Guglielmo MARCONI (25 April 1874-20 July 1937)

V19 28 OCT 2019

PART 1: HIS LIFE AND COMPANY

Introduction

Wireless telegraphy was the outcome of a chain of effort formed by the mathematician, the laboratory experimenter, the inventor, and the capitalist.
For instance: in 1864, **James Clerk Maxwell** (1831-1879) working on purely theoretical lines, reached the conclusion that an electric spark or disruptive discharge," would set up oscillations in the ether".
In 1887, **Heinrich Hertz** (1857-1894) proved by experiments that Clerk Maxwell's theory was correct. He demonstrated that an electric spark "brings about the radiation of etheric waves" which may be reflected, refracted, and polarised like those of light. In 1895, Guglielmo Marconi began his attempts to utilise these waves for signalling purposes. In 1896, he took out the first of the patents which were later acquired by Marconi's Wireless Telegraph Company, and utilised in the development of a world-wide system of wireless telegraphy by land and sea.

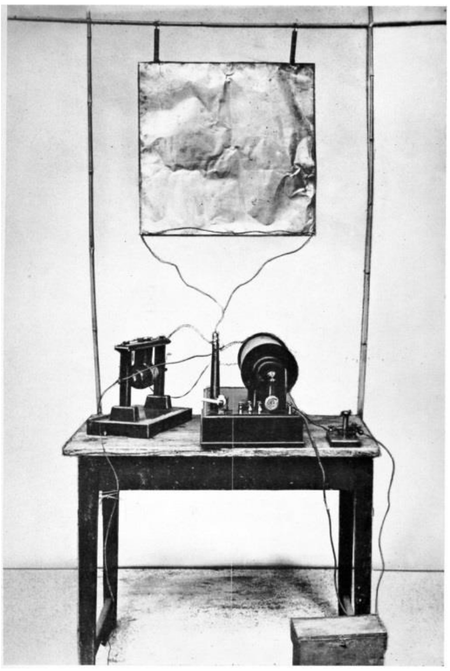
1. THE EARLY YEARS (a),[3]

1.1. Guglielmo Marconi's youth

On April 25, **1874**, an event occurred which would change the world forever: on that day Guglielmo Marconi was born in Bologna, Italy. His first influences proved unusual: His father, Giuseppe, was an able, dignified Catholic Italian businessman. His mother, Annie a Protestant Irish girl of Daphne Castle, County Wexford, was descended from a family of well-known Jameson whiskey distillers in Dublin. Their first child, Alfonso, had been born nine years before Guglielmo. Neat, tidy, studious and obedient, he was nearly the opposite of his younger brother.
Guglielmo's boyhood was passed in the country at his father's handsome Villa Grifone estate at Pontecchio, some eleven miles outside the city of Bologna. Guglielmo wasn't a particularly clever boy; in fact, he was a bit mischievous. He never lacked imagination, and it was his ability to focus with intense concentration which set him aside from the boys in town. He was always a favourite with his mother; his hobbies became fishing, sailing, playing the piano and horse-back riding.
While at home he preferred to spend most of his time in the family library, which concentrated on history, science and technology. In his early years Guglielmo never attended a public school, and although he was tutored in many subjects, he was largely self-taught. His mother also encouraged him to speak and write fluently in English, a decided advantage in later years.
When he was twelve years old he attended the Cavallero Institute in Florence.
Over the winter, Guglielmo enrolled in the Technical Institute at Leghorn, where he left at the age of 18. He developed an appetite for an increased knowledge of electricity and its associated areas.
Marconi thoroughly enjoyed playing with electricity, performing "scientific" experiments whenever he could borrow the money from his critical father, who frowned upon his interests.
Upon noting her son's strong interest in electricity, Annie prevailed upon a neighbour to allow Guglielmo to attend some lectures at the University of Bologna. The neighbour and lecturer was **Professor Augusto Righi** (1950-1920), a noted physicist at the University, and who was acquainted with the work of Heinrich Hertz.

He allowed Marconi to borrow books from the university library, and even perform some experiments. While the professor believed there was nothing new and exciting in the work, he encouraged Marconi to continue. Inspired by Hertz, Guglielmo repeated his electromagnetic wave experiments, using parabolic reflectors.
In December, **1894**, after spending countless hours constructing apparatus with no success, he was able to perform a demonstration for his mother. Pressing a key in one room, he made a bell ring in another, thirty feet (9 m) away. This was the beginning of wireless communication!

1.2. Further experiments



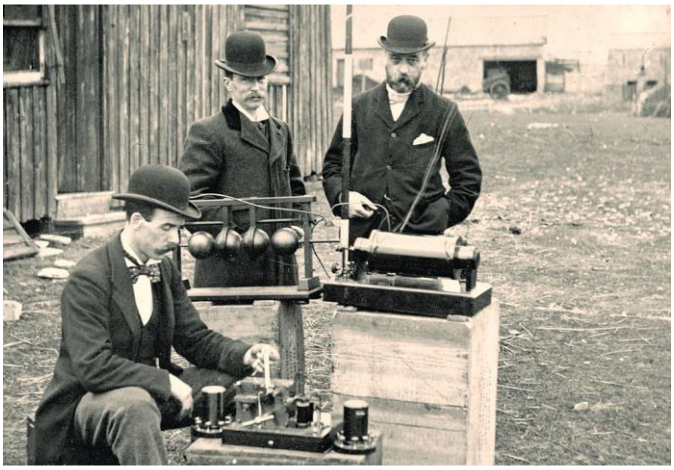
The story of his further early experiments is peculiarly interesting. Guglielmo Marconi was only twenty-one years of age when he began the attempt to put Hertz's laboratory experiments to practical use. After his first efforts made at his father's villa in Pontecchio, from room to room, his next step was to try longer distances in the garden of the Villa Grifone and after numerous experiments (some of them with parabolic reflectors) he was able to receive signals the length of the garden.
The apparatus employed in these experiments was very simple. In the transmitter he used an induction coil to produce a spark between two metal balls, one of which was connected to a metal can hoisted on a mast, and the other to a metal plate in the earth. In the receiver he used an improved 'detector', a form of "*coherer"* (see PART 2), connected to a similar "aerial" and a similar "earth". This arrangement of aerial wires and earth connections was found by Marconi to give the maximum of reliable effect with the minimum of energy. It was an entirely novel arrangement of conductors, and it made wireless telegraphy really practical for the first time.
The results were incredible: he could now signal for hundreds of meters with his contrivance! By September **1895**, he had increased his range of transmission across the estate surrounding the Villa Griffone to more than two kilometres.
Latterly, of course, the distances of transmission have further grown, wireless installations have become more complicated, and various refinements have been introduced. But the garden experiments at Pontecchio supplied the germ which was destined to grow, twelve years later, into the realisation of Transatlantic wireless telegraphy.
At the end of 1895 Marconi, this time encouraged by his father, decided to offer his system to the Italian Ministry of Post & Telegraph. The officials, content with landline cables and wires, had no interest in ideas of 'wireless'. It is interesting to surmise that had the Italian Navy been approached, the entire history of wireless telegraphy might have been rewritten…

1.3. Farewell Italy, hello England

On 2 February **1896**, thanks to the help of his mother's family, the Jameson's, 21 year old Guglielmo and his mother Annie arrived safely in England. They rented a house in Bayswater and were much supported by the Jameson's. Guglielmo got all the facilities he needed to work on and improve his system. **Henry Jameson-Davis,** his mother's cousin**,** introduced Guglielmo to one of the foremost patent lawyers in London. That was very useful as Marconi deposited on 2 June 1896 a provisional specification of his invention in the London Patent Office. On 2 March 1897, he followed this up with a complete specification, including eleven drawings for 'Improvements in Transmitting Electrical Impulses and Signals and in Applications therefor". This reaches acceptance on 2 July 1897 with the granting of patent # 12,039 (details in PART 2). Although some observers accused him of plagiarising the work of an English physicist, **Professor Oliver Lodge** (1851- 1940), the overall reaction was favourable.

He then brought his apparatus under the notice of **Sir William Preece** (1834-1913), then Engineer-in-Chief to the General Post Office, and in charge of all forms of communication in England. Marconi performed numerous experiments for Preece throughout the day. Preece was impressed, and offered Guglielmo the use of his laboratory for future experiments.

In Marconi's first official demonstration, over a distance of somewhat less than a mile, before senior officials and engineers of the GPO, his transmitter consisted of an induction coil and a Righi spark gap placed in the focal line of a parabolic reflector which was fabricated of sheet copper. His receiver combined an improved Branly coherer a polarized relay, a Morse inker for recording, and a parabolic reflector (see PART 2). An epoch-making day, not only was it an unqualified success for Marconi, but it marked the beginning of the British interest in wireless telegraphy.



Between June **1896** and July 1897, Marconi conducted several more experiments under the supervision of the Post Office, the War Office, and the Admiralty. Tests were made successfully between St. Martin's-le-Grand and the Thames Embankment, but the experiments which first roused the authorities and the to the importance of the invention were those carried out in March **1897** on Salisbury Plain, when Marconi covered a distance of over four(eight?) miles. Here he was using longer antennas, supported by kites! This experiment attracted considerable attention from both the press and the public at home and abroad. A Mr. **George.S. Kemp** was assigned to assist Marconi with the venture, beginning an association which was to last over 35 years, until Kemp's death in 1932.

More and more experiments were done leading to further improvements and reaching greater distances; I will only mention here, briefly, a couple of them (many more are, amongst others, described in [11]):

-In May 1897, a series of demonstrations were made across the Bristol Channel, communication being established between Penarth and Brean Down, a distance of nearly nine miles (14 km).

As a matter of course, the interest taken in these demonstrations was nowhere keener than in Germany. Among those who witnessed the Bristol Channel experiments was **professor Adolf Karl Heinrich Slaby** (1849-1913). He himself, had been attempting to utilise Hertzian waves for signalling purposes, but had not been able to telegraph more than one hundred meters through the air. Professor Slaby afterwards became one of Marconi's competitors, being a partner in the Slaby-Arco system which was adopted by the German Government, but he has probably never ceased appreciate the debt he owned to Marconi's success.

-Also in 1897 Guglielmo received an invitation from the Italian government to go to Rome and to the naval base of La Spezia and give demonstrations of his wireless system, mainly shore to ship transmissions. Here he reached more than 11 miles (18 km) and, for the first time, showed that wireless could reach into the 'great unknown' beyond the visible horizon. As a result, his apparatus was to be adopted by the Italian Navy.

-The first ship-to-shore message took place on Christmas Eve, **1898**, when Marconi successfully made contact between the South Foreland Lighthouse, near Dover, and the East Goodwin Lightship, in the English Channel, a distance of 12 miles.

-On 6 July he was summoned to give a personal demonstration of his wireless to the Italian King and Queen. Such was the impression he made that the King and Queen invited him to a dinner!

-On 27 March **1899** he established communication between France and England, across the English Channel between a station in Wimereux (Boulogne, FR) and the South Foreland Lighthouse (UK), a distance of 32 miles .The next step was the transmission of messages between Wimereux and Chelmsford, a distance of 85 miles (146 km), some 30 miles over sea and 55 over land. This sensational feat was at once aroused by the daily press.
-Upon the completion of the tests across the English Channel, Marconi decided to turn his attention to America. He had been invited by James Gordon Bennett, owner of the New York Herald. On 11 September 1899 he sailed from Liverpool, arriving in New York on 21 September. On 29 September his equipment was in place and the first U.S. shipboard wireless message was transmitted from S.S. Ponce to a shore station set up on a tall building at Navesink Highlands, New Jersey. Other tests were performed for the U.S. Navy.
- For my compatriots: on 3 November 1900, the Belgian Royal Mail Steam Packet "Princesse Clementine", plying between Ostend and Dover, was equipped with wireless telegraphy and a Marconi station was installed at 'De Panne', near Ostend, on the Belgian coast (more on this below). More on this below.These ship to shore installations have frequently proved of great value in saving life and property.

Convinced that, in the short term, wireless would offer greater benefit at sea than on land, he set up the world's first fixed transmitting station on the western tip of the Isle of Wight, at the Royal **Needles** Hotel.
Having listed coastguards to help erect a mast 120 feet high (37m), he was ready to transmit. In December 1897, having fitted areals and receivers to a pair of local ferry boats, he began tests of reception at sea. Signal rates of about four words a minute were achieved, sometimes beyond the horizon and in atrocious weather, at ranges up to 18 miles (29 km). In June 1898, Marconi was visited at the Needles station by the influentiel scientist, **Lord Kelvin** (1824-1907). Kelvin was clearly impressed by what he saw and soon afterwards became a staunch supportrer of Marconi's efforts.

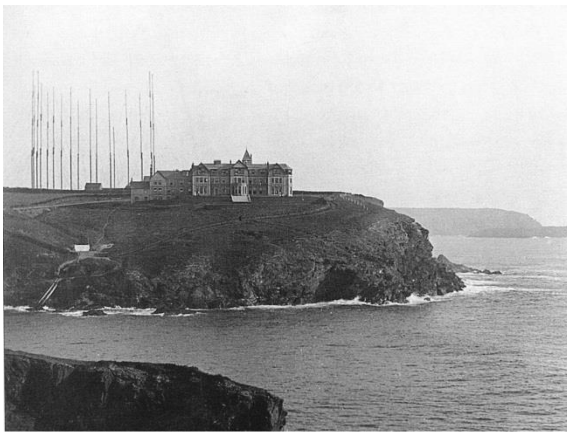
At that time his apparatus allowed to sent Morse code at about a rate of 12 to 15 five-letter words per minute (the word 'Paris' was thr reference word).
"Electric wave telegraphy" had thus been established by Marconi on a practical base. He had demonstrated its utility, especially for communication between ship and ship and ship and shore, a work which could not be established by any other system. And a few years later his system proved its military value for the British in the Anglo-Boer War in South Africa

The company's expansion and the growing complexity of its technological demands meant that its operations inevitably came to rely less on a single figure and became more of a team effort.
Having initially employed support staff such as George Kemp and **William Walter Bradfield** (1879-1925), and recruited technicians straight from school for in-house training, Marconi recognised the need for a broader scientific base and set about recruiting engineers and physicists with abilities comparable o his own.
Some were near-contemporaries such as **Charles Samuel**., **Charles Samuel Franklin,** and **Richard N. Vyvyan**, whose careers matured with the company, whilst others arrived with names and reputation already made.
Of these the most notable early on was **Dr John Ambrose Fleming** (later Sir Ambrose). His first contact with Marconi came in 1899, when aged 49 and professor of electrical technology at University College London. Soon afterwards, while retaining his professorship, Fleming became a technical consultant and in December 1900, its first 'Scientific Adviser', a post he would keep for more than 30 years. But his first challenge was perhaps his most daunting- to extend wireless signals across the Atlantic.

2. BRIDGING THE ATLANTIC

In **1900**, five years after he had made his first experiments in the garden at Pontecchio, Marconi had raised the range of transmission by wireless telegraphy to over 200 miles (322 km). It was inevitable, therefore, that he should expect to increase the range still further and to bridge the Atlantic as he had bridged the Channel.
Pessimistic prophets were not slow to declare such a feat to be impossible. They confidently predicted that the curvature of the earth would prevent the electric wave from England being detected in America, unless the aerials from which the waves were despatched exceeded several miles in height. They also declared that the tremendously powerful waves from the long- distance station would swamp the feebler waves from the ordinary ship and shore stations, just as thunder drowns the noises of every-day life.
Taking the latter point first, Marconi had good reason for believing that the prophets were mistaken. He had already developed his " tuning" or syntonic system so far that he felt sure the traffic between ships and shore stations would not be disturbed by the thunders of his long-distance stations. His earliest receiving instruments had been sensitive to practically every kind of electric wave; but his later instruments were designed to respond only to waves of a certain frequency. A tuning fork will start vibrating if all exactly similar tuning fork in its vicinity is struck, but it will not resonate even to a thunder- clap unless the note of the clap is of the proper pitch. A similar power of selection is employed by the tuned or '*syntonic'* wireless apparatus. Marconi proved that the long-distance station at Poldhu could send messages to a Cunard liner several hundreds of miles out at sea without affecting the messages sent from a neighbouring station to a ship approaching Southampton Water.
As regards the obstacle presented by the curvature of the earth, that proved to be a bogey, like Professor Airy's famous pronouncement, fifty years before, that an Atlantic cable could never be laid, and, if laid, could never be used for the transmission of electric signals. Marconi convinced himself, by tests made between two stations two hundred miles distant, that the electric waves he was employing were able to make their way round the curvature of the earth. He concluded that the curvature of the earth was not likely to constitute a barrier to the transmission of the waves over great distances. Although this time Marconi was completely mystified why this was so; it was later determined that this phenomenon was the result of the signals being refracted back to the earth by the ionosphere (the "Kennelly–Heaviside" layer).

In 1900, therefore, experiments in transatlantic transmission were begun in earnest at Poldhu. Shortly afterwards the erection of a similar transatlantic station was begun at Cape Cod (Cape Cod is a geographic cape extending into the Atlantic Ocean from the south-eastern corner of mainland Massachusetts). Towards the end of **1901** the station at Poldhu was far enough advanced to try the experiment of transmitting signals right across the ocean. The completion of the arrangements was, however, delayed owing to a storm which wrecked the masts and aerial at Poldhu on 18 September 1901.



Nevertheless by the end of November the aerial was sufficiently restored to enable Marconi to complete the preliminary tests which he considered necessary prior to making the first experiment across the Atlantic. Another accident, in this instance to the masts at Cape Cod on 24 November 1901, seemed likely to postpone the tests for several months more. Marconi therefore decided that in the meantime he would use a purely temporary receiving installation in Newfoundland for the purpose of testing how far the arrangements in Cornwall had been conducted in right lines. He accordingly left for Newfoundland on 27 November 1901, with two assistants. As it was impossible at that time of the year to set up a permanent installation with poles, Marconi decided to carry out the experiments by means of receivers connected to elevated wires supported by balloons or kites, a system which had been previously used by him when conducting tests

across the British Channel for the Post Office in 1897. He also employed a telephonic receiver which registered the messages by means of a series of clicks.
Marconi's assistants at Poldhu had received instructions to send on and after 11 December, during certain hours every day, a succession of “S's" followed by a short message. In the Morse code the letter 'S" is represented by three successive dots. On **12 December 1901** the signals transmitted from Cornwall were clearly received at the pre-arranged times, in many cases a succession of "S's" being heard distinctly, although probably in consequence of the weakness of the signals and the constant variations in the height of the receiving aerial no actual message could be deciphered.
The result obtained, although achieved with very imperfect temporary apparatus, was sufficient to convince Marconi that by means of permanent stations (that is, stations not dependent on kites or balloons for sustaining the elevated conductor) and by the employment of more power in the transmitters it would be possible to send messages across the Atlantic Ocean with the same facility with which they were being sent over much shorter distances.
In February, **1902**, further tests were carried out between Poldhu and a receiving station on board the American liner “Philadelphia” en route from Southampton to New York; readable messages were received from Poldhu up to a distance of 1,551 miles (2.496 km) and “S's" and other test letters were detected as far as 2,099 miles (3.378 km). The distances at which the messages were received are all verified and counter-signed by the Captain and Chief Officer of the ship, who were present during the tests.
Early in 1902 modifications and improvements were carried out at Poldhu, wooden towers being erected to replace the masts, and at the same time a high-power station was commenced at Cape Breton (Nova Scotia) to enable Marconi to carry out further tests. These tests were greatly facilitated by the subsidy of £16,000 granted by the Canadian Government to support Marconi's experiments.
During the time that constructional work was in progress at Glace Bay, Cape Breton, tests from Poldhu were carried out over considerable distances, the Italian Government very kindly placing the cruiser "Carlo Alberto" at Marconi's disposal for this purpose. During these tests messages were received direct from Cornwall by the " Carlo Alberto " in the Baltic, the North Sea, the Bay of Biscay; also at Ferrol, Kiel, Cadiz, Gibraltar and Spezia. Many more successes followed. In October **1903**, it became possible to supply the Cunard steamship " Lucania " with news transmitted direct from the shore during the entire crossing from New York to Liverpool.
It should be noted that the apparatus used was totally different from what was used in the ‘early’ years. Now heavy machinery was employed in the power stations (as they were called), including a steam machine to drive a high tension dynamo or alternator, a rotating discharger, …

3. MARCONI COMPANIES

3.1. In England and abroad.

By **1897** the system had reached the stage at which the fourth link in the chain of development was required. Capital was, of course, necessary to realise the commercial benefits of wireless telegraphy on a large scale—to manufacture the instruments and develop the business generally, and on 20 July 1897, the **Wireless Telegraph and Signal Company, Limited**, was formed, with a nominal capital of £100,000, to acquire Marconi’s patents in all countries except Italy and her Dependencies. Its factory was a converted warehouse in Hall Street, Chelmsford, the first establishment in the world for making wireless apparatus.
Marconi made a special arrangement with Italy in return for the substantial and enthusiastic assistance rendered to him by the Italian Government.
Subsequently the name of the Company was altered on 23 February **1900** to **Marconi's Wireless Telegraph Company, Limited (MWTC)**, and in April 1905, the capital was increased to £500,000 in £1 Ordinary Shares, So rapid was the growth of the business that the capital was again increased, in April, 1908, when it

was raised to £750,000. Henry Jameson-Davis (who we have met here before), representing the interest of his family that was a big shareholder, became the first managing director.
(The MWTC name only changed in 1963 into "Marconi Company Limited", followed later on by a lot of further changes due to acquisitions, mergers, ...)

We have seen that Marconi went to the U.S. in September 1899. Before he left America, he organised on 22 November **1899**, under the laws of the state of New Jersey the **American Marconi Telegraph Company.** (capital = $10,000,000).
On 25 April **1900** (Marconi's twenty-sixth birthday) **The Marconi International Marine Company – MIMCC**-was formed to establish marine wireless telegraphy on a sound commercial basis throughout the world. It has offices in London and in Brussels, Belgium (26 October 1901, capital, B.Frs. 600,000).
Following this other companies were incorporated in the following countries:
United States: on 16 April 1902 (capital, $ 6,650,000)
Canada: on 1 November 1902 (capital, $ 5.000,000)
France: on 24 April 1903 (capital, Fr.Frs. 100,000)
Argentine: on 4 August 1906 (capital, $ 6,750,000)
Other: Russia in 1908; Spain and Germany in 1910; "Australasia" in 1912; Holland in 1916; …

3.2. A special case: Belgium [2],[13],[14], (j).

The Belgian King Leopold II (1835-1909), Belgian engineers, the army and politicians showed interest in wireless telegraphy after hearing about Marconi's electrical spark experiments. One has to know that King Leopold II was the founder and sole owner of the Congo Free State, a private project undertaken on his own behalf.
Electrical engineer by appointment to the Royal Palace and to the city of Brussels, **Maurice Travailleur**, was commissioned in 1998 to examine whether Marconi's technology could be used to connect Congo to the telegraphy network in Saint-Paul-de-Loanda (situated at the West coast of Angola). That was the nearest point where all submarine cable links converged. Travailleur spoke to Colonel **Albert Thys**, a man that was heavily connected with the African possessions of King Leopold II. Thys had established a bank with the very purpose of financing such undertakings: the 'Banque d'Outremer' (Overseas Bank).With a little help from his English friends, Thys brought Travailleur in contact with Marconi. Talks began as early as 1899. On 3 March 1900 Marconi demonstrated his invention in the Royal Palace. The experiment took place in the presence of His Majesty the King, Princes Clémentine, Prince Albert and a number of members of the Belgian Government. After the successful demonstration, Marconi could arrange various audiences with ministers. And the decision was taken to create a company that would specifically pursue activities in wireless telegraphy between ships and between ships and land stations.

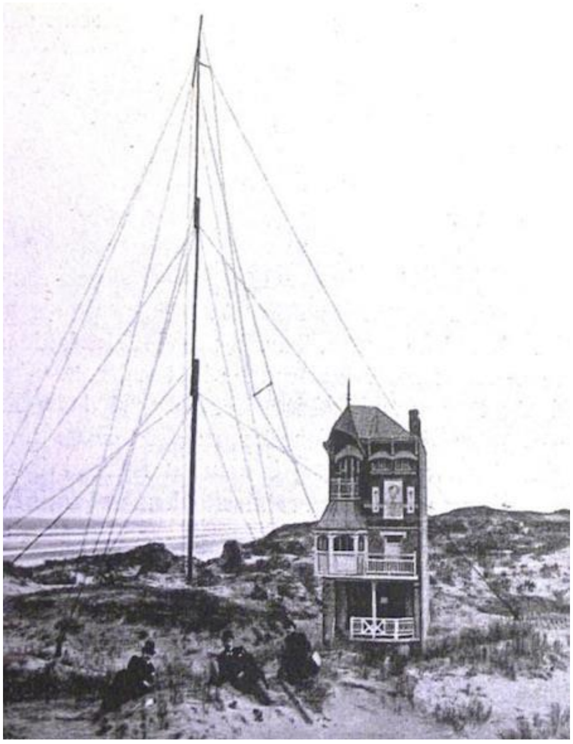
I must note here that the MIMCC, established in 1900, had a strong Belgian presence. The board of directors was a select group with as Chairman **Joseph Devolder**, Vice-President of the Belgian Société Générale company and a former Minister. The Directors included Colonel Thys and Maurice Travailleur, and a number of eminent people from Belgian banking circles. The intention was that this company would handle all activities in the field of maritime radiotelegraphy in all countries other than Great Britain and Italy. Activities in continental Europe would be run from an office in Brussels.
In 1901 all those MIMCC activities were accommodated in a new company under Belgian law.

This company was given the name of **"Compagnie de Télégraphie sans Fil" – CTSF**. It was housing in the Brederodestraat 13 in Brussels (the location of the 'Banque d'Outremer'). The biggest shareholder was the Banque d'Outremer which purchased 156 of the 200 shares. Marconi, referred to in the report of the first shareholders' meeting by the term "ingénieur électricien" had (only) four.
CTSF immediately entered into contact with the Belgian State for the installation of wireless telegraphy systems aboard all mail-boats. CTSF was the exclusive MIMCC agent for the countries of the European

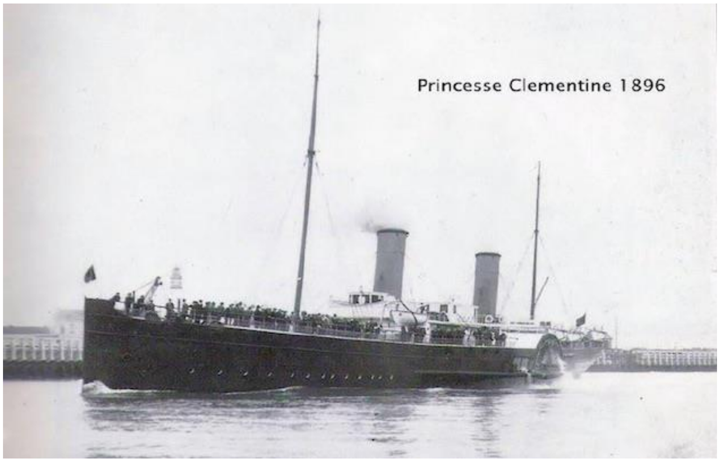
continent, their colonies and dependent territories. The profit was to be divided equally between CTSF and MIMCC. It also acquired the rights for non-maritime applications of wireless telegraphy in certain European countries and Congo. CTSF took over the Brussels' office of MIMCC, including its management and personnel, together with the coastal station in De Panne and the radio equipment. The fourteen souls (including a representative for France and one for Germany) would have to build the future of the new company. In 1904 they had also representatives for Italy, Spain and Portugal.

Meanwhile, however, competitors have appeared on the scene, such as Germany's Telefunken, who have patents based on the inventions of Adolf Slaby and do not intend to stand idle by and allow Marconi's hegemony to remain unchallenged.
CTSF had fitted radio installations in 144 ships before 1912 was out. 1912 was the year of the Titanic disaster (see 4.1.) which, naturally, increased interest in radio systems still further, and CTSF obviously turned this to good account.

It might be interesting for the Belgian readers to learn a bit about the first coastal station



Villa Les Pavots (Belgian coast)



On 10 November 1900, the construction of a wireless Morse connection between the Belgian coast and the luxury mail boat "Princesse Clémentine" started. The fixed installation, with a 46 m antenna, was located in the villa 'Les Pavots' (later renamed villa 'Yvette') in De Panne. A cable connected the villa to the telegraph office in Ostend . In 1902 this first Belgian radio station moved to Nieuwpoort.
The connection was made to the luxury mailboat 'Princesse Clémentine' which was operational between Ostend and Dover. For this purpose a 16 meter high transmitter mast was placed on the breeding mast.

*And also for my compatriots, I am telling here the further 'capricious' course of **CTSF***
*- In 1913 it became "Société Anonyme Internationale de Télégraphie sans Fil" (**SAIT**) {2}, headed by people we know by now: the Banque d'Outremer, Telefunken and Marconi Wireless Telegraph Co. each*

owned a holding of one third of the capital. Colonel Albert Thys was the Chairman and Maurice Travailleur Managing Director.

*- 1958 saw the conclusion of an agreement to take over SBR "Société Belge de Radio", a long time leading company that was producing in the past classic radios, and later involved in industrial electronics and telecommunications production activities. The name became "**SAIT Electronics**" {3}*

- In 1992 SAIT-Electronics acquired the innovative Belgian company 'Devlonics' and a new subsidiary ' "SAIT- Devlonics" was set up.

*- Also in 1992 they acquired the Dutch 'Radio Holland Group'. The new name became "**SAIT – RadioHolland**" {4}*

*- In 2000 a fifty-fifty merger took place with the Norwegian company STENTO and the new name became "**SAIT-STENTO**" {5}*

*- In 2001 the company changed its name in "**ZENITEL**" {6}*

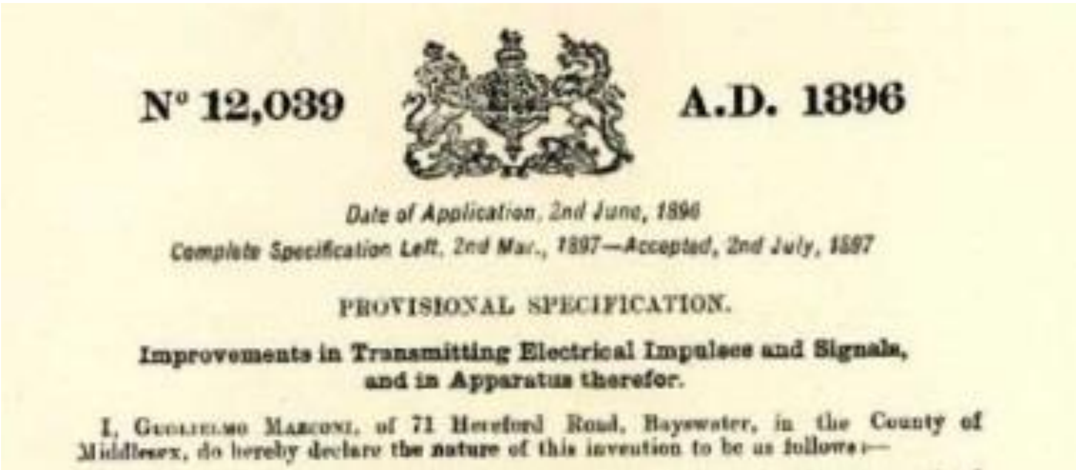
*- In 2013 it was 'back to the roots'(100 years later); the name became again "**SAIT**" {7}*

*- In 2014 SAIT was taken over by SECURITAS; leading to the name "**SAIT a SECURITAS COMPANY**" {8!} WOW…*

4. ABOUT SOME OF HIS PATENTS

4.1. His first one (i)

He obtained his first patents in Britain. We have seen above (1.3.) that his very first was #12,039 (1897) "Improvements in Transmitting Electrical impulses and Signals, and in Apparatus therefor". Date of Application 2 June 1896; Complete Specification Left, 2 March 1897; Accepted, 2 July 1897 (later claimed by Oliver Lodge to contain his own ideas which he failed to patent).



Nº 12,039 A.D. 1896

Date of Application, 2nd June, 1896

Complete Specification Left, 2nd Mar., 1897—Accepted, 2nd July, 1897

PROVISIONAL SPECIFICATION.

Improvements in Transmitting Electrical Impulses and Signals, and in Apparatus therefor.

I, Guglielmo Marconi, of 71 Hereford Road, Bayswater, in the County of Middlesex, do hereby declare the nature of this invention to be as follows:—

It might be interesting to have a bit closer look; what follows here are a selection of paragraphs and drawings out of it .

QUOTE

I, Guglielmo Marconi, of 71 Hereford Road, Bayswater, in the county of Middlesex, do hereby declare the nature of this invention to be as follows:

According to this invention electrical actions or manifestations are transmitted through the air, earth, or water by means of electric oscillations of high frequency.

At the transmitting station I employ a Ruhmkorff coil having in its primary circuit a Morse key, or other appliance for starting or interrupting the current, and its pole appliances (such as insulated balls separated by small air spaces or high vacuum spaces, or compressed air or gas, or insulating liquids kept in place by a suitable insulating material, or tubes separated by similar spaces and carrying sliding discs) for producing the desired oscillations.

I find that a Ruhmkorff coil, or other similar apparatus, works much better if one of its vibrating contacts or brakes on its primary circuit is caused to revolve, which causes the secondary discharge to be more powerful and more regular, and keeps the platinum contacts of the vibrator cleaner and preserves them in good working order for an incomparably longer time than if they were not revolved. I cause them to revolve by means of a small electric motor actuated by the current which works the coil, or by another current, or in some cases I employ a mechanical (non-electrical) motor.

The coil may, however, be replaced by any other source of high tension electricity.

At the receiving instrument there is a local battery circuit containing an ordinary receiving telegraphic or signalling instrument, or other apparatus which may be necessary to work from a distance, and an appliance for closing the circuit, the latter being actuated by the oscillations from the transmitting instrument.

The appliance I employ consists of a tube containing conductive powder, or grains, or conductors in imperfect contact, each end of the column of powder or the terminals of the imperfect contact or conductor being connected to a metallic plate, preferably of suitable length so as to cause the system to resonate electrically in unison with the electrical oscillations transmitted to it. In some cases I give these plates or conductors the shape of an ordinary Hertz resonator consisting of two semicircular conductors, but with the difference that at the spark-gap I place one of my sensitive tubes, whilst the other ends of the conductors are connected to small condensers.

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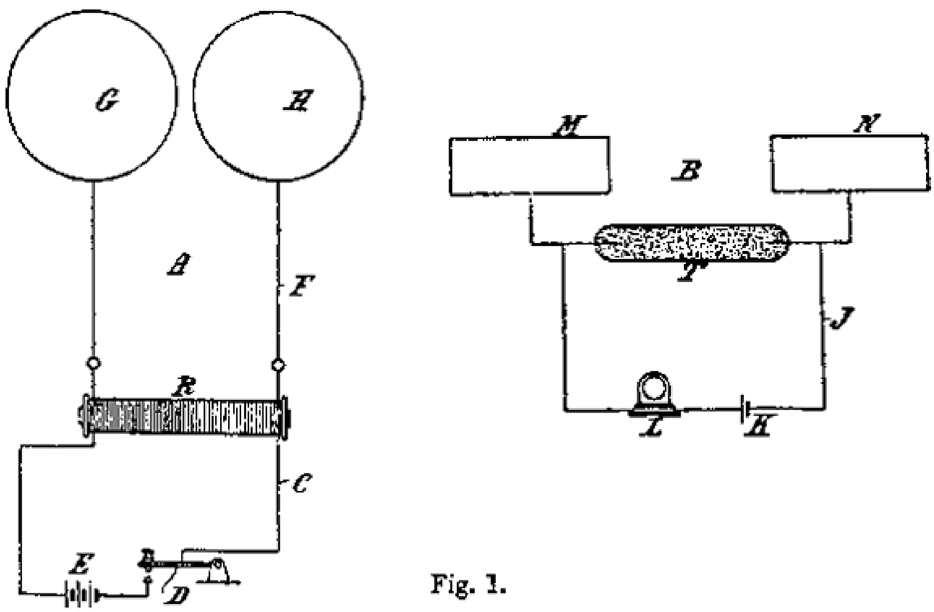

Fig. 1.

In order that my specification may be understood, and before going into details, I will describe the simplest form of my invention by reference to figure 1.

In this diagram A is the transmitting instrument and B is the receiving instrument, placed at say ¼ mile apart.

In the transmitting instrument R is an ordinary induction coil (a Ruhmkorff coil or transformer).

Its primary circuit C is connected through a key D to a battery E, and the extremities of its secondary circuit F are connected to two insulated spheres or conductors G H fixed at a small distance apart.

When the current from the battery E is allowed to pass through the primary of the induction coil, sparks will take place between the spheres G H, and the space all around the spheres suffers a perturbation in consequence of these electrical rays or surgings.The arrangement A is commonly called a Hertz radiator, and the effects which propagate through space Hertzian rays.

The receiving instrument B consists of a battery circuit J, which includes a battery or cell K, a receiving instrument L, and a tube T containing metallic powder or filings, each end of the column of filings being also connected to plates or conductors M N of suitable size, so as to be preferably tuned with the length of wave of the radiation emitted from the transmitting instruments.The tube containing the filings may be replaced by an imperfect electrical contact, such as two unpolished pieces of metal in light contact, or coherer, &c.

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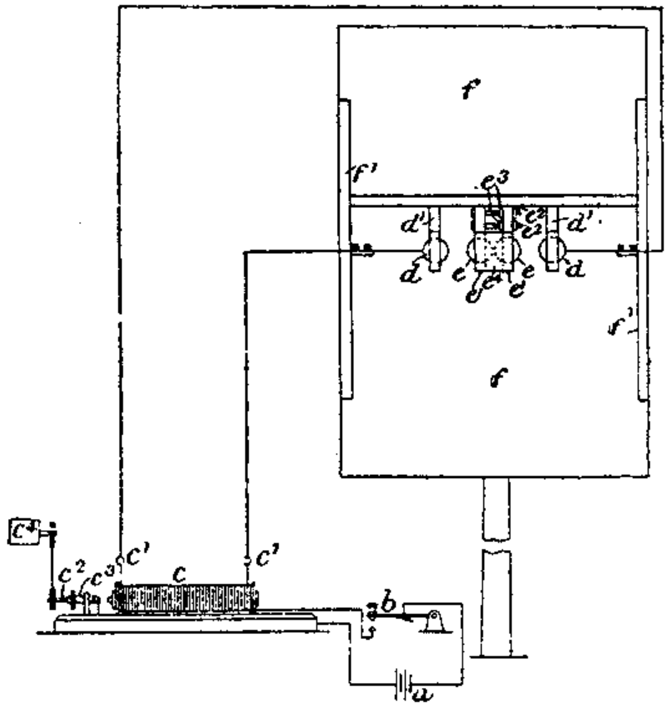

Fig. 3.

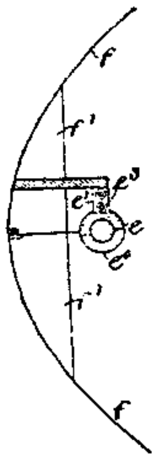

Fig. 4.

Figure 3 is a diagrammatic front elevation of the instruments at the transmitting station, in which e e are two metallic spheres corresponding to G H in figure 1. c is an induction coil corresponding to R. b is a key corresponding to D, and a is a battery corresponding to E.
Figure 4 is a vertical section of the radiator or oscillation producer mounted in the focal line of a cylindrical parabolic reflector f in which a side view of the spheres e e of figure 3 is given.

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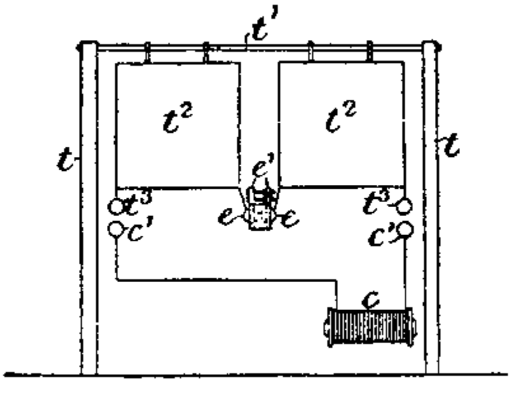


Fig. 9

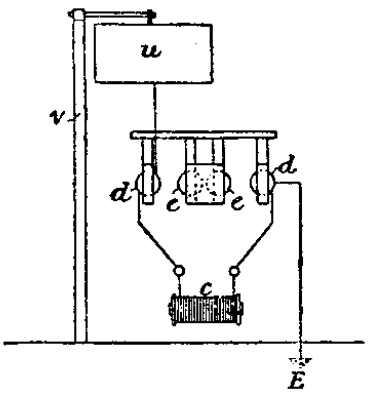


Fig. 10.

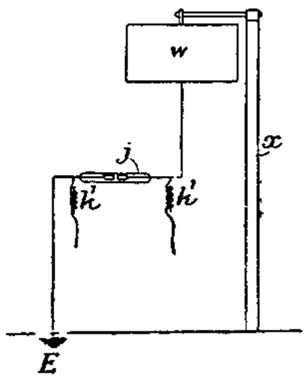
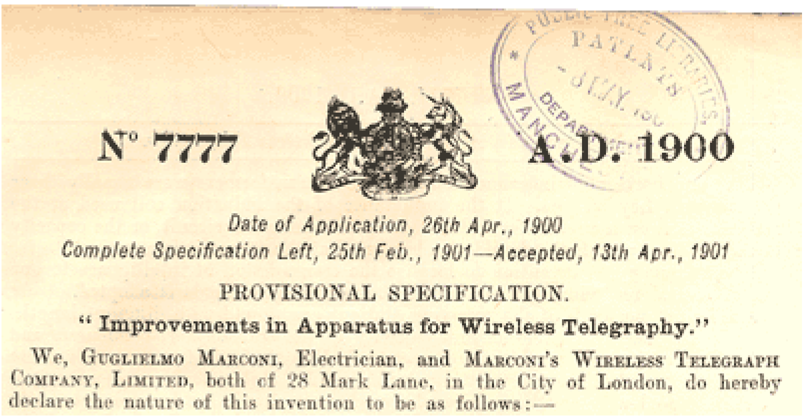


Fig. 11.

Figure 9 is another form of transmitter in which two large metallic plates t2 t2 are employed. Figure 10 shows a modification of the arrangements at the transmitting station, and figure 11 a modification of the arrangements of the receiving station, which enables one to signal through obstacles such as hills or mountains.
UNQUOTE

4.3. The 'famous four sevens' patent


N° 7777 A.D. 1900

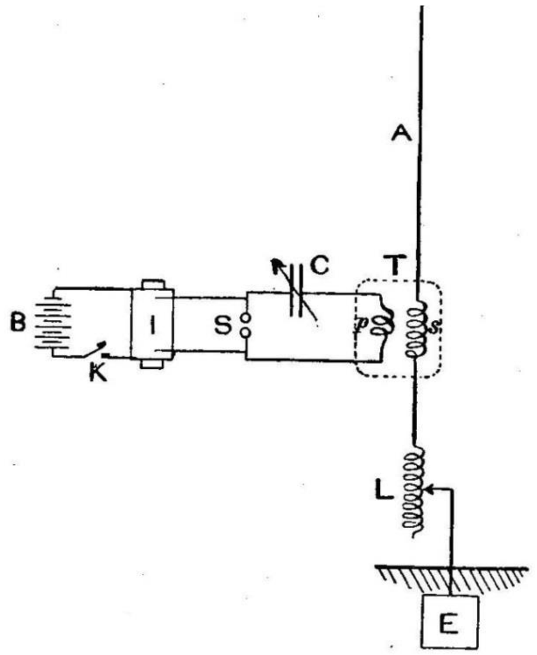
Date of Application, 26th Apr., 1900
Complete Specification Left, 25th Feb., 1901—Accepted, 13th Apr., 1901

PROVISIONAL SPECIFICATION.

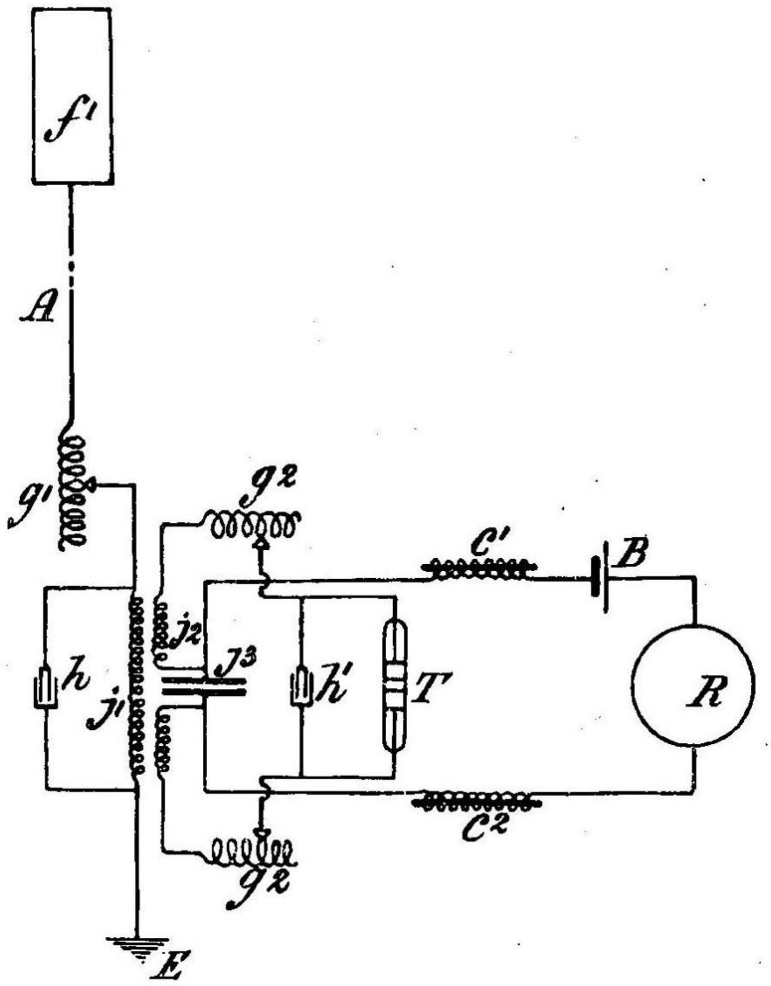
" Improvements in Apparatus for Wireless Telegraphy."

We, Guglielmo Marconi, Electrician, and Marconi's Wireless Telegraph Company, Limited, both of 28 Mark Lane, in the City of London, do hereby declare the nature of this invention to be as follows:—

Then came the important 'famous four sevens' patent: No. 7,777 (1900) "Improvements in Apparatus for Wireless Telegraphy". Date of Application 26 April 1900; Complete Specification Left, 25 February 1901; Accepted, 13 April 1901.This one documented a system for tuned coupled circuits ("syntonic telegraphy") and allowed simultaneous transmissions on different frequencies. Adjacent stations were now able to operate without interfering with one another and ranges were increased. The patent solved the problem in which, as power was increased to obtain longer ranges, signals spread to the extent that simultaneous transmission from adjacent ships or shore stations caused overlap and mutual interference.



Arrangement of Transmitting Apparatus in Marconi System of Syntonic Wireless Telegraphy. A, antenna; L, tuning inductance; E, earth plate; p, s, oscillation transformer; C, condenser; S, spark balls; I, induction coil; B, battery; K, sending key.



Arrangement of Receiving Apparatus in Marconi System of Syntonic Wireless Telegraphy. A, antenna; E, earth plate; g^1, g^2, tuning inductance; j^1, j^2, jigger; j^3, jigger condenser; c^1, c^2, choking coils; T, sensitive tube, or coherer; R, relay; B, battery.

The above two drawings comes out of the great book by John Ambrose. FLEMING [11]

4.4. More patents

Several others followed: 10245 (applied 1902), 5113 (1904), 21640 (1904), 14788 (1904).

His list of US patents is very long. It ended with # 1,981,058 "Thermionic valve". Filed 14 October 1926; Issued 20 November 1934. All of them had to do with ‘wireless telegraphy’, except this last one and 1,377,722, filed in 1918, that was about an "Electric accumulator".

U.S. patent 586,193 “Transmitting electrical signals” was the equivalent of his first UK one, the 12,039; and U.S. Patent 763,772 "Apparatus for wireless telegraphy" was the equivalent of the British 7,777.

4.5. A bit about legal actions in defence of his patents.

Of course, Marconi's success created the raise of competitors, resulting in successive disputes (especially in England, Germany and America) for alleged infringements of mutual patents. Some of the oldest discussions dragged on for many years. Here are a few examples:

Patent 7777 of 26 April 1900 was inspired by an experiment patented in 1879 by his old rival Professor Oliver Lodge, of tuning the sending and receiving aerials. Marconi's patent was for selective tuning in which the circuits in the transmitter and receiver, as well as the aerials were tuned to the same wavelength.? Lodge was unhappy and litigation followed…

Later on Marconi had also to fight TELEFUNKEN for infringing the 'Four Sevens' patent. On 6 March 1913 the differences between the two companies were settled by an arrangement to exchange patents, to accept each other's spheres of commercial influence and to maintain personal contacts.
(Telefunken, founded in Berlin in 1903, was a joint venture of Siemens & Halske, led by **Professor (Karl) Ferdinand Braun**-(1815-1918) and the Allgemeine Elektricitäts-Gesellschaft (AEG), led by **Dr. Adolf Slaby** (1849-1913) and **Count Georg von Arco** (1869-1940).

In September 1903, while In America, Marconi appeared for the company at its first American court action in pursuance of alleged patent infringements. The defendant, **Dr Lee de Forest**, had written to him in 1899 applying for a job, was refused, and had become a potential threat. This dispute between Marconi and de Forest was to become bitter and protracted. This long-running dispute erupted afresh on 22 November 1906, when Professor Ambrose Fleming, the company's scientific adviser, informed Marconi that the 'redoubtable Dr Lee de Forest' had 'begun to appropriate, while developing his 'audion' (triode) valve, his thermionic' (diode) valve.

In 1943(!), the Supreme Court of the United States handed down a decision on Marconi's wireless patents restoring some of the prior patents of Oliver Lodge, John Stone , and Nikola Tesla. The decision was not about Marconi's original radio patents and the court declared that their decision had no bearing on Marconi's claim as the first to achieve radio transmission, just that since Marconi's claim to certain patents were questionable, he could not claim infringement on those same patents

5. LATER YEARS

5.1. A word about theTitanic

The role played by Marconi Co. wireless in maritime rescues raised public awareness of the value of radio and brought fame to Marconi, particularly the sinking of the RMS Titanic on 15 April **1912** and the RMS Lusitania on 7 May 1915. On 18 June 1912, Marconi gave evidence to the Court of Inquiry into the loss of Titanic regarding the marine telegraphy's functions and the procedures for emergencies at sea.[4]. Britain's postmaster-general summed up, referring to the Titanic disaster: "Those who have been saved, have been saved through one man, Mr. Marconi ... and his marvellous invention."
Marconi was offered free passage on Titanic before she sank, but had taken Lusitania three days earlier. As his daughter Degna later explained, he had paperwork to do and preferred the public stenographer aboard that vessel.

5.2. Marconi's later years [a]

5.2.1. The company

As this book is about the 19-th century, I will only comment very briefly about the further evolution of Marconi and his companies.

As the first decade of the 20th century went on, more and more ships of the mercantile marine were equipped with Marconi apparatus. Parallel with this there was an increase in the number of installations on land and on lightships, lighthouses and other points of importance to the safety of shipping. But also important for its success was the working of both ship and shore stations by operators trained to obey the same rules and regulations as the service was organised on its own account.

The business model Marconi used for his radio communications equipment was to charge a rental fee. This also included the fees for the use of a trained radio operator and the use of the Marconi shore based stations. Users with equipment from competitors could not use the shore stations except for emergency communications. With the Marconi company possessing a large number of strategically located stations, this provided a strong incentive for ships to use the Marconi equipment rather than that of a competitor.

These arrangements enabled the company to restrict competition. The governments, however, did not want to see a Marconi monopoly. They made the case that competition would lead to lower rates and improved service; in other words, would be good for consumers around the world and hence a legitimate objective for an international treaty. In particular he German emperor, Wilhelm II, was alarmed that this new technology might end up in the exclusive control of a British company. He assembled an international conference in Berlin in 1903 to try to convince the other governments that wireless communication should be open, regardless of who owned the equipment. The International Radio Telegraph Convention of 1906 set the course for an international regulatory regime, first for wireless, then broadcasting, and ultimately all telecommunication.

Over the years, the Marconi companies gained a reputation for being technically conservative, in particular by continuing to use inefficient spark-transmitter technology, which could be used only for radio-telegraph operations, long after it was apparent that the future of radio communication lay with continuous-wave transmissions which were more efficient and could be used for audio transmissions. Somewhat belatedly, the company did begin significant work with continuous-wave equipment beginning in 1915, after the introduction of the oscillating vacuum tube (valve). The New Street Works factory in Chelmsford was the location for the first entertainment radio broadcasts in the United Kingdom in 1920, employing a vacuum tube transmitter and featuring Dame Nellie Melba. In 1922, regular entertainment broadcasts commenced from the Marconi Research Centre at Great Baddow, forming the prelude to the BBC.

5.2.2. *Guglielmo's personal life.*

On 16 March **1905** Marconi married Beatrice O'Brien. They had three daughters, Degna (1908), Gioia (1916), and Lucia (born and died 1906), and a son, Giulio (1910). In 1913, the Marconis returned to Italy and became part of Rome society. Beatrice served as a lady-in-waiting to Queen Elena. Marconi and Beatrice had divorced in 1924.

The year **1909** brought good news for Marconi: he was the first Italian to be awarded the Nobel prize for physics. The bad-and, to many, bewildering- news was that he shared it with Professor K. Fr.Braun, who we met here before as the founder of Telefunken (he is also known as the inventor of the cathode ray tube). Before the ceremony in Stockholm in December, the two physicists were reluctant to meet. When they did, Braun apologised handsomely, and concerned the prize should have been Marconi's alone.

In **1914**, Marconi was made a Senator in the Senate of the Kingdom of Italy and appointed Honorary Knight Grand Cross of the Royal Victorian Order in the UK. During World War I, Italy joined the Allied side of the conflict, and Marconi was placed in charge of the Italian military's radio service. He attained the rank of lieutenant in the Royal Italian Army and of commander in the Regia Marina.

Having a longtime passion for the sea and the intellectual solitude that it offered, in **1919** Marconi bought a yacht and renamed it **Elettra**.

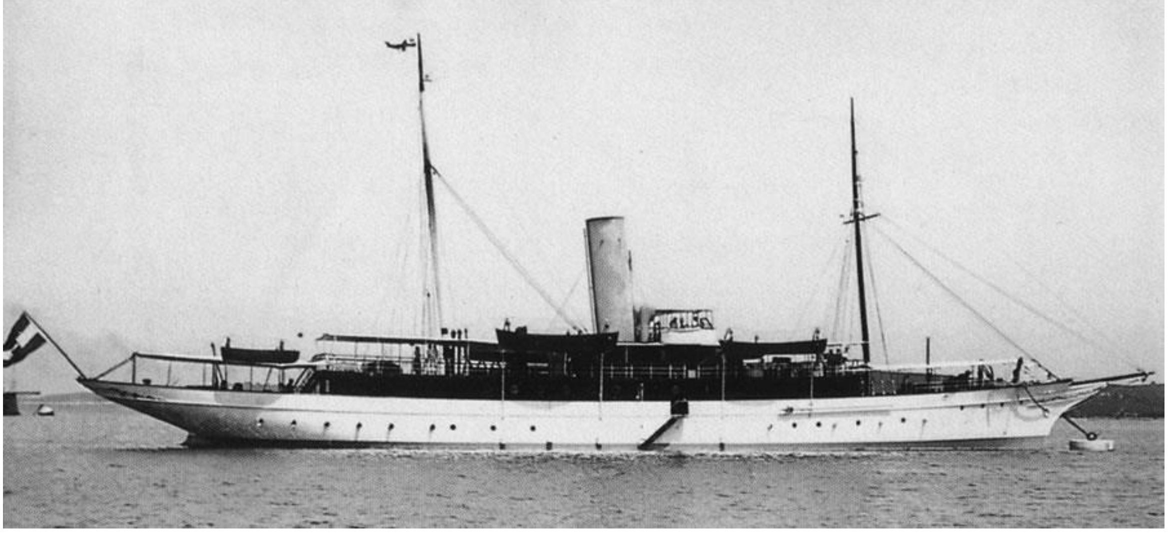
Marconi joined the Italian Fascist party in **1923**. In **1930**, Italian dictator Benito Mussolini appointed him President of the Royal Academy of Italy, which made Marconi a member of the Fascist Grand Council.

Marconi went on to marry Maria Cristina Bezzi-Scali in **1927**. To do this he had to be confirmed in the Catholic faith and became a devout member of the Church. He was baptised Catholic but had been brought up as a member of the Anglican Church. They had one daughter, Maria **Elettra** Elena Anna (born 1930).

Marconi wanted to personally introduce in **1931** the first radio broadcast of Pope, Pius XI, and did announce at the microphone: "With the help of God, who places so many mysterious forces of nature at man's disposal, I have been able to prepare this instrument which will give to the faithful of the entire world the joy of listening to the voice of the Holy Father"…

Later in life, Marconi was an active Italian Fascist and an apologist for their ideology and actions such as the attack by Italian forces in Ethiopia

While helping to develop microwave technology, Marconi suffered nine heart attacks in the span of 3 years preceding his death. He died in Rome on **20 July 1937** at age 63, following the ninth, fatal, heart attack, and Italy held a state funeral for him. In addition, at 6 pm the next day, the time designated for the funeral, all BBC transmitters and wireless Post Office transmitters in the British Isles observed two minutes of silence in his honour. The British Post Office also sent a message requesting that all broadcasting ships honour Marconi with two minutes of broadcasting silence as well



Elettra, the Yacht

His wife Maria Cristina Bezzi-Scali and their daughter Elettra.

5.3. Tributes

5.3.12. Awards

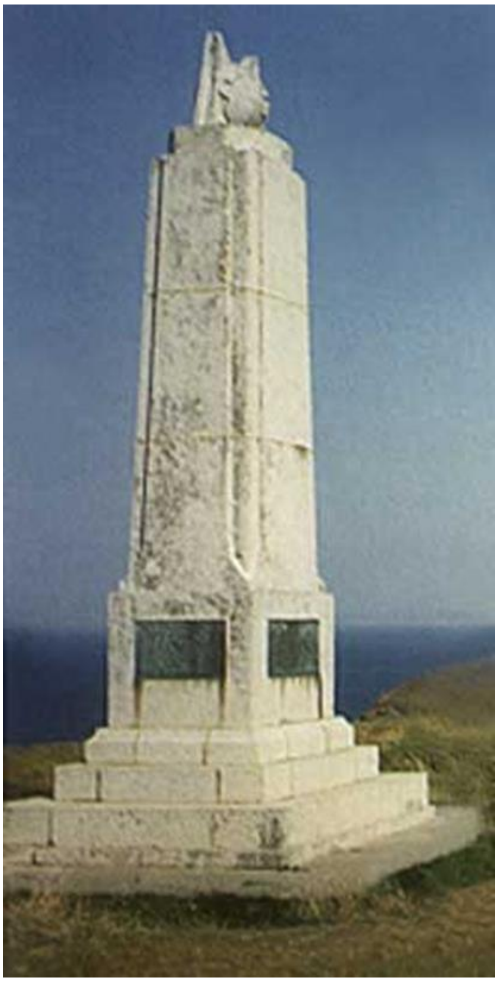
•-In 1902 he was appointed a Grand Officer of the Order of the Crown of Italy[66]
•-In 1909, Marconi shared the Nobel Prize in Physics with (Karl) Ferdinand Braun for his contributions to radio communications.
•-In 1914 named senator by the king of Italy Vittorio Emanuele III
•-In 1929, he was made a marquess by King Victor Emmanuel III, thus becoming Marchese Marconi.
•-In 1931, he was awarded with John Scott Medal by wireless telegraphy
•-In 1975, Marconi was inducted into the National Inventors Hall of Fame.
•-In 1977, Marconi was inducted into the National Broadcasters Hall of Fame.
•-In 1988, the Radio Hall of Fame (Museum of Broadcast Communications, Chicago) inducted Marconi as a Pioneer (soon after the inception of its awards).
•-In 2009, Italy issued a commemorative silver €5 coin honouring the centennial of Marconi's Nobel Prize.
•-In 2009, he was inducted into the New Jersey Hall of Fame.

5.3.2. Monuments

- A funerary monument to the effigy of Marconi can be seen in the Basilica of Santa Croce, Florence But his remains are in near the Mausoleum of Guglielmo Marconi in Pontecchio Marconi, near Bologna. -- ------------>>
- His former villa, adjacent to the mausoleum is the Marconi Museum (Italy) with much of his equipment.
- A statue of Guglielmo Marconi stands in Church Square Park in Hoboken, NJ.
- A large collection of Marconi artefacts was held by The General Electric Company, p.l.c. (GEC) of the United Kingdom which later renamed itself Marconi plc and Marconi Corporation plc. In December 2004 the extensive Marconi Collection, held at the former Marconi Research Centre at Great Baddow, Chelmsford, Essex UK was donated to the nation by the Company via the University of Oxford. This consisted of the BAFTA award-winning MarconiCalling website, some 250+ physical artefacts and the massive ephemera collection of papers, books, patents and many other items. The artefacts are now held by The Museum of the History of Science and the ephemera Archives by the nearby Bodleian Library. Following three years' work at the Bodleian, an Online Catalogue to the Marconi Archives was released in November 2008.(h)
- A Guglielmo Marconi sculpture by Attilio Piccirilli stands in Washington, D.C. --------------------------------------- ---------------->>

- A granite obelisk stands on the cliff top near the site of Marconi's Poldhu Wireless Station in Cornwall, commemorating the first transatlantic transmission. Hereby the photo as well as the texts on the plaques on

1. The POLDHU wireless station was used by the Marconi company for the first trans-oceanic service of wireless telegraphy which was opened with a second Marconi station at Glance bay in Canada in 1902.When the Poldhu station was erected in 1900 wireless was in its infancy, when it was demolished in 1935, wireless was established for communication on land, at sea and in the air. For direction finding, broadcasting and television.



2. One hundread yards north east of this column stood from 1900 to 1935 the famous Poldhu wireless station designed by John Ambrose Fleming and erected by the Marconi company of London from which were transmitted the first signals ever conveyed across the Atlantic by wireless telegraphy. The signals consisted of a repetition of the morse letter 'S' and were received at St Johns Newfoundland by Guglielmo Marconi and his British associates on 12 12 1901.

3. From the Marconi company's Poldhu station in 1923 and 1924, Charles Samuel Franklin, inventor of the Franklin beam aerial, directed his short wave wireless beam transmissions to Guglielmo Marconi on his yacht 12 'Eletttra' cruising in the south Atlantic. The Epoch making results of these experiments laid the foundation of modern high speed radiotelegraphy communication to and from all quarters of the globe.

4. To commemorate the pioneer work done by Guglielmo Marconi and his research experts and radio engineers at the Poldhu wireless station between 1900 and 1935, the Marconi company presented this historic land to the *National Trust.Some six acres of cliff land were given in 1957 and four acres behind the cliffs, on which stood the* station and mast, were given in 1960.

5.3.3. Some of the places and organisations named after Marconi

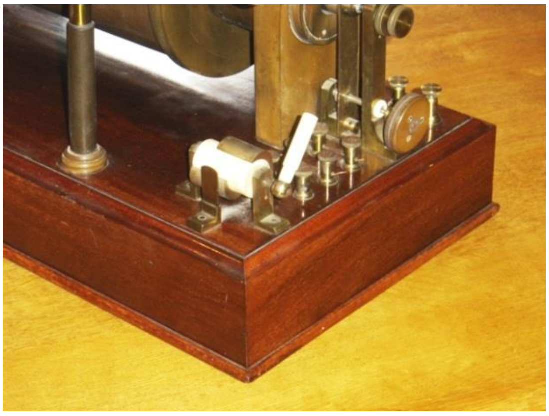
- The asteroid 1332 Marconia is named in his honour.
- A large crater on the far side of the moon is also named after him.
- Bologna Guglielmo Marconi Airport is named after Marconi, its native son.
- Open University Guglielmo Marconi in Rome, Italy (Università Telematica "Guglielmo Marconi")
- Ponte Guglielmo Marconi, bridge that connects Piazza Augusto Righi with Piazza Tommaso Edison, in Rome
- Department of Electrical, Electronic and Information Engineering "Guglielmo Marconi" (DEI), Università di Bologna
- Marconi Beach in Wellfleet, Massachusetts, part of the Cape Cod National Seashore, located near the site of his first transatlantic wireless signal from the United States to Britain. There are still remnants of the wireless tower at this beach and at Forest Road Beach in Chatham, Massachusetts.

PART 2: HIS APPARATUS

(All photos are from apparatus that were once in my collection)

1. TRANSMITTER APPARATUS

The 10 inch induction coil (spark inductor)



Heinrich Ruhmkorff (1803 - 1877) was a German instrument maker who commercialised the induction coil, often referred to as the Ruhmkorff coil. Although Ruhmkorff is often credited with the invention of the induction coil, it was in fact invented by Nicholas Callan in 1836 based upon the theories of **Micheal Faraday** (1791-1869). Ruhmkorff patented his first coil in 1851.

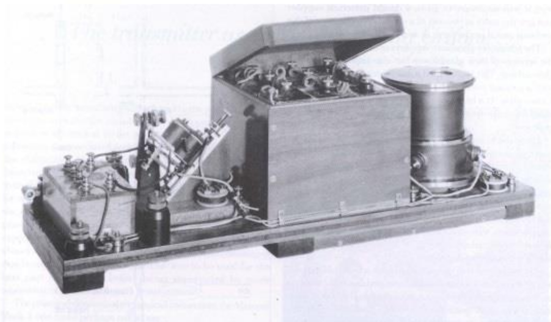
The purpose of the induction coil is to generate a very high voltage, such that it is able to create an electric spark (as done in the cylinders of the ignition engines of our cars). The principle is that of a 'transformer': there are two layers of separate windings: the primary, with a low number of windings, and the secondary, *with a high number of windings. Due to the effect of the electrical induction, a voltage is generated in the secondary layer that is proportional to the ratio of the number of coils in the two layers.*

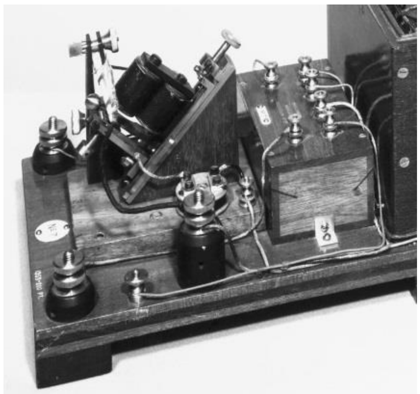
In the case of Marconi's typical coil, a very hefty electric spark of 10 inches (25 cm) - hence the name '10 inch coil'- is created. It is this spark that generates the electromagnetic radiation. The primary circuit generally consists of 360 turns of copper wire (No. 12 SWG > 0.1 mm) - and the secondary of 17 miles (!) of very thin copper wire (No. 34 SWG > 0.009 mm).

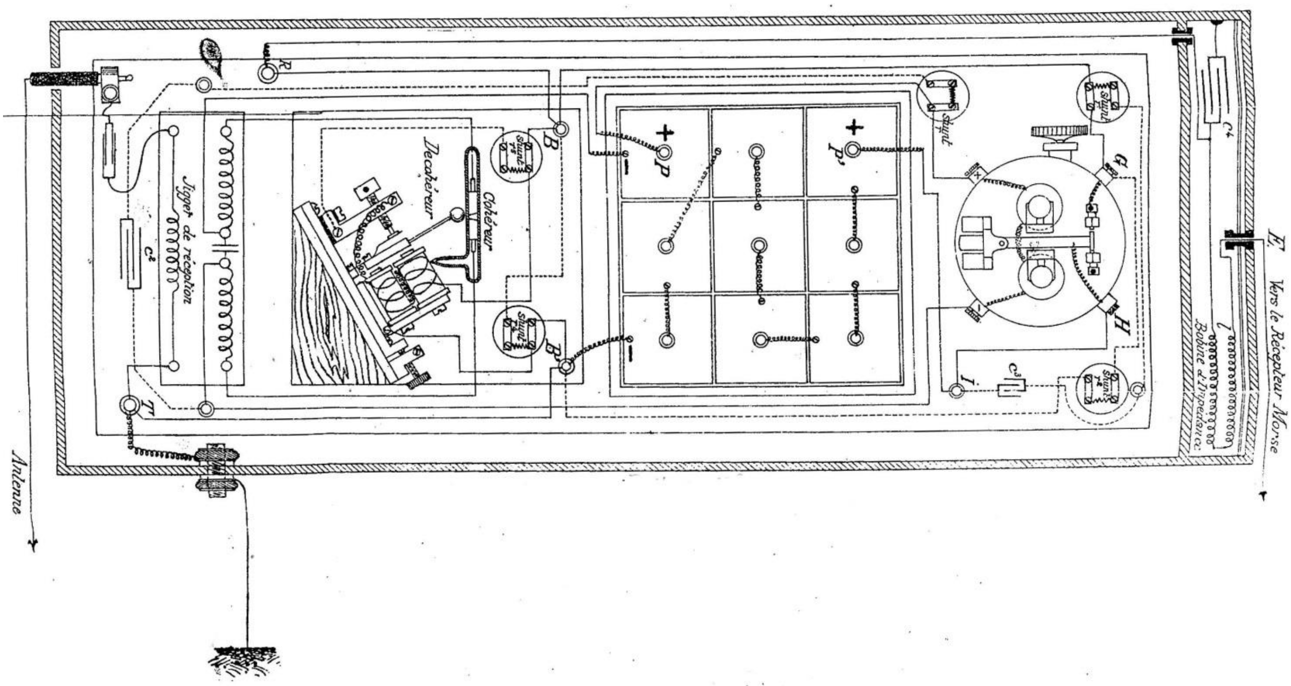
2. RECEIVING APPARATUS

2.1. A Replica of the first 'commercial' receiver

The photos on the left are showing my replica, the ones on the right are showing a real one (Science Museum, London).

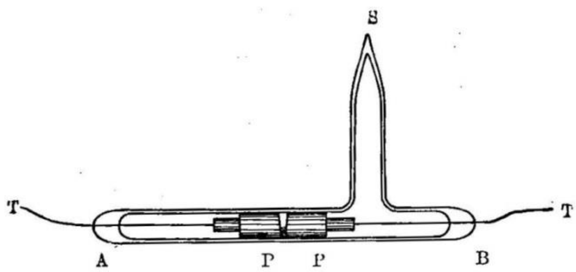






2.2. The coherer [11]

Patent No. 12,039 of 2 June 1896



Marconi Sensitive Tube or Cymoscope. (*Full size.*) A, B, glass tube exhausted; T, T, platinum terminal wires; P, P, silver bevelled plugs; S, side tube for exhaustion.

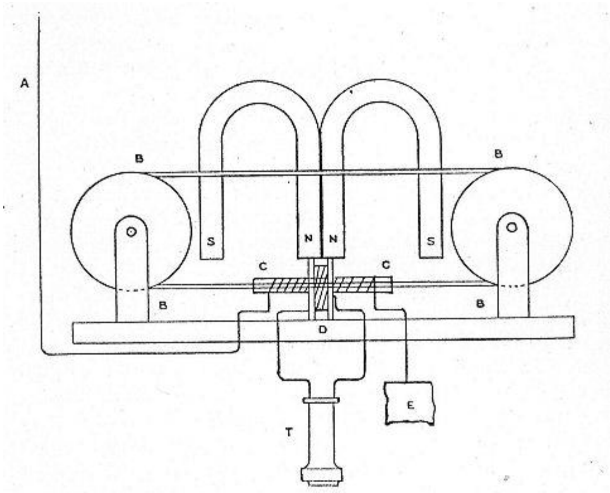
Forerunners that observed the anomalous change in resistance of metal particles responding to electrical sparks generated in its vicinity were, amongst others, ***Professor David E. Hughes*** *(1831-1900), in 1879, and T. Calzecchi-Onesti, in 1884. This phenomenon was further examined by the French* ***Edouard Branly*** *(1844-1940) in 1890 and was given, in 1894, a practical use by* ***Oliver Lodge*** *(1851-1940) and by the Russian scientist* ***Alexander Popoff*** *{or Popov > Попóв} (1859-1906).*

> *Note: Following his experiments, Popoff has been called by the Russians, as of 7 May 1895,"the father of the radio". In Russia May 7th is celebrated as "Radio Day". This date is different from the 'World Telecommunication Day' that has been celebrated annually on 17 May since 1969. That date marks the anniversary of the founding of the "International Telegraph Union" on 17 May 1865, when the first International Telegraph Convention was signed in Paris.*

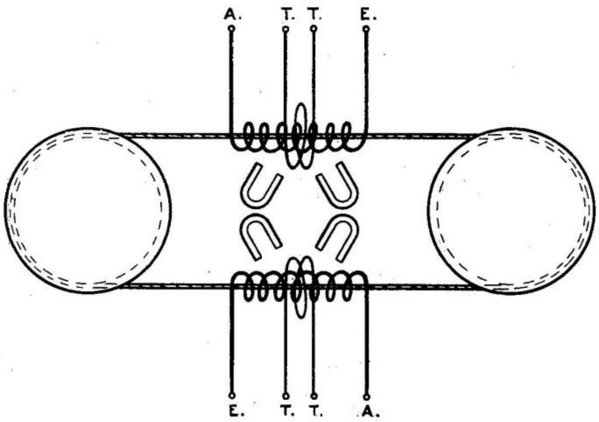
Simplified said, he coherer consists of a small tube containing metal filings, which have the peculiar property of allowing a current of electricity to pass through them only when they are under the influence of an electric wave. When an electric wave -such as is set up by a thunderclap or an electrical discharge artificially produced- strikes the filings they 'cohere' (cling together), in a molecular sense, and allow the current to pass. Put into a circuit with a battery, the passage of the current constitutes a signal, as it can be used to make a click in a telephone or to work a telegraph (by using the morse code) or other recorder.
Marconi tried many different kinds of metal filings, and eventually determined that a combination of 95% nickel and 5% silver produced the most sensitive device. See much more about the coherer in [11].

2.3.The Magnetic Detector (often called the **"Maggie")**

Patent No. 10,245 of 1902

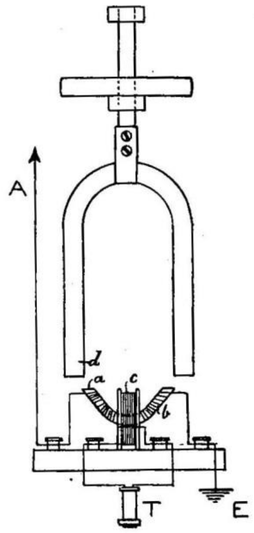


The wiring



Principle

The instrument consist of a band of insulated iron wires moving through duplicate sets of coils in front of a system of permanent magnets. As a general thing only one set of coils is in use at once, but with extremely long waves the two sets can be connected up, primaries in series and secondaries in series, with enhanced effect. The clockwork that drives the band runs for 90 minutes without rewinding.
The Maggie works by using the hysteresis of the magnetization in the iron wires. For further details, I refer the reader to Wikipedia and the likes.



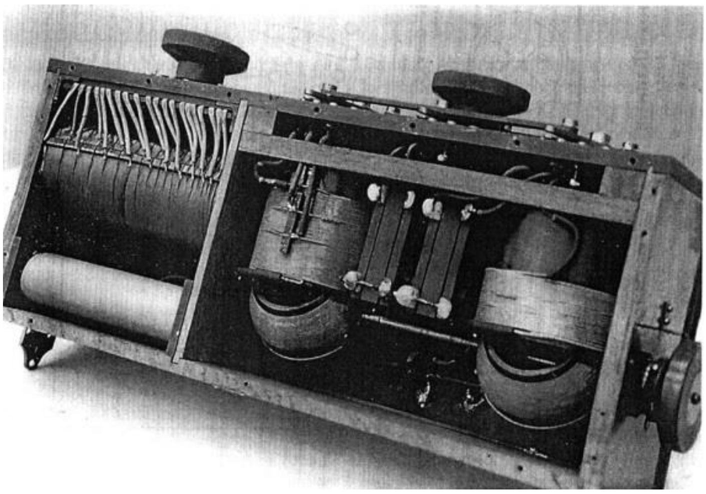
His first model

Although Marconi did not invent the magnetic detector -amongst many others Lord **Ernest Rutherford** (in 1895) and Prof. **Reginald Fessenden** were involved-, he did a considerable amount to develop it and to make it a practical device. The magnetic detector was more sensitive and also more reliable than the coherer. As a result, it was widely used as the standard detector on maritime receivers between about 1902 until about 1914. They were particularly suited to use on board ships where they were relatively immune to their movements, unlike coherers which were not. After this time it tended to be replaced by crystal and valve (vacuum tube) detectors that were more sensitive.

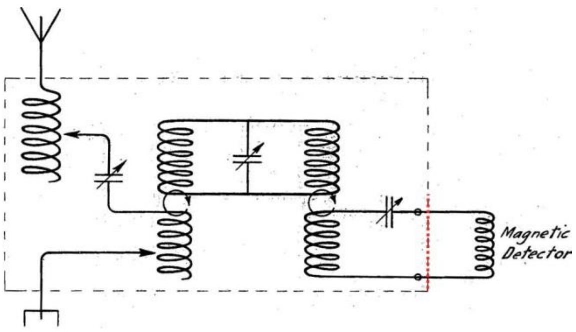
Marconi made initial sketches in January 1902. In may he filed designs for the first of two patents ‘upon the discovery that a core of magnetic material becomes sensitive to high frequency oscillations when placed in a varying or moving magnetic field’.

2.4. The Multiple Tuner

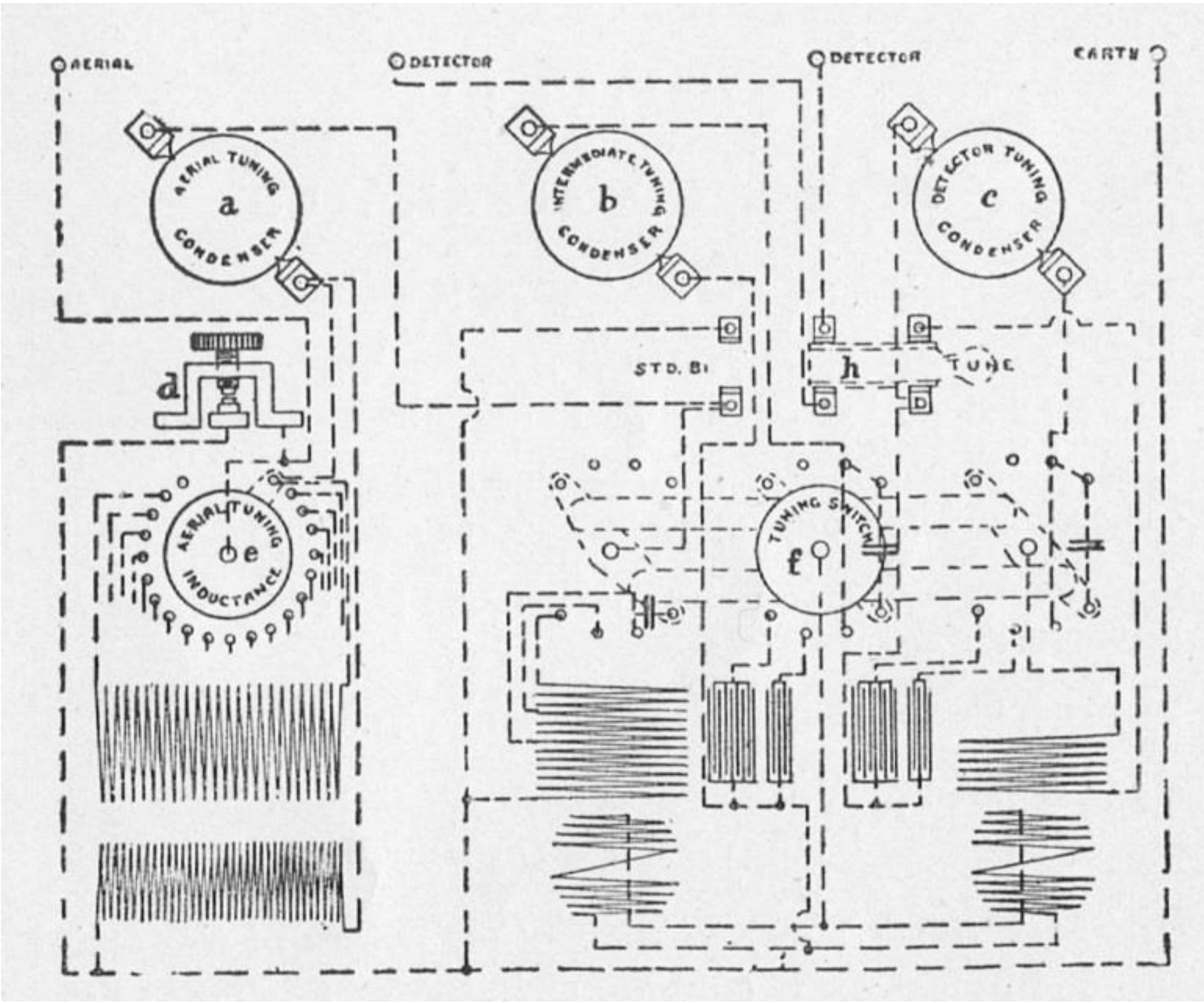
Patents Nos. 11,575 of 1897 ; 12,960 on 4 June 1907; 15,909 of 1906 ;etc.
The important 12,960 one was granted to the Marconi Wireless Telegraph Co. Ltd. AND ***Charles Samuel Franklin*** *(1879-1964). Right after his graduation in 1899 C.S. Franklin joined the Marconi where he spent his entire professional career where he made quite a number of inventions.*



This tuner was specially constructed for use with the Magnetic Detector. The wave range is 100-2,500 (3.000) metres. This range was sufficiently great to take in all wave lengths in practical use in connection with ship working. It consists of a box which is provided with three adjustable condensers and five adjustable inductance coils.



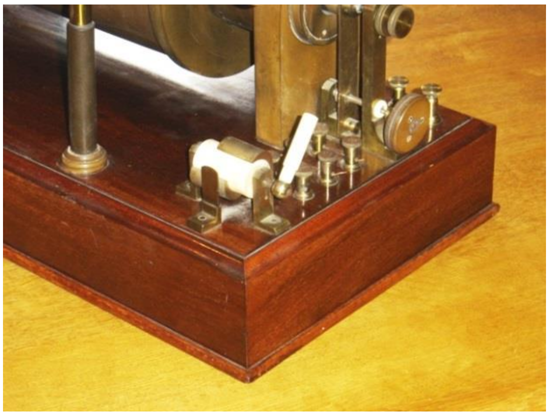
The principle: three tuned circuits



Schematic presentation with all elements and the wiring [11]

3.TRANSMITTER APPARATUS

The 10 inch induction coil (spark inductor)

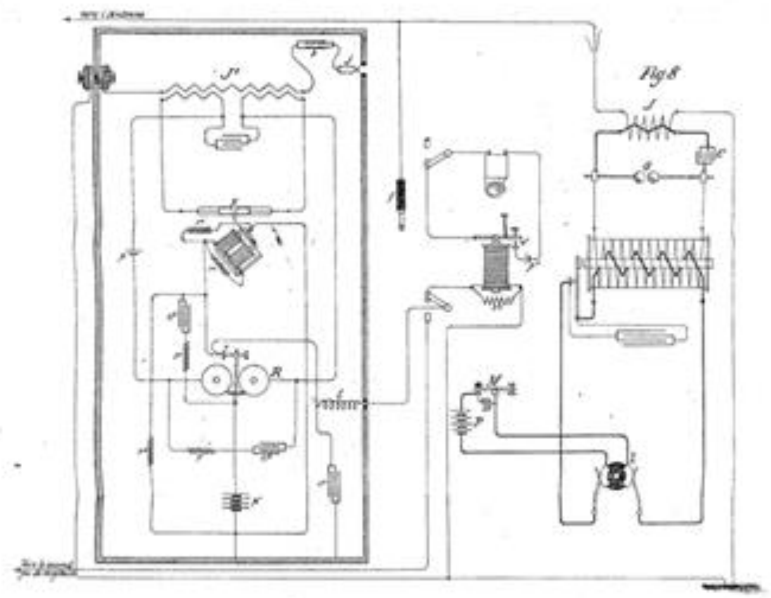


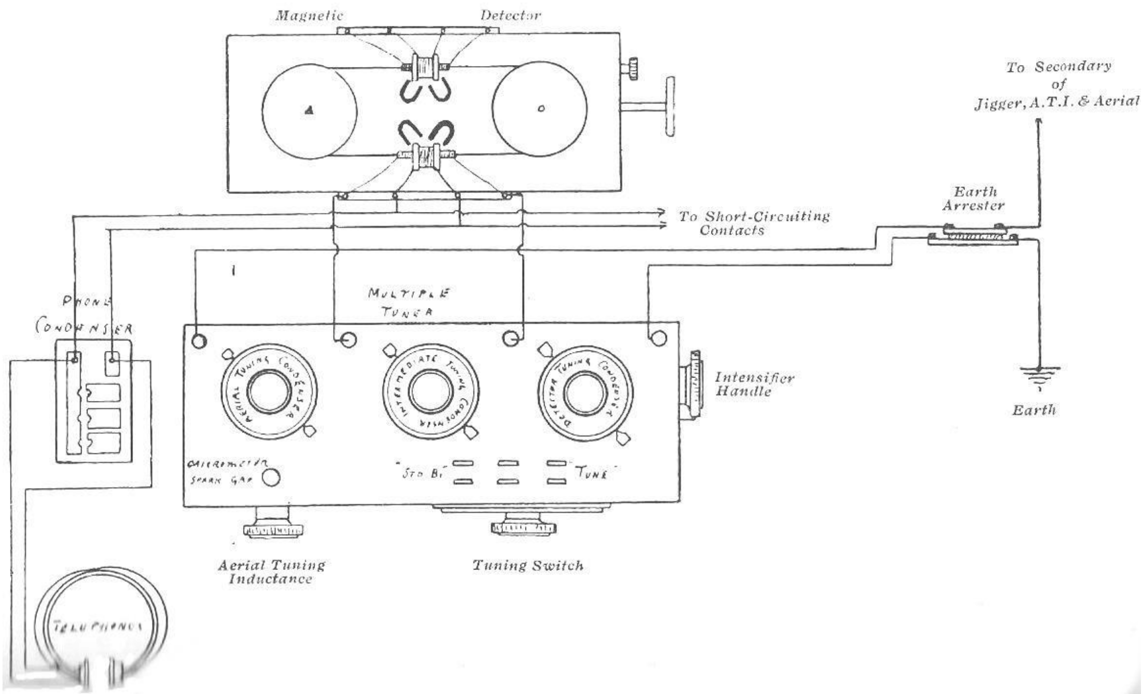
Heinrich Ruhmkorff (1803 - 1877) was a German instrument maker who commercialised the induction coil, often referred to as the Ruhmkorff coil. Although Ruhmkorff is often credited with the invention of the induction coil, it was in fact invented by Nicholas Callan in 1836 based upon the theories of **Micheal Faraday** (1791-1869). Ruhmkorff patented his first coil in 1851.

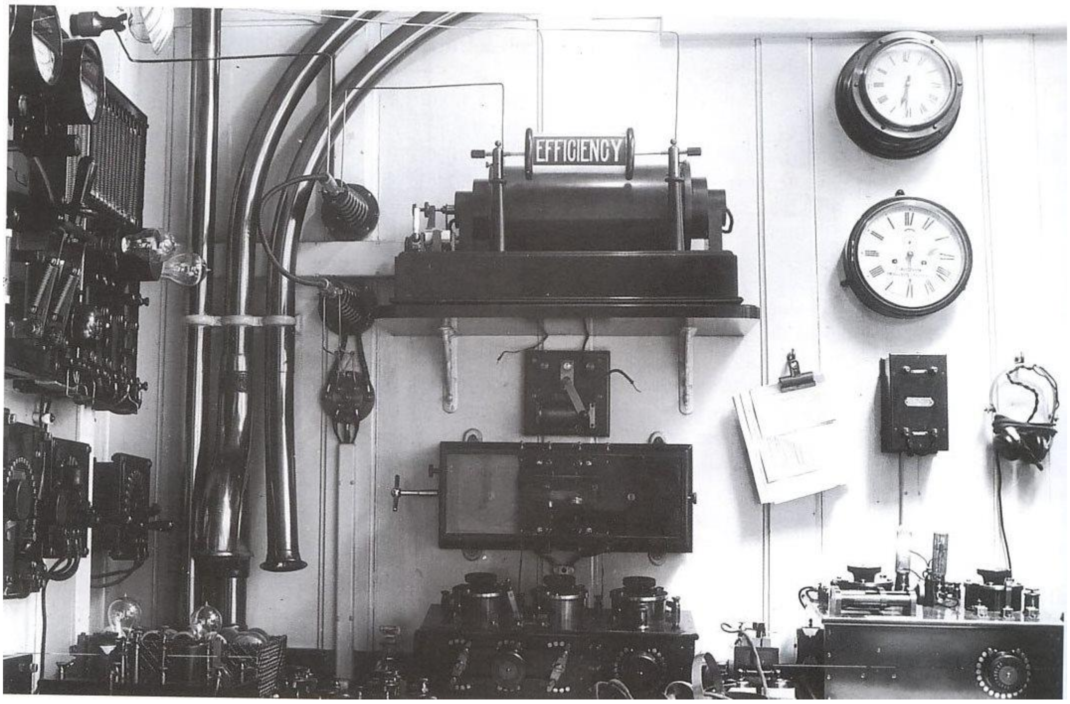
The purpose of the induction coil is to generate a very high voltage, such that it is able to create an electric spark (as done in the cylinders of the ignition engines of our cars). The principle is that of a 'transformer': there are two layers of separate windings: the primary, with a low number of windings, and the secondary, with a high number of windings. Due to the effect of the electrical induction, a voltage is generated in the secondary layer that is proportional to the ratio of the number of coils in the two layers.

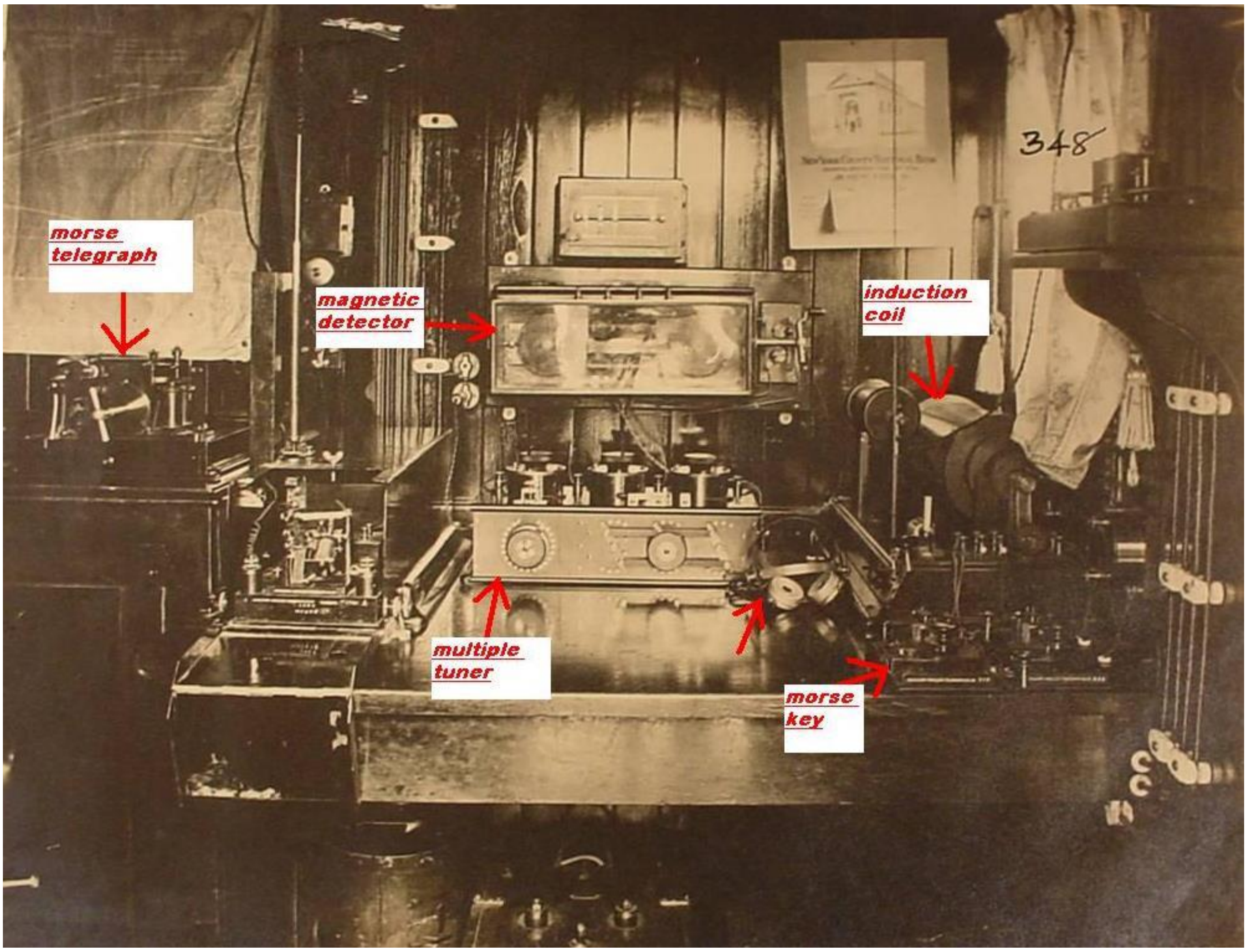
In the case of Marconi's typical coil, a very hefty electric spark of 10 inches (25 cm) - hence the name '10 inch coil'- is created. It is this spark that generates the electromagnetic radiation. The primary circuit generally consists of 360 turns of copper wire (No. 12 SWG > 0.1 mm) - and the secondary of 17 miles (!) of very thin copper wire (No. 34 SWG > 0.009 mm).

4.SOME IMAGES OF COMPLETE EARLY INSTALLATIONS






EFFICIENCY


348
morse telegraph
magnetic detector
induction coil
multiple tuner
morse key

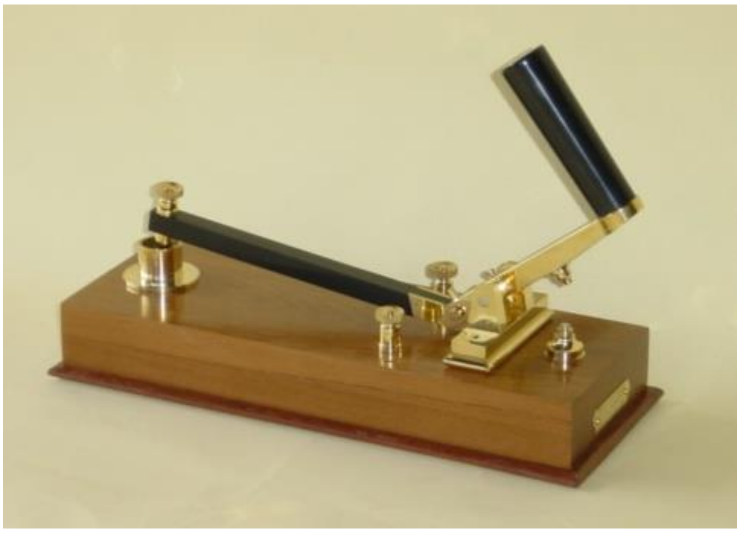
5. OTHER APPARATUS

5.1. His earliest Morse keys

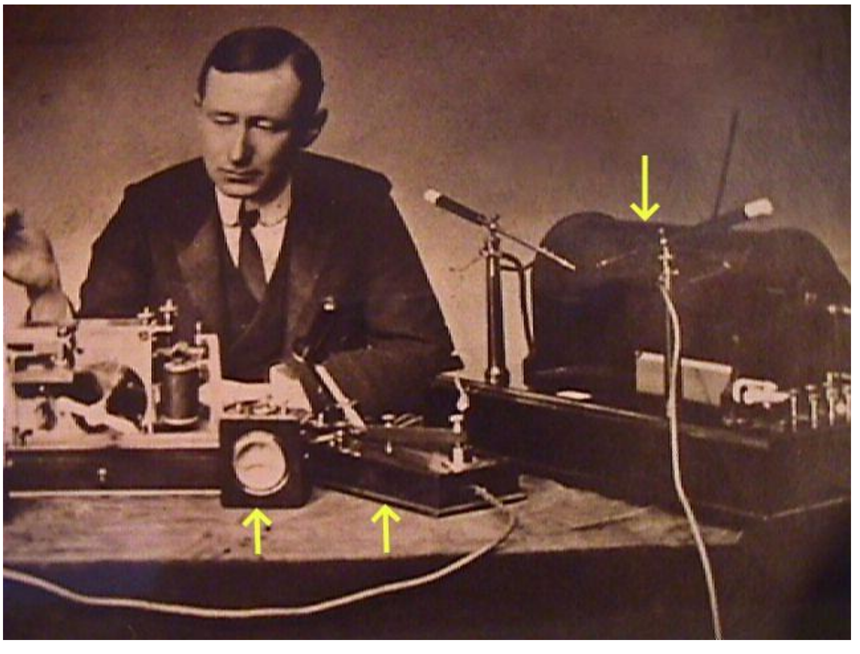
Both keys shown here are replicas, very nicely made by Phil Boyle (UK), in strict conformity with the originals from Marconi.

5.1.1. The 'Grasshopper'

Most probably his first 'official' one (1896?).



The terminal at the end of the ebonite road was connected with the aerial by means of a flexible lead. While transmitting with this key, the aerial was disconnected from the receiver, using the insulating handle (ebonite). The long arm fell into place when the key was not used for sending, thus connecting the aerial with the receiver



5.1.2. The “Guillotine” key

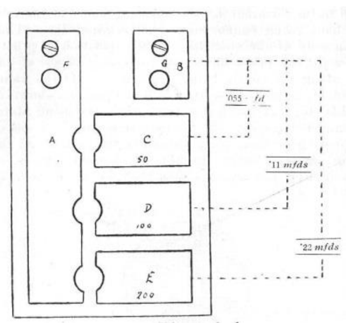
Its ‘official’ name is Side-Lever Morse Key (c. 1910). It is probably Marconi's most famous telegraph key, nicknamed the "Guillotine Key" because of the side lever, which is used to short out the receiver to protect it during transmission. Lifting the lever up would disable the keying and shut the transmitter down. The sidelever was also used to disable accidental keying when the transmitter was not in use.

5.2. Telephone transformers

Patent No. 887 of 1907
It was sometimes convenient to use low resistance headphones with crystal valve sets and for this it is necessary to insert this ‘step-down’ transformer.
It has been found in practice that the best results could be obtained when using a high-resistance telephone with the magnetic detector, and a low-resistance telephone with a crystal or valve detector. So this transformer was of particular advantage in stations where both magnetic and crystal or valve detectors were used as the marconist could use the same headphones.[5]

5.3. Telephone Condenser

Such condensers , variable in steps up to a maximum of .2 μFarads, were used for shunting low resistance telephones in receivers where the shunting capacity was not otherwise provided. It was placed in parallel with the headphones for the purpose of improving the sound of the signal It did not alter the tone of the signals but improved their quality, removing the muffled sound sometimes heard and making the morse signals clearer and more metallic. [5]



5.4. Galvanometer – at the left
and
5.5. Tuning condenser – at the right

- *The galvanometer is a simple current indicator*
- *The tuning condenser (Patent No. 15909 of 190 had ebonite for dielectric. It was constructed to have the largest possible capacity for its size: .012 µFarads*

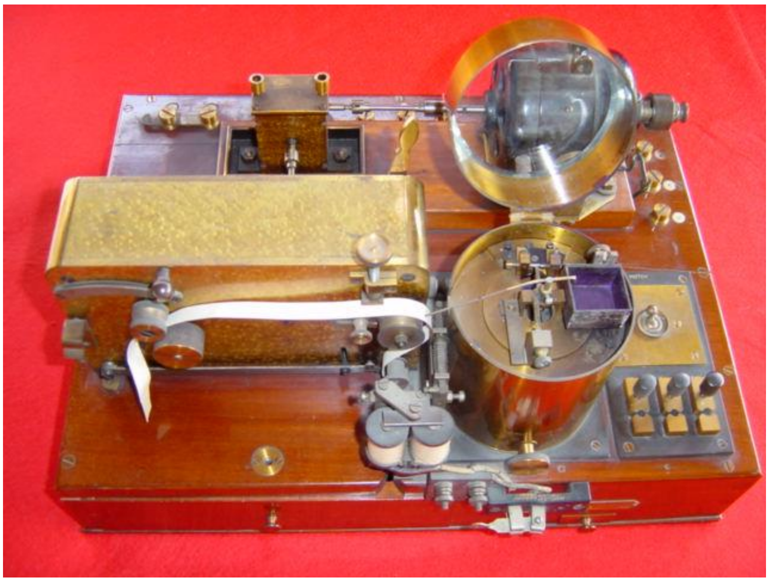
5.6.. A two valve Marconiphone A2 radio

6. APPARATUS FROM A LATER DATE

What follows are Marconi instruments of a later date and that were once part of my collection. They have nothing to do with the essence of my article (the early years of Guglielmo Marconi); I am just proud to show them…

6.1. A Marconi Siphon Recorder (undulator)

More on this special Morse receiver can be found in Chapter XX



6.2. A Marconi amplifier AGI with V24 valves

6.3. A V24 valve

The Marconi V24 valve, from about 1919, was a further development of the 'R' type aimed at improving the high frequency performance. The V24 was designed around 1919 and was used as an RF amplifier with a filament current of 0.7 Amps. The anode voltage would have been in the range 24 to 50 Volts. The ‘24’ in the V24 name being an indication of the use of standard 24 Volt supplies of the type used on board ship for lighting.© 2000-2019 Allan Wyatt; see http://www.r-type.org/index.htm).

5.4.An old tuner

6.5. A two valve Marconiphone A2 radio

PART 3: ILLUSTRATIONS

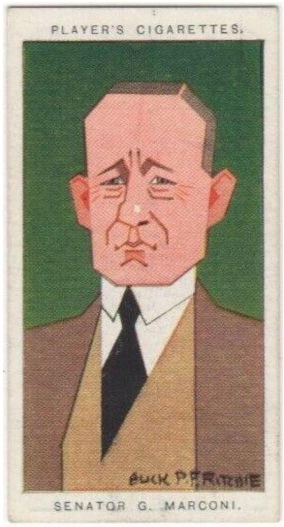
3.1. Phonecards

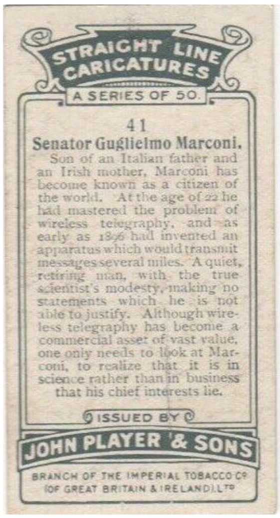
This set of seven 'Marconi' phonecards has been issued by British Telecommunications plc in 1996, 100 years after Marconi patented his system of wireless telegraphy. An historical explanation is written on the back of those cards.

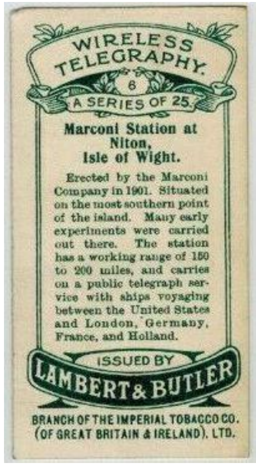
Two more phonecards; left from France, right from Venezuela

3.2. Postal stamps

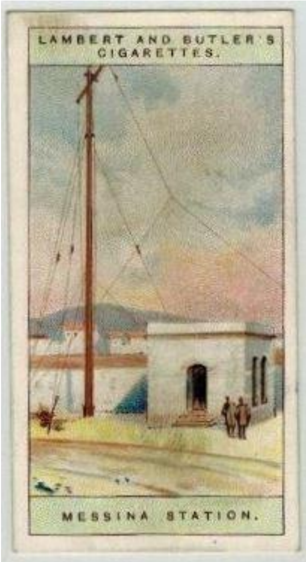
3.3. Colour-printed trade cards

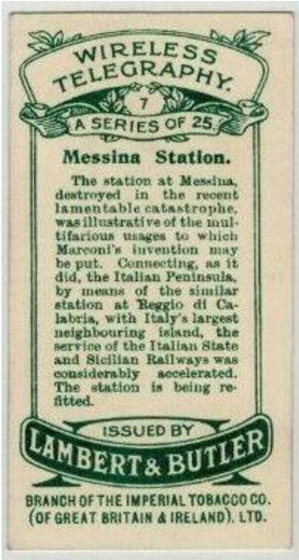






MARCONI CABIN ON BOARD A WHITE STAR LINER.

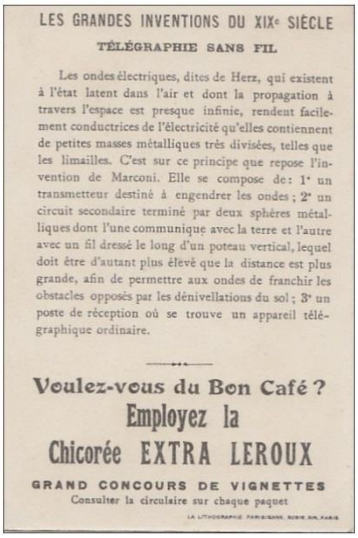



WIRELESS TELEGRAPHY.
7
A SERIES OF 25.

Messina Station.

The station at Messina, destroyed in the recent lamentable catastrophe, was illustrative of the multifarious usages to which Marconi's invention may be put. Connecting, as it did, the Italian Peninsula, by means of the similar station at Reggio di Calabria, with Italy's largest neighbouring island, the service of the Italian State and Sicilian Railways was considerably accelerated. The station is being refitted.

ISSUED BY
LAMBERT & BUTLER
BRANCH OF THE IMPERIAL TOBACCO CO. (OF GREAT BRITAIN & IRELAND), LTD.

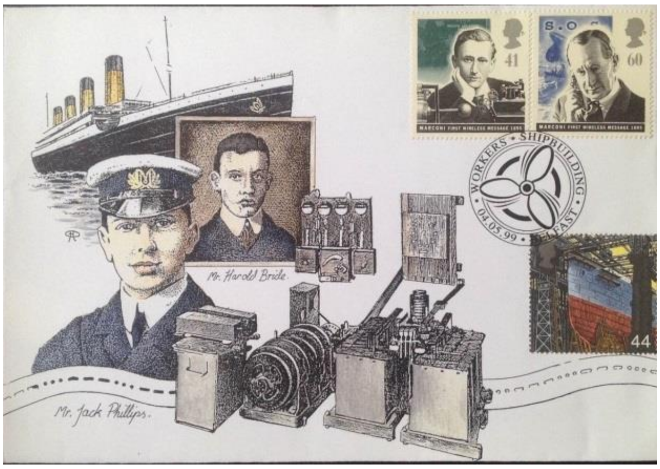

LES GRANDES INVENTIONS DU XIXe SIÈCLE

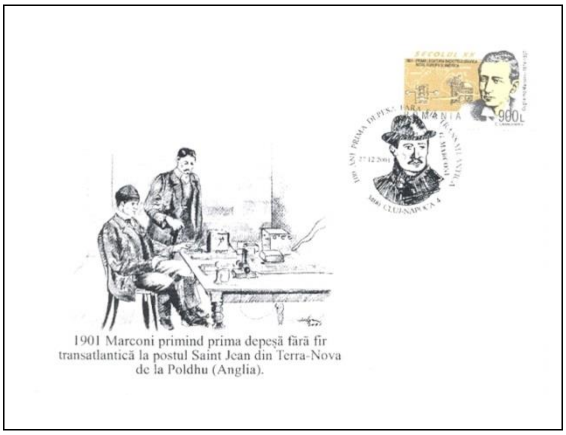
TÉLÉGRAPHIE SANS FIL

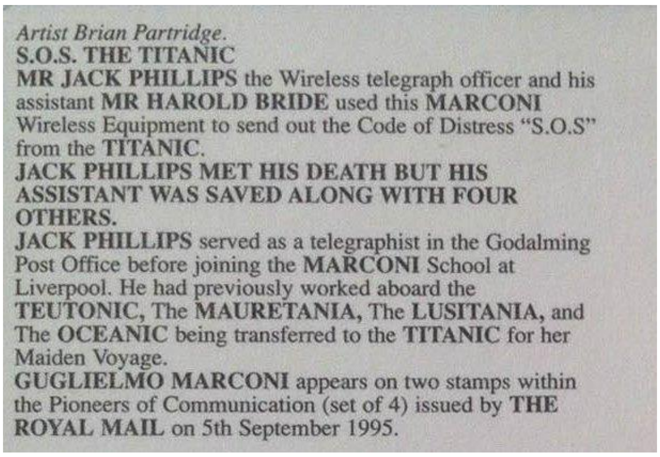
Les ondes électriques, dites de Herz, qui existent à l'état latent dans l'air et dont la propagation à travers l'espace est presque infinie, rendent facilement conductrices de l'électricité qu'elles contiennent de petites masses métalliques très divisées, telles que les limailles. C'est sur ce principe que repose l'invention de Marconi. Elle se compose de: 1° un transmetteur destiné à engendrer les ondes; 2° un circuit secondaire terminé par deux sphères métalliques dont l'une communique avec la terre et l'autre avec un fil dressé le long d'un poteau vertical, lequel doit être d'autant plus élevé que la distance est plus grande, afin de permettre aux ondes de franchir les obstacles opposés par les dénivellations du sol; 3° un poste de réception où se trouve un appareil télégraphique ordinaire.

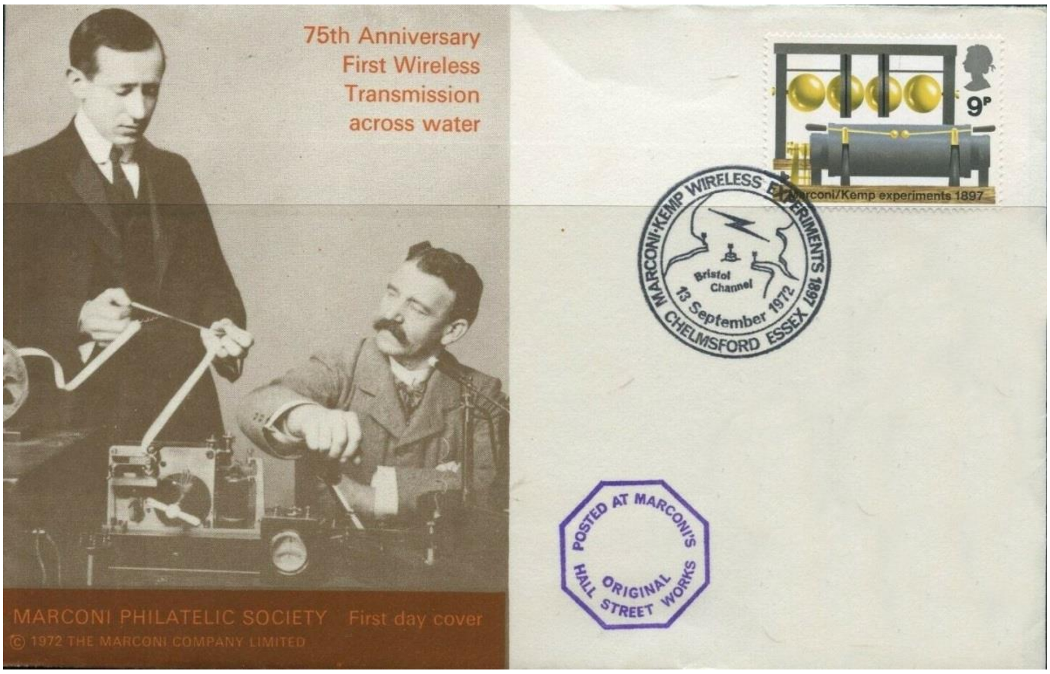
Voulez-vous du Bon Café?
Employez la
Chicorée EXTRA LEROUX
GRAND CONCOURS DE VIGNETTES
Consulter la circulaire sur chaque paquet

3.4. Postcards






Artist Brian Partridge.
S.O.S. THE TITANIC
MR JACK PHILLIPS the Wireless telegraph officer and his assistant **MR HAROLD BRIDE** used this **MARCONI** Wireless Equipment to send out the Code of Distress "S.O.S" from the **TITANIC**.
JACK PHILLIPS MET HIS DEATH BUT HIS ASSISTANT WAS SAVED ALONG WITH FOUR OTHERS.
JACK PHILLIPS served as a telegraphist in the Godalming Post Office before joining the **MARCONI** School at Liverpool. He had previously worked aboard the **TEUTONIC**, The **MAURETANIA**, The **LUSITANIA**, and The **OCEANIC** being transferred to the **TITANIC** for her Maiden Voyage.
GUGLIELMO MARCONI appears on two stamps within the Pioneers of Communication (set of 4) issued by **THE ROYAL MAIL** on 5th September 1995.



3.5. Money

500 Lira

10 Euro

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INTERNET

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(c) https://www.thoughtco.com/guglielmo-marconi-biography-4175003

(d)-https://www.latimes.com/opinion/op-ed/la-oe-raboy-marconi-technoloy-regulation-20160811-snap-story.html

(e) https://en.wikipedia.org/wiki/Alexander_Stepanovich_Popov

(f) https://en.wikipedia.org/wiki/Coherer

(g) https://www.ultra-tcs.com/uploads/downloads/Marconi_Radio_History_LV.pdf

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(j) https://debliedemaker.wordpress.com/2014/12/09/de-panne-pionier-in-het-maritiem-radioverkeer/

THANK YOU:

- My friend **Jim KREUZER** (USA), for his great article in the AWA Review vol. 9-1995; p. 7-96. Jim is a world authority regarding "Marconi" and has most probably the finest Marconi collection in the world

- **AWA,** the U.S. Antique Wireless Association for having given permission to use extracts out of Jim Kreuzer' s article in its Review vol. 9-1995; p. 7-96.

- ***Karel VERSTRINGE** (B), a long time friend (from the time that I was still collecting radios), for his reference to the Compagnie de Télégraphie sans Fil"- CTSF.

- **Seb BLOMMAERT** (NL), also a long time friend**,** who has made that splendid replica of Marconi's first standard wireless receiver.

- **John LIFTEN** (UK), Emeritus Curator of Communications at the Science Museum in London, for having allowed me and Seb to take the measurements and photographs of the Marconi's first 'commercial' receiver (see 2.1.).

- **Andrew WOOD (UK),** Founder of the UK "Communications Museum Trust" (www.communicationsmuseum.org.uk) , who has been so kind to correct my 'Flemish English'.