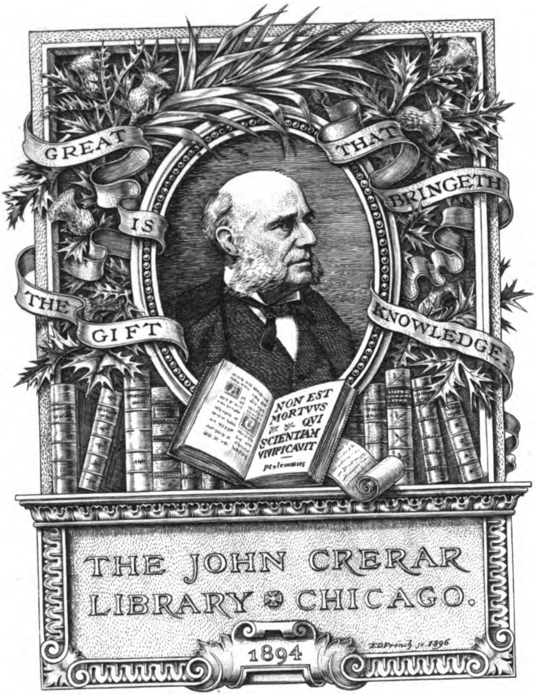

GREAT
IS
THE
GIFT
THAT
BRINGETH
KNOWLEDGE
NON EST MORTVVS QVI SCIENTIAM VIVIFICAVIT
Ptolemaeus
THE JOHN CRERAR LIBRARY CHICAGO.
1894

NOTE

For the benefit of the readers of this book we will state that the author, a boy of only sixteen years of age has written and published it alone and unaided.

REPORTER PUBLISHING CO,
Printers.

WIRE and WIRELESS TELEGRAPHY

By

Edmund B. Moore

Springfield, Vt.

SPRINGFIELD
REPORTER PUBLISHING CO.
1904.

CONTENTS.

...PREFACE...

In this little volume I have endeavored to give a brief but intelligible and connected description of the science and history of the Electric Telegraph, the scientific principles, practical applications, and a brief sketch of the developments.

Much care has been taken in preparing the chapters in the latter part of the book, which give a very good idea to the reader of the present systems and stations of Wireless Telegraphy.

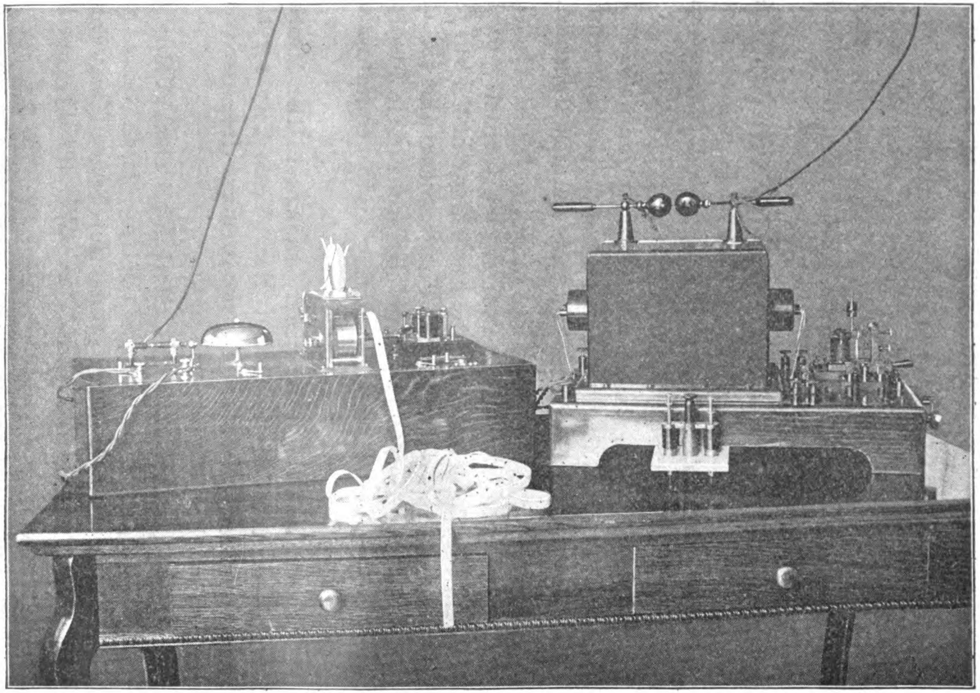
The rapid progress of the introduction of Wireless Telegraphy upon the ocean also gives us an opportunity to discuss its various uses and advantages upon shipboard.

This little volume is addressed principally to the readers who have no previous knowledge of the subject. It is written in good, plain language so that the amateur may readily understand and comprehend it, also the professional may find it interesting and to contain many good points well worth notice.

I wish to extend my hearty thanks to the Manhattan Electrical Supply Co. of New York City for their kind generosity in allowing me to make free use of the cuts from their supply catalogue.

Also to the Thos. E. Clark, Wireless Telephone and Telegraph Company of Detroit, Mich., who have been very kind in loaning cuts for Space Telegraphy, Coherer Circuit, and Class "A" Wireless Transmitter and Receiver which appear in this volume.

EDMUND B. MOORE.



WIRELESS TRANSMITTER AND RECEIVER.

Wire and Wireless Telegraphy.

CHAPTER I.

GROWTH OF THE ELECTRIC TELEGRAPH.

The Electric Telegraph, as it exists at the present day, was of slow and gradual growth, it was so slow however, that it is absolutely impossible to point to any one man as being the original inventor of the electric telegraph.

In following the history of almost any scientific invention we will find the process of development to resemble the process of nature in the organic world and as it may appear to flash suddenly upon the world, it will be found that this sudden appearance is the advance in to public notice the result of long and careful work.

Some of the description and illustration which have been handed down to us are naturally absurd. Some of them relate that magnetism was one of the agents which the priests employed to determine their dupes, other accounts state that an iron tripod turned around in obedience to the movements of the priest, with certain movements, the object of which the narrator did not understand, of an iron ring hung from a cord which the priest held in his hand.

Inscribed on separate plates, were the letters of the alphabet which were arranged around the tripod and as the plates moved, they were drawn upon a table in such movements, that would spell out the answer of the oracle.

These effects could, no doubt, be produced by magnetism, and it is not known just what other means were employed if not the latter. It is quite possible that lodestone was known to a few of the learned men of ancient Egypt, and possibly it was by this that the people of ancient Rome were also enlightened on the subject.

It was a belief by the majority of the ancients, even down to the seventeenth century that communication could be carried on between two friends by the use of the magnet or a piece of lodestone.

One of the many devices employed by them in this feat, consisted in balancing a pair of steel needles upon vertical axes resting upon circular bases. Each needle was to be rubbed by the same lodestone. In order to determine the signals, the letters of the alphabet were inscribed around the circumference of the bases.

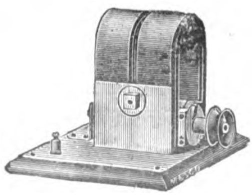


FIG. 1

Now if two friends wished to carry on a conversation with each other, and they each possessed one of the wonderful instruments, the one wishing to converse would turn the pointer of his instrument to each letter successively so as to spell out the required sentence. The needle of the distant instrument would move from letter to letter in exact sympathy with the first, spelling out the sentence which he sent.

To show the superstitious belief of these ancient people I will give a sketch of one of many impossible and supernatural methods then believed in. It consisted in cutting portions of skin from corresponding portions as the arms of two persons, and transplanting them, intending to have the new portion grow to the new arm, which is very possible, sometimes being done at the present day in modern surgery.

It was also necessary in the process to have the letters of the alphabet tattooed in each transplanted piece of skin and when two, who have undergone this process wished to converse with each other, one would prick the letters upon his arm and a corresponding pain would be felt in the arm of the friend.

It will probably appear to the reader almost impossible for any reasonable person to believe such foolish statements, but in those ancient times, things of this kind were largely believed in by the majority of the people.

In reality the starting point of the Electric Telegraph was in the year 1729, when Stephen Grey made his first famous discovery, the fact that substances could be divided with respect to their electrical behavior, into two separate classes of conductors and insulators.

In the early stages of the electric telegraph, many scientific men occupied themselves with experimenting with electricity, which they produced largely by friction, and proved very unsuccessful. One of the first means of producing this and to retain the charge was by the aid of the Leyden Jar, which was discovered at Leyden in 1745 by Musschenbrock.

One of the first means in which frictional electricity was employed in communication between two places, consisted of twenty-six wires being stretched upon insulators between the two stations and at the end of each wire hung a metal ball, and under each were pieces of paper having the letters of the alphabet inscribed upon the same.

When one wished to correspond with the other he would bring the end of the wires at the sending station in contact with a charged electrical conductor, passing from letter to letter spelling out the required message. The means of determining this message at the receiving end was by metallic balls which were attracted by the charge of electricity from the sending station and in this way the message was spelled out by watching the balls suspended over their corresponding letters.

In the year 1787, Monsieur Lomond of Paris made a very important discovery in which he reduced the twenty-six wires to but one. The letters determined by different movements of a pitch ball hung from a conductor in contact with the wire.

These forms were improved largely by Chappe in the year 1790. His device consisted of two clocks each regulated so that the second hands of each would move in unison. Around the dial were inscribed the letters of the alphabet so when the hands were in motion they would point to the same letter respectively.

To determine the exact moment when the observer should read off the letters to which the hand on his instrument pointed, was indicated by various sound signals but these were soon abandoned and electrical signals took their place. The charge of a Leyden Jar was again used but without success, because the insulation qualities of the wire could not be made strong enough to withstand the Electro Motive Force of the static charge.

In the year 1795, Don Francisce Salva also contrived a device where but twenty-six wires were used. He explained the difficulty of suspending this large number of wires upon poles, and contrived the idea of binding the number together with pitch coated paper forming a cable. He was the first to conceive the idea of making an electric telegraph cable.

Shortly afterwards (1816) Sir Francis Ronald constructed an apparatus whereby the wires between the two stations were contained in a glass tube and this laid in a wooden trough which was coated inside and out with pitch to exclude all moisture.

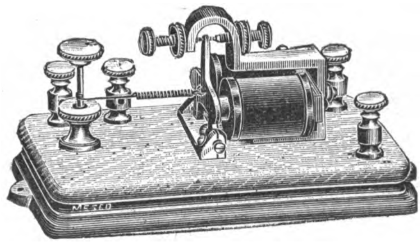


Fig. 2

We will not take the space in this little volume to discuss Ronald's different instruments, his being the most successful however, and received with the greatest attention of any up to his time.

The current for operating the different instruments had, up to this time, been generated from a static machine or voltaic battery. Steinheil invented in the year 1835 what is known as a magneto-electric machine, see Fig. 1, for generating a constant and even amount of electrical current. In the year 1838 he also made a very important discovery where he used the earth for the return circuit, doing away with one wire.

Two very important steps were also made in telegraphy by Edward Davy, who invented the "Relay," see Fig. 2 and the "Recording Telegraph." See Fig. 3.

Professor Wheatstone, a physicist, had a very important part in the progress of telegraphy. He was the first to construct a practical line on a large scale and his methods were adopted upon different railroads in London and Birmingham.

In the year 1831, Henry constructed the first magnetic telegraph which consisted of a small office bell which would tap when attracted by the polarized armature. Previous to this about all the former types employed either the galvanometer or needle principle, but from this time on we will see that the galvanometer principles were practically done away with and Henry's adopted.

The electric telegraph as it exists today was invented and perfected by Samuel B. Morse.

Morse, an American, was born in Charlestown, Massachusetts in the year 1791. The plans for his instruments were drawn up in Professor Morse's mind while crossing the Atlantic to America. He was a very poor man and often lived on a few cents a day, but finally Alfred Vail gave him financial assistance and secured a patent on the electric telegraph in Professor Morse's name.

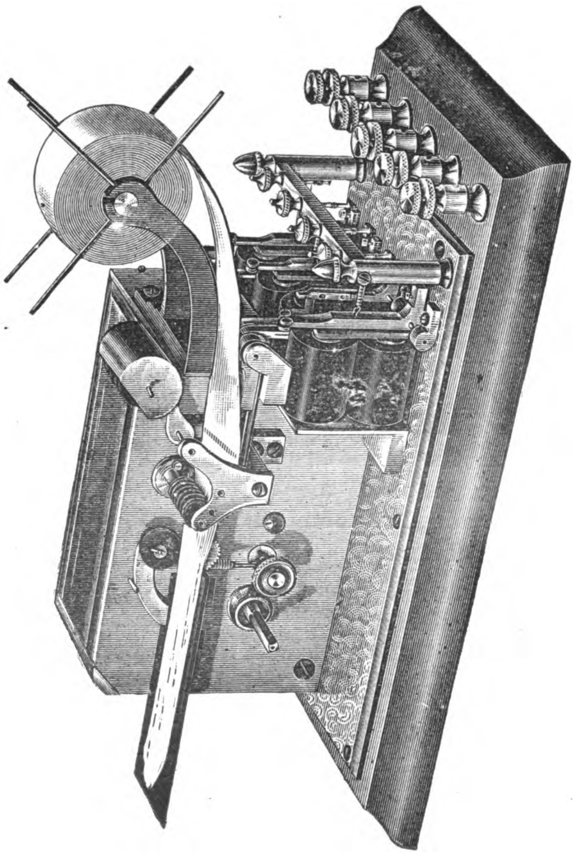


Fig. 3

He had his invention now safe, but he was not successful in receiving help. Finally, he asked Congress to grant him $30,000 whereby he intended to construct a line from Washington to Baltimore. Congress did not approve of the idea at first, but on the last day of session March 3rd, 1843, granted him the sum required.

The line from Washington to Baltimore, a distance of forty miles, was completed in the year 1844 and a Miss Ellsworth, a personal friend of Morse, sent the first message over it which read as follows:—"What hath God wrought." The first three years the telegraph line was open to all who wished to use it; but later, a small charge was made on each message.

At the present time there are about 200,000 miles of telegraph line in the United States, enough to reach around the earth more than eight times. Although messages could be sent at a very rapid rate with the ordinary style telegraph, the large increase of business demanded a still faster method. This was accomplished by Gintl, of Vienna, who invented the system now called the Duplex, where two messages could be sent along the line in opposite directions without interfering with one another. Shortly after this was made known to the world Mr. Thomas A. Edison, a well known American scientist, invented a system whereby two sets of signals could be sent along the line in opposite directions without interfering in the least with each other. This method is called Quadruplex Telegraphy.

The number of messages was also increased by Delany, his system being called the Multiplex Telegraphy, consisting of apparatus enabling three or more messages to be sent at the same time in opposite directions.

The last two systems are not used to such a large extent as the Duplex System which is used extensively in America on lines where the traffic is very heavy.

When Salva made his first cable he also suggested that the intervention of the sea or other bodies of water need not interfere with telegraphic communication between two places. This fact was demonstrated later by an American, Cyrus W. Field. The first successful cable was laid from America to Europe in the year 1866.

The operations for laying this cable began in 1854. The first two laid were unsuccessful and were partially lost, but in 1858 he was successful in laying one from Ireland to Newfoundland. The cable worked with difficulty for about three weeks and then ceased to operate. This accident was due to the construction of the cable which was injured by a piece of iron.

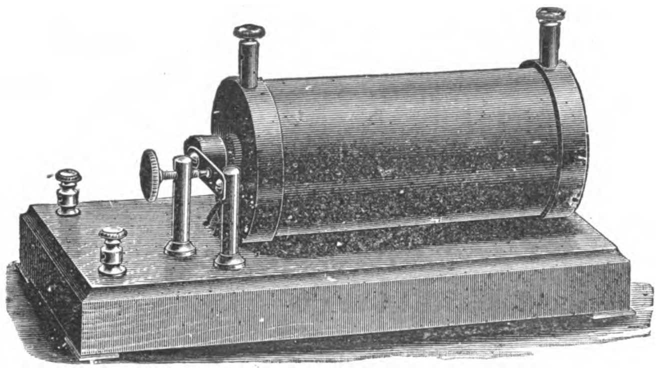


Fig: 4

Finally a new cable was constructed heavier than these and more durable, being protected on the outside by bands of heavy wire. When all was made ready the noted ship, Great Eastern, began the difficult task (1865) of laying the cable. After a large amount had been laid out, it parted,owing to the tremendous weight. The finances of the different companies backing this work were by this time nearly exhausted. But in the year 1866 it was tried again, the Great Eastern laying the cable as before. This attempt proved successful and it was put at once into active service. The cable which was lost in 1865, was later grappled, brought to surface, and the necessary repairs made, a new cable joined to it and then successfully laid.

These two cables are, or have been, up to a recent date, in active service.

The construction of these cables was largely of a solid copper conductor imbedded in a thick insulation and protected outside by a covering of heavy iron wire. It was found that after these had been bent a few times they were more or less sure to break. The cables which are in use at the present date are made up of small copper wires twisted together, which makes them very flexible and more durable.

CHAPTER II.

SUBSTANCE, ETHER AND WAVES.

Before we take up the theory of Wireless Telegraphy I wish to make clear to you a few facts, which will lead up and make plainer the higher steps of the subject.

First, as an illustration, we will take sound.

We all know that when a person speaks we are able to hear what is being said. Of course all this takes place under normal conditions. Now have you ever stopped to think how it is and why we are able to hear? When a person speaks he sends forth or gives over to the air a certain amount of energy which is sent out or transmitted by his vocal organs, over which he has perfect control.

Now when he speaks he sends forth sound vibrations which are given over to the air, and travel at the rate of 1109 feet per second at 32 degrees Fahrenheit. A rise in the temperature diminishes the density of the air and thus increases the velocity of sound. A difference of one degree F. makes a variation of a little more than a foot. Sound also moves much faster in damp than in dry air.

Sound waves travel through water about 4,700 feet per second. Water being much more dense than air should on this account conduct sound more slowly, but its high elasticity measured by the amount of force required to compress it, more than quadruples the rate. Sound waves travel through solids faster than through air.

Now with sound waves there are three distinct steps, viz,-the transmitting of the sound waves, the carrying of the waves, and the instrument used to receive them which we all know as the ear. If a person was delivering a lecture and those in the front part of the hall were able to hear while those in the rear were not, what would be the consequence? Why, some one would shout "Speak up louder," and the one speaking would have to put more energy into his voice, thereby sending forth stronger vibrations into the air.

Air vibrations are very slow compared with ether waves. A man's natural voice when speaking produces about 130 waves per second, while a woman's shrill scream sends forth 2,000 vibrations, comparatively nothing, as we shall see, with the rate of ether waves.

Ether waves are of widely different length and rapidity or frequency. Scientific men have found by innumerable experiments that vibrations of one speed will produce light, another will produce heat, and still another will produce electricity. If ether vibrates at the inconceivable rapidity of 400 trillions of waves per second, it will produce an effect upon our eyes whereby we will see the color red, if it vibrates twice as fast we will see the color violet, when if more slowly, from 200 to 400 trillions per second, we have the sensation of heat.

What is known as X-rays or more commonly speaking as unseen light is produced when the ether vibrates more rapidly than violet or from about 800 trillions upward.

We are able to see only seven colors with vibrations from 400 to 800 trillions per second. If we were able to see more than seven colors which are common to most everybody, perhaps the colors which are now unseen would be more beautiful and delicate than the present seven, also many new electrical effects would be brought within our reach.

We know that if ether did not exist everywhere there would be total darkness, for the light from the sun, moon, and even the distant stars is brought to us by the ether.

Any luminous body such as the sun, a lamp, etc., sets in motion waves in the ether, which are given off

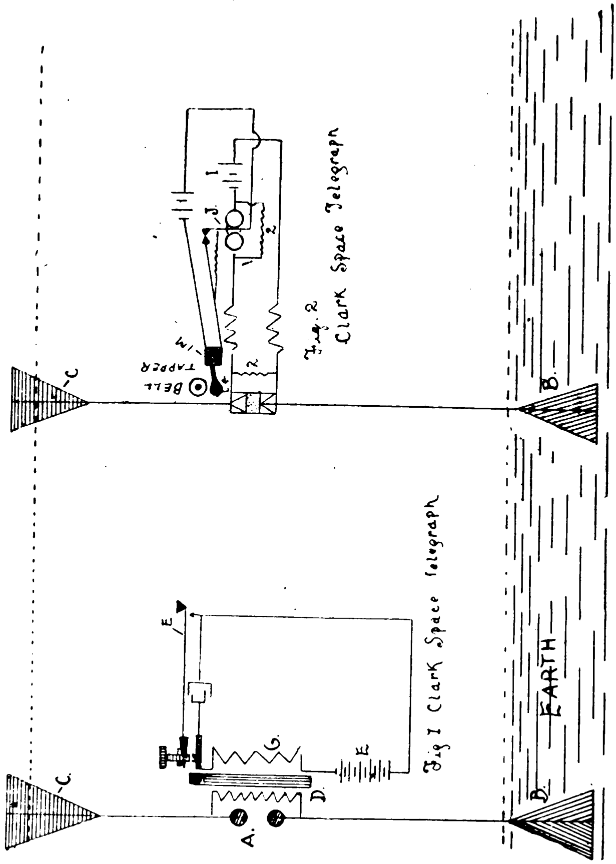


Fig. 5

and spread in every direction. These waves or light waves travel at the rate of 186,000 miles per second, and are received by the eye giving the impression of light.

Now if we could travel at the rate of a ray of light or 186,000 miles a second, it would take us eight minutes and two seconds to reach the sun, being 93,000,000 miles away, and 4,700 years to reach the most distant ~~planet~~ star outside of the solar system being 874,000,000 miles away, and which can only be made visible by a very powerful telescope, thus appearing to be but a mere speck of light in the heavens.

Suppose you were to ask an astronomer if there were any planets beyond this one, he would readily answer you that they have proof to show, that there are many beyond this.

Thus we have a sure proof that the element ether extends all over the universe even beyond space. If it did not would we be able to see those distant planets, even with the aid of a powerful telescope? No, they would be entirely invisible. This shows us that ether does extend beyond the most distant planets.

It takes a ray of light, traveling at the rate of 186,000 miles per second, just eight minutes and two seconds to come from the sun, five hours to come from the stars and 4,700 years to come from the most distant ~~planet~~. star So we now see that if this ~~planet~~ star should fail to become luminous, it would be 4,700 years before it would appear to us.

We have now seen that the element ether plays a very important part with light waves, etc.

It also has this same importance with many other ele-ments, such as magnetism, etc.

Magnetism is a property which is given to a piece of steel or iron, when an electric current is passed around it, causing it to contract or repel other pieces of metal such as iron, steel or nickle. The metal itself is called a magnet.

This kind of magnet just dsecribed is an artificial kind, that is, the property is given to it by the electrical current passing around it.

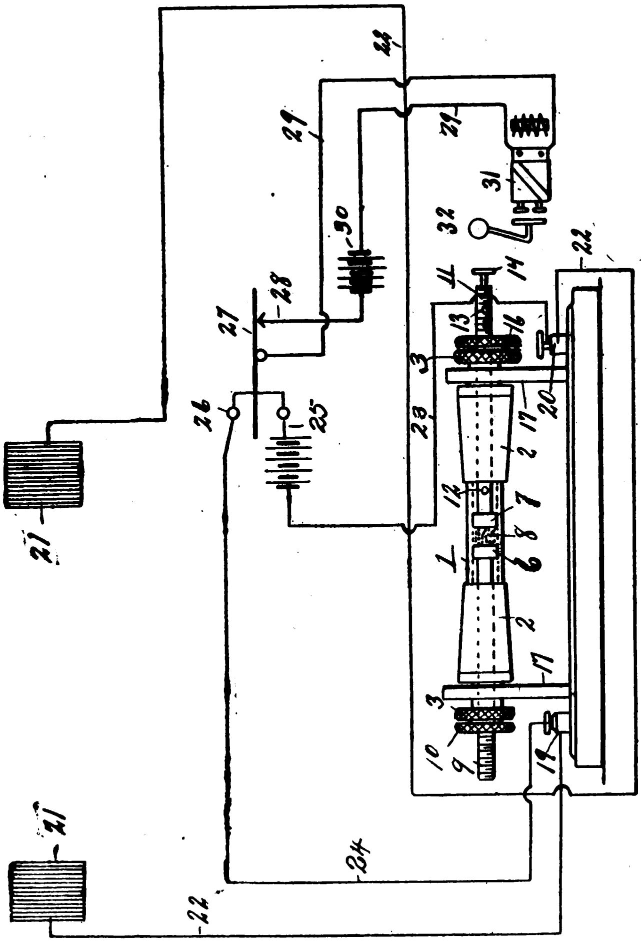


Fig. 6

There is a certain kind of ore which has this peculiar property and it is, therefore, a natural magnet. This ore is called lodestone. It is black in color and when hung freely by a silk thread or other means it is found to have opposite poles and they point respectively to the North and South poles of the earth.

This could be called one of the first type of compasses.

Now we will suppose that there were a number of small compasses placed around about and you have in your hand a large magnet, say two feet long and two inches in diameter and you were to move it back and forward or wave it, every compass around you, or rather this large magnet, would be attracted and moved, each movement corresponding to the large one. If the large one was moved twice to the right the smaller ones would move in the same manner. So you see that the entire alphabet could be spelled out, different movements to the right or left representing different letters of the alphabet. The effect on the small magnets would be just the same even if they were separated by walls or other substances. The magnetic force, or force of attraction, is transmitted by the aid of the ether, which as we have seen is contained in everything.

We have given, up to this point, a brief description of the substance ether, its relation to light, sound etc. The remaining chapters will be reserved to give an idea of the science of wireless telegraphy, its workings, the construction of the different instruments implied, and the relation of one instrument to another.

CHAPTER III.

WIRELESS TELEGRAPH INSTRUMENTS.

In the process of wireless telegraphy there are three separate steps just about the same as there was with light and sound.

Now in the wireless system there is the transmitter which sends the messages, or in other words the instrument which sends out electrical vibrations into the ether. Second, the transmission of the vibrations through space. Third, the receiving apparatus which is used to receive these electrical vibrations and to re-inforce the current, making it work instruments which resemble the ordinary style of telegraph instruments, and it is by these that the letters of the alphabet are determined.

The transmitting apparatus employed is very simple in construction and very easily understood. The instrument used to send out these vibrations into the ether is known as an induction coil or more commonly called a Rhumkorff coil. See Fig. 4.

It consists of two coils of wire wound around a soft iron core which is made of soft annealed iron wire bound together and soldered at the ends. This style of core is used because it has shown that it gives better results than a solid core.

The first coil G, see Fig. 1, in Fig. 5, which is wound upon the core is called the primary coil and consists of about two or three layers of number eighteen magnet wire. Usually this is cotton covered. A large amount of this wire is not used because it has been found by experiments that a smaller amount produces better magnetic effects upon the core and also increases the inductive current.

The second coil D is now wound upon the first after being insulated by two or three turns of shellaced paper. This coil differs from the first in two ways—first, very fine wire is used in its construction; second, a very large amount is wound upon the coil, the more wire used usually the better as it increases the length of the spark between the brass balls. (a.)

The two ends of this coil are connected to the oscillator or brass balls, (a) between which the spark passes. The ends of the primary coil are connected, one wire running direct to the battery E, the other in series with the vibrator with its armature opposite the end of the core and working on the principle of an electric bell from the vibrator to the key (e) and (also see Fig. 7) then to the battery.

When the key is pressed it closes the circuit which sends an alternating current through the primary coil and passes from this coil to the next or secondary by what is known as induction, passing around the many turns of fine wire which increases the potential of the current and when it becomes strong enough to break down the air gap between the two brass balls, a stream of sparks leaps across resembling miniature lightning.

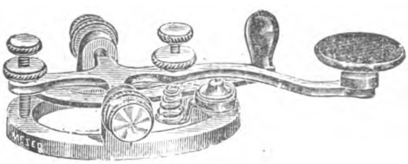


Fig. 7

One of the oscillators is connected to a wire leading to the ground (b) and the other to a wire leading up into the air (c) and is called the aterrnac.

We have seen that with heat and light waves a disturbance in the ether takes place producing certain vibrations or waves of certain length to produce light, heat, etc.

The disturbances in transmitting of wireless messages to set the ether in vibration are caused by the passing of the electric spark between the brass balls, (a).

This spark produces disturbances in the ether just as a stone does when dropped into a pond or body of water. It creates a series of waves spreading out in all directions and gradually fading away to naught.

It is the same process which takes place in transmission of messages, that is, when the electric spark passes between the two oscillators. The waves are set in vibration and are given a greater force by the use of aerial wire. These waves penetrate everything and travel at the speed of about 25,000,000 per second.

This is all there is to the transmitting apparatus, being very simple in construction and in operation to perform such wonderful results.

The receiving apparatus is a very complicated affair and should be very sensitive in operation.

The main instrument in the receiving set is the coherer, (Connections shown in Fig. 6.) which is also very simple but delicate. It consists of a small glass tube, (1) about one quarter of an inch inside diameter and about two inches long supported by standards (17-17) into which two silver plugs(6 and 7)are inserted, a space being left between the inside ends of about one-eighth of an inch. This space is filled with silver and nickle filings (8) of about ninety-six per cent nickle and four per cent silver.

Connected in series with this instrument is an ordinary relay (25 and 26) of very high resistance, say about 6,000 ohms, also a few cells of strong batteries..

Leading from one post of the coherer (19) is connected a wire running to the ground (22) and from the other post (20) one leading to the air wire.

Now the silver and nickle filings (8) which are placed between the silver plugs (6 and 7) offer a very high resistance for the electric current which operates the relay, (25 and 26) but when the feeble impulses from the transmitting station are sent out and pass down the air wire (22) to the ground (independent of the other circuit) and the electrical resistance is at once lowered, the filings in the coherer, cohere, or gather together, and the electrical current of the local batteries (see 25, Fig. 6) will then pass freely, operating the relay (26) by the local batteries which are connected in series with the coherer.

If only a simple impulse was sent, the filings would remain cohered and would not be able to detect the next wave unless the filings were automatically shaken. So we connect on the local circuit of the relay, an instrument resembling an ordinary electric bell (see 31, Fig. 6 and Fig. 8) also four or five good strong batteries (30 and Fig. 9) to operate same. The bell or tapper as it is termed, is placed in such a position that the hammer (32) will gently hit the glass tube of the coherer (at 14) and shake the filings. We also connect on in multiple with this local circuit an ordinary telegraph sounder (see Fig. 10) from which the dots and dashes are distinguished.

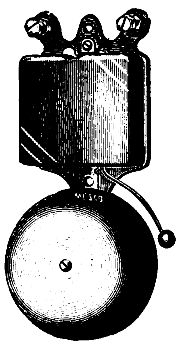


Fig. 8

In the receiving apparatus, to compel the oscillatory current induced in the circuit by the electric waves to transverse the coherer, instead of wasting most of its energy in the alternative path afforded by the relay, what is known as choking coils (see 22, Fig. 2 of Fig. 5) are introduced between the coherer and the relay (J) and these coils are wound so as to have self induction or inertia. It has been found by Signor Marconi that if these coils are omitted while other circumstances remain the same, the distance at which the signals can be transmitted is lowered to nearly one half of that obtained when they are connected on the circuit.

In large stations where messages are to be sent a great distance and where a very high voltage is used to operate the coil, the key for operating the coil of the transmitter is usually inclosed in a sound proof booth, in which the operator manipulates it at will, where if he was exposed to the noise caused by the large sparks leaping across the air gap he would not be able to withstand the noise without doing damage to his ears.

When the key (see e, Fig. 1 of Fig. 5)at the sending station is depressed, it closes the circuit of the primary coils (g) and batteries (E), causing an induced current to flow around the secondary (D), thus producing a large spark that leaps across the air gap (A) between the oscillators.

This spark sets the ether waves into vibration which travel up the aerial wire (C) and are sent off into space going in all directions. Now it is not more than probable that a very small fraction of these waves will collect upon the aerial wire of the receiver (at C, Fig. 2 of Fig. 5)thus passing down and reaching the coherer, then through the filings to the ground (B) and back again to the transmitting station (b). But it should be carefully understood that when the waves pass through the metal filings to the ground it lowers the resistance caused by them, thus causing the local current to flow. This local circuit should not be confused with the aerial and ground circuit of the coherer. It is entirely separate. Of course the lowering of the resistance and the closing of the local circuit all take place in such a small fraction of a second that there is really no time between the two.

When the local circuit is closed it operates the decoherer (31 Fig. 6) or electric bell which mechanically separates the silver and nickle (8), causing the resistance to rise to its natural state. This circuit also operates an ordinary telegraph sounder, (Fig. 10) or a recorder, (Fig. 3) if one is used instead of the sounder.

If three depressions are made with the sending key at the transmitting station it causes three brisk sparks to leap across between the oscillator of the coil. This produces three sets of wave disturbances in the ether which follow one another in rapid succession.

When these or rather the first set of waves reach the receiving station and pass down the aerial wire, it causes the local circuit to close, thus working the decoherer which replaces the silver and nickle filings ready for the following waves, and also at about the same instant the lever of the sounder is drawn down making a click,or if a recorder is used,it records a dot on the moving strip of paper. Thus you see that these three sets of waves would be recorded at the receiving station as three dots. This in the Morse code, which is generally used in this country, represents the letter "S".

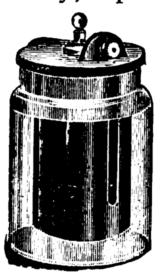


Fig. 9

If a dash was sent, or the key held down for a space of time, (usually twice the length of a dot), it would cause the local batteries to remain closed for a short time, and the lever of the sounder would be held down until the last wave which was sent out from the sending station passed.

During this elapse of time the decoherer is busy shaking up the filings in the coherer, but the instant the last wave "is over," the circuit is opened, and the filings have been replaced to their natural state, and the lever of the sounder at once rises by the tension of the spring on it, thus producing a dash.

We can now see how easy it would be to send the entire alphabet by wireless, having dots and dashes, and combination of dots and dashes, represent different letters of the alphabet.

CHAPTER IV.

MARCONI'S CAPE COD STATION.

The reader has at this point a very good idea of the construction and operation of the apparatus employed in wireless telegraphy, so we will therefore continue this little volume with a brief description of the different systems and stations in practical use.

Marconi was a mere boy when he first began to dream of sending messages through space without wires. He was about twenty-one years old, a shy, modest youth, when he went from his home in Italy to the city of London, to make known to the world one of the greatest inventions of the century.

He is tall, slender, and has a rather dark complexion. He bears an Italian name and was born in Bologna, Italy, in the year 1874. The larger part of his education he received at Bologna, Leghorn, and Florence. Marconi speaks the English language readily, being only half Italian. His mother was an English woman.

The early part of his experimenting was carried on in the fields of his father's farm, and the instruments which he then used consisted merely of tin boxes placed upon poles of various heights. One set was connected with the crude sending instruments, and the other, with the crude receiver which he had manufactured himself.

His mother was the means of his getting the funds for the different Marconi companies. In fact, Marconi's relatives on his mother's side, largely make up the directors of the several Wireless Telegraph Companies that he now heads.

The Cape Cod Wireless Telegraph Station was completed in the year 1903. There are but three others in the world constructed for the same purpose. These are at Table Head, Nova Scotia, and at Poldhu on the coast of Cornwall, in the British Islands.

The English Station is the oldest. The Canadian Station is the one from which Marconi succeeded in sending messages across the ocean and receiving replies, and at the American Station he has been successful in communicating with England. The station on the American coast is about one thousand miles farther away from Poldhu than Table Head, and has therefore done more wonderful work. These three stations are about the same size and power, and a description of one will do very well for the others.

The three are situated on high lonely bluffs looking out over the mighty Atlantic, on which there are no buildings to obstruct the pathway of the ether vibrations. The Cape Cod Station is the most picturesque of them all. It is completely surrounded by a wind swept, sand blown country. It is wonderful how such a little outpost as this should be the birth place of one of the marvels of the 20th century.

The Cape begins at the North Eastern end of Buzzards Bay to leave the main land of the old Continent for a long journey out into the Atlantic. For about twenty miles it runs off to the South, but all the time it is running away on a curve that brings it up to the North. For about twenty miles more, it holds to this direction, and then turns back toward the place where it first started, ending at what is called Provincetown, more than twenty miles to the East of Plymouth. On the extreme end, farthest out in the ocean, is the point where the wireless telegraph station has been built, in other words anchored, which would be a much better way to describe the manner in which the buildings, etc., are held together.

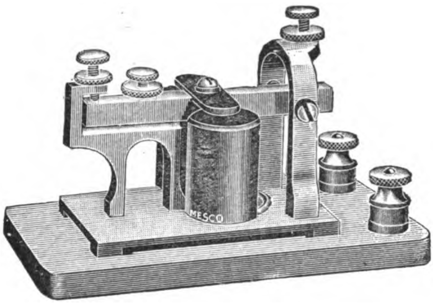


Fig. 10.

This little settlement is supposed to be a part of South Wellfleet, but just where this community begins and ends would be impossible for one to readily decide. The surrounding country as far as the eye can see is almost altogether given over to scrub pines, brown sand dunes, and on the bay side, to swamps and inlets.

There, in their loneliness, facing each other, stand two weatherbeaten houses, but there is hardly any other sign of life or anything that one could call a village. Behind one of the pine grown hills about one mile off, can be seen looming up, the last sixty or seventy feet of the four massive square framed towers.

Even from this place, or as far as the railroad, one must raise their eyes to see their distant tops. The sight of their great size and height stationed off there in the loneliness of Cape Cod, is strange enough to make an all round spot for the romance of Wireless Telegraphy.

The road which takes us to the Marconi station winds monotonously up to the cliff, where a few acres are enclosed by a barbed wire fence, and on them stand the four great towers, also the little low buildings which make up the station of South Wellfleet. In the fore ground is situated a cosy little one story cottage surrounded by a tasty piazza. In the rear, is the stable where the carriages and horses are kept. The little cottage itself, is known as the "S" cottage, as that is the signal which Marconi and his superintendent received from the steamship Philadelphia when she was about 2009 miles away.

This was accomplished in the winter of 1902. Also on January, 1903., President Roosevelt of the United States sent his first wireless message from this station to King Edward VII, of England.

Off toward the sea is a little brick building where is placed the fuel which generates the power for the plant.

The great towers form a large square and are about 210 feet apart being very much larger at the base than at the top, which is about 225 feet above the level of the ocean. They are constructed of the heaviest pine which is most securely braced. Each tower is strengthened by two great steel cables which are anchored in beds of concrete far below the surface of the sand. All this is absolutely necessary for their safety, because they are exposed to the full force of the wind and storms from every direction, and a bed of sand is not a very good foundation for extremely tall structures. The poles which were erected in 1900 to hold the wires were blown down in a gale. This disaster occurred in the first part of the construction of the plant and meant a loss of about $50,000 and a great loss of time. In the construction of this plant the Cape Cod men were largely employed, as they were all expert sailors, and climbing great heights is an every day matter with them.

From tower top to tower top is stretched a heavy wire and to this are attached many smaller ones, about one hundred to a side, four hundred in all. These wires (each hundred) form an inverted triangle which has its base on the large wire in the air, and the vertex far below, passing into a little opening in the operator's house, where the messages are sent and received. This building, together with another which contains the steam engine and the generating apparatus is built in what is known as "the insides." Nobody is allowed to enter the house but the trusted employees of the Marconi Wireless Company, and it is protected outside by a high fence.

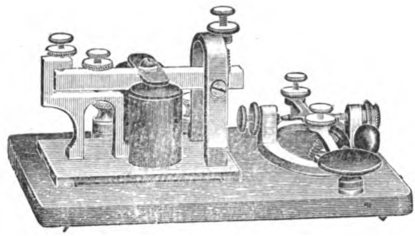


Fig. 11

When a strong breeze is blowing the sand flies into one's face with such force that it is almost painful and again the loose surface is blown about like snow drifts. In the winter when there is a light fall of snow it is often not a strange sight to see the white completely covered by the brown which is very much lighter in weight.

The superintendent of the plant is Mr. Taylor, who was formerly employed at the Poldhu Station on the coast of Cornwall. Marconi and his assistants have worked much together and during his recent visit to this station they again joined in conducting experiments. The superintendent takes great interest in the wireless work and is fond of praising Marconi's work. Mr. Taylor's assistant is Charles V. Sargent, who with his wife make up the entire force. The presence of a woman is readily revealed by the tasteful furnishing of the house and the flowers growing at its doors. They are all interested in their work and strive their best to work out the possibilities of the future.

CHAPTER V.

WIRELESS TELEGRAPH ON SEA.

Wireless telegraphy became a necessity on ships as well as on land and over great distances over water. In the last few years many ships have been equipped with the system and it has proven a great success, by saving life and property. It is also of importance in war, enabling one army to send messages and dispatches to a distant station without exposing their men to the enemy's fire. The many uses to which it could be put to service are too numerous to mention. Wireless telegraphy was used in the Spanish and American war and proved very important in many cases. It was also used extensively in the Russian and Japanese war, many of the attacks on Port Arthur being accomplished by the aid of wireless telegraphy.

In the year 1900, there were five systems installed on ships of the Royal Navy then in South African waters. It proved so successful that in the latter part of the same year thirty-two more ships and stations on land were also equipped.

When the contract was accepted, it was understood that each apparatus should be satisfactorily worked by naval officers between two ships stationed at Portland and Portsmouth, a distance of sixty-five miles of which about eighteen miles lay overland. The height of the aerial wire was limited to eighty-two feet on each ship. The necessary apparatus was installed and none of them were rejected as unsatisfactory. Messages have been transmitted and received by these ships over a much greater distance than was first calculated.

The Marconi System is also in commercial use between Borkum Light ship in Germany and Borkum Riff, a commercial charge made for each message received, and between May 15th and October 31st, 1901, over five hundred and sixty-five messages were sent and received.

In November 1900, communication was established between the Belgian mail steamer "Princess Clementine" and La Panne, messages being sent and received very successfully.

The telegraph apparatus on this ship was installed in one of the private cabins, and from here the aerial wires were run up the foremast, which had been lengthened for this purpose, and at the top of same was placed a spar making an angle of forty-five degrees with the mast, the total height being about 100 feet.

It was afterwards found that communication could be maintained between Dover Harbor and La Panne, a distance of forty-three miles, with the mast reduced to seventy-two feet.

On one occasion the Princess Clementine herself during a fog went ashore on the coast of Belgian. The ship immediately telegraphed to Ostend for assistance, and within a short time a tug was under way to her relief.

Another time the Princess Clementine was passing the Rugtingin Light ship, situated sixteen miles from Dunkirk, when a message was received from the former station that her lighting apparatus was out of order. The Captain immediately sent a message to Dunkirk notifying them of the mishap and a crew was at once sent to their aid to make the necessary repairs, thus avoiding the accidents which might have occurred to the passing vessels had the lights of the light ship been extinguished.

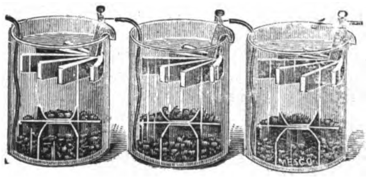


Fig. 12

The steam ship Lucanca has also been fitted with wireless apparatus and has proven more than successful, shortening the time of isolation from communication with land while crossing the Atlantic to about twenty-four hours.

The Marconi system has also been installed for the French Government for setting up communication between Atibes, in France, and the island of Corsica, the distance thus covered being about one hundred and twenty-five miles.

In December 1898, communication was established between the South Foreland light ship, at Dover, and the East Goodwin light ship, a distance of twelve miles. The apparatus had not been in use long, before the warning of several wrecks had been made known on shore. The system has proven very successful and is in operation at the present time.

When the Cunard liner Etruria was nearing the coast of Ireland on an eastern voyage she was in communication with the Marconi wireless telegraph station seventy miles distant, and about midnight received a dispatch from Reuter's agency which was utilized in publishing the first copy of the latest innovation of ocean travel, a newspaper at sea, with all the latest news of the world told in tabloids.

Purser J. A. McCubbin acted as editor and prepared the "copy" which was set in type by the ship's printer, A Harris, and the paper was run off on a hand press at 2 A. M. on Saturday, February 7, nearly twelve hours before the ship reached her dock. Assistant Purser H. D. Stainer acted as circulating manager for the paper and a copy was presented at the breakfast table.

The paper printed in nonpariel type with brevier headlines was as follows:—

"S S ETRURIA"

LATEST NEWS PER REUTER'S AGENCY,

VIA MARCONI WIRELESS TELEGRAPHY

"Venezuela question still unsettled: negotiators discussing various proposals, which appear satisfactory to neither party. Meanwhile blockade continues. Castro inflicted another severe defeat on revolutionist.

Senate postponed for a week in consideration of Dr. Crum.

Coal famine in New York seriously delaying departure of liners.

American war ship going to Anapala, Honduras, owing to indications of a general conflagration in the Central American Republic.

Lehmann of Yale awarded the first Rhodes Scholarship.

Roosevelt and Hayes practically abandon hope of Senate ratifying Alaskan treaty owing to opposition of Senators North and West.

Brazil decided upon the military occupation of Acre. The Sultan of Morocco routed the Pretender.

King Edward confined to the house since Monday by influenza."

Signor Marconi was a passenger on the ship when this first experiment with a newspaper at sea was tried and he took a lively interest in the proceedings. That night a concert was held in which Signor Marconi took part. Purser McCubbin, to get his hand in for the editorial work before him in getting out the first "wireless" paper sent the following dispatch by wireless to the Cunard Officers about 10 P. M. when the Crookhaven Station was first picked up.

"The Etruria left New York on Saturday, January

3rd, with 201 passengers on board, among whom was Signor Marconi.

The passage was a fair one notwithstanding the fact that considerable westerly gales were encountered.

On the last night out, a concert was given under the chairmanship of P. H. Holt, Esq., in which Signor Marconi took part and proved by his rendering of Mascagni's Intermezzo on the piano, that he was an expert in transmitting waves of sound as well as etheric ones."

The Etruria was in command of Captain John Pritchard, who succeeded Captain Watt, who had been assigned to the Campania, vice Captain Walker, the Captain of the line, retired.

The uses of wireless telegraphy upon sea are many and have been brought to a successful financial standpoint.

We have seen how wireless telegraphy on shipboard has proven for itself a practical necessity. It enables the steamers to keep in communication with the land station and other passing ships. It makes ocean travel very much safer and after the greater part of the vessels have been equipped with wireless apparatus, collisions at sea will be a thing of the past.

The possibilities and advantages of wireless telegraphy of the future are innumerable. Every day, almost, brings to the light of the world some new discovery or invention which makes one less step to the perfection of the system. The world is full of busy men studying and seeking for some new device or element which will raise the process of wireless telegraphy to perfection.

And here, I think, we may leave the very interesting subject in the hope that all have seen clearly what is already known about Wireless Telegraphy. There are many things which are quite improbable but which are not impossible.

Our big world rolls over from day to day just as smoothly as it did many centuries ago, without a squeak to show that it needs oiling or attention after all these many years of revolution. But times change, as men are always changing, and because civilization goes ever marching onward. The impossibilities of yesterday become the accomplished and accepted facts of today.

Here is a description founded upon the wonders of electricity and nature and written for the people of this generation, yet when the reader's children have become men and women this may seem to them as a thing of the past. Therefore, I will conclude this little volume with the inspiration that the future may bring to light many new discoveries and inventions which will lead the science of wireless telegraphy to the stage of perfection.

ADVERTISEMENTS