carried forward to the current year, an increase during the year of £416 4s. 9d.

The Committee regret to report the death of 17 members. The amount payable by the North British & Mercantile Insurance Company in respect of the life assurance of the foregoing members was £1,960, making a total of £4,300 since the inception of the fund.

After the adoption of the Report the Chairman explained that the fund was growing, and would continue to grow from year to year under the conditions set forth in the constitution of the fund. The companies have provided, and will continue to provide, for all cases of temporary disablement, therefore the main object of the Benevolent Fund should be to provide for those cases where a man by accident or infirmity cannot continue in his employment and subscribe to the fund until the normal retiring age of 60. The idea should be to compensate for the difference between the pension which would be given at the time of such incapacity and that which the pension would be at maturity—viz., at the age of 60 years. The chairman was careful to point out that this was only his own personal view, and that he would like to hear any other views which members might have.

No other views being expressed the suggestion was adopted unanimously.

Institute of Radio Engineers

Temporary Suspension of Activities

OWING to conditions brought about by the war, it has been decided to suspend the meetings of the Institute of Radio Engineers, except on special occasions. Among other difficulties, that of securing new papers with regularity is perhaps the most prominent. All interested in wireless telegraphy will look forward with pleasurable anticipation to the resumption of normal conditions by this thriving society, to which the radio world owes so much.


If you have applied for a COMMISSION, write us for our Naval Kit List.

Personal Notes

Lady Student's Success.

Miss Kathleen M. Videon, of Skelton, has recently obtained a Postmaster-General's First-Class Certificate of Proficiency at the Rutherford Technical College Wireless School, Newcastle-on-Tyne, and is at present training as a mechanical inspector of wireless telegraph apparatus at the Regent Street Polytechnic, London.

Presentation.

Mr. W. W. Inder, manager and chief instructor of the Scottish Wireless College, Aberdeen, and Mr. D. M'Kay, assistant instructor, were recently presented by the students at the school with a handsome silver-mounted pocket book and a tobacco pouch and pipe respectively, in token of esteem.

Obituary.

We deeply regret to announce the death of Captain W. H. Payne, of Amalgamated Wireless (Australasia), Limited, who fell a victim to smallpox at Bagdad in December last. Captain Payne had been attached to His Majesty's Forces but a few months at the time of his death. In our June 1917 issue we published a note regarding a farewell luncheon given to this gentleman on his departure from Australia. Captain Payne, who in peace time was deputy manager, was loved and respected by all who knew him, as was evident from the sincere tributes paid to the memory of the gallant officer at a meeting held in his honour at Wireless House, Sydney, on January 7th last. The meeting opened with Chopin's March Funèbre, which was followed by a speech by Mr. E. T. Fisk, managing director, who paid a touching tribute to his late friend and colleague. Messages and telegrams of sympathy from a number of prominent people were read, and a number of other officials of the company also spoke. A message of deep sympathy from the whole of the staff was conveyed to the widow, and the proceedings terminated with the "Dead March" in *Saul*.

THE LATE CAPT. W. H. PAYNE.

Company Notes

Report of the Directors of the Marconi Wireless Telegraph Company of America

The operations for the fiscal year show, before allowing for reserves, a net income of $780,592.44 as compared with $336,040.59 for the year 1916.

In last year's report you were told that when diplomatic relations between the United States and Germany were severed, on February 3rd, 1917, your General Manager promptly telegraphed the President of the United States, as follows:

"The Marconi Wireless Telegraph Company of America, in accordance with the Act to regulate Radio Communication, approved August thirteenth, nineteen hundred and twelve, hereby places at the disposal of the Government, for use in any emergency, its entire organisation and personnel, including its high power and coastal stations wherever situated, its manufactories, workshops and trained staff. Myself, associate officials, and staff, are subject to your orders or to the orders of any particular department of the Government which may need our services. I shall be glad to proceed to Washington for conference if you so desire."

Acknowledgment of the above was received from the President, also from the Secretary of War and the Secretary of the Navy, all of whom expressed their thanks, and their appreciation of the spirit of co-operation displayed by your company.

Following the declaration of war with the German Empire, the Director Naval Communications, on April 7th, telegraphed your company as follows:

"The President having ordered the immediate taking over by Navy Department of all radio stations including high-power stations in United States and possessions no commercial traffic whatever should be accepted for transmission *via* radio through any Atlantic and Gulf Coast radio stations. For the present radio service Pacific Coast between ship and shore, Pacific transoceanic, Alaska and Great Lakes continue, Naval control. Please cooperate."

This was followed by subsequent orders, under which no commercial traffic can be accepted by your company for transmission *via* wireless through any station, and by the taking over by the Navy Department of all of your company's coast stations, as well as its high-power stations in New Jersey, California, Hawaii and Alaska, for military purposes. The Massachusetts stations, intended for communication with Scandinavia and Russia, and now in course of construction, have likewise been commandeered by the Navy Department, and the work of completion is being pushed forward as rapidly as possible, so that they may be turned over to that department without unnecessary delay.

All these stations are operated or will be operated for governmental and public message traffic, subject to censorship, all the operating staff being enrolled in the Navy.

Reasonable rental compensation arrangements have been agreed to, based on your company's investment in certain plants and on estimated traffic earnings under normal conditions of others.

With the stoppage of its commercial telegraph traffic, your company's officers turned their attention to ways and means whereby the facilities remaining under their control might be best used for the service of their country and the benefit of the stockholders in this emergency.

Our pressing needs of the hour, briefly, were:

First: Facilities and trained experts for the manufacture of the new wireless equipment for the large number of vessels built and commandeered by the United States Shipping Board and the Navy Department.

Second: A constant supply of capable, licensed wireless operators, for service on the rapidly increasing merchant marine.

Third: Trained construction men to instal wireless apparatus on the vessels, and engineers capable of coping with the many problems of wireless communication and production.

To meet the first need, your company has built two large additions to its factory in Aldene, New Jersey, and is now engaged in