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WIRELESS TELEGRAPHY.

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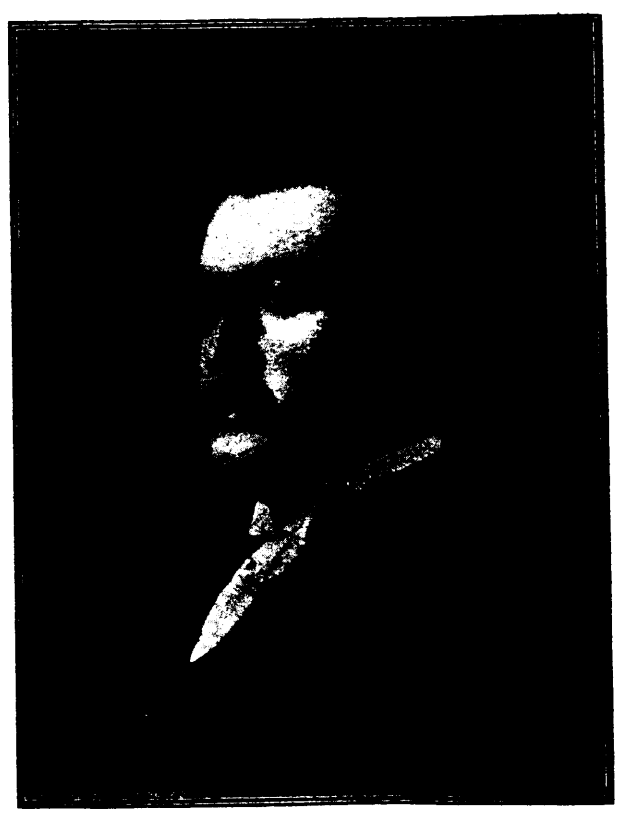
Wireless telegraphy, or the transmission of signals through space by means of electric waves, is of comparatively recent development, although the idea of the existence of electric waves dates back some 40 years. In 1868 Clark Maxwell, then Professor of Physics in Cambridge university, first published a theory showing that an intimate relation between electricity and light existed. This theory, which has received most conclusive substantiation since then by eminent physicists, is known as the electromagnetic theory. It tells us that electric waves and light waves are similar, that they represent a transfer of energy by means of the all-pervading universal ether, that they differ radically in their effect on the physical senses, in wave length and period of vibration, and that both possess the same velocity of 187,000 miles in a second. Many of the exponents of the electromagnetic theory discussed the properties of electric waves long before they were experimentally demonstrated.

Our experimental knowledge of the existence of electric waves dates from about 1880. Hertz, a German physicist, while working under the illustrious Helmholtz discovered that small sparks could be made to pass between two conductors when held near a circuit in which electric oscillations were set up. He soon discovered that this was due to the action of electric waves, and realizing how fundamental in importance this was to the thorough knowledge of the electromagnetic theory he commenced a series of experimental researches, which were of such a brilliant and productive nature as to mark them as amongst the most important investigations in the whole domain of science. A host of experimenters then followed and amongst them Signor Marconi, who has since become so closely identified with the subject.

In 1890 the coherer was discovered by Branly and simultaneously by Oliver Lodge. Lodge's coherer was a very delicate instrument and by its means the electric waves could be detected at a much greater distance than was possible with the conductors used by Hertz. In 1895 in Cambridge Mr. Rutherford, now Professor of Physics in McGill university, first showed that the waves could be observed by a magnetic detector. He discovered that a weakly magnetised steel wire becomes instantaneously demagnetised under the influence of electrical oscillations such as electric waves. With his detector he succeeded in establishing communication at half a mile.

In 1896 Marconi went from Italy to England, and with the help of a Government grant obtained through the instigation of Sir Wm. Preece, head of the English telegraph department, commenced a series of experiments in wireless communication. Very rapid strides were made, and the distance to which signals could be sent was very much increased. An important development soon followed in regard to the use of a vertical wire for transmitting the waves instead of a horizontal one which increased the distance still more. Although Marconi has come to be chiefly associated with developments in wireless telegraphy other systems have been established in various countries, which involve slight modifications in the apparatus employed. In Germany the Arco-Slaby system is used with success; and in the United States the De-Forest is being installed in many places.



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Wherever a rapidly oscillating electric current exists waves are set up in the ether. These travel out in a spherical form on all sides just as the ripples grow around the spot where a stone is dropped into quiet water. Such an oscillating current is produced when a spark passes between the metallic knobs attached to the secondary or fine wire coil of an induction coil. This oscillation produced by the sudden rush back and forth of the spark is rapidly damped and soon dies out. To increase the time of the oscillation large metal plates are connected to the knobs. The larger the plates the slower is the time of vibration and the longer the wave.

The primary circuit of the induction coil is connected with a battery of accumulators or storage cells of low voltage. These would not in themselves be sufficient to cause a spark to pass between the knobs, but by an induced action of the magnetism set up by the primary coil of the induction coil a current of very high voltage is set up in the secondary, which causes the spark and consequently the very rapid oscillations. To receive the waves and render them apparent, two metal rods are stretched for some distance. These rods terminate in knobs between which sparks are seen to pass by a passage of a current of electricity collected from the waves which impinge on the rods. Hence, whenever sparks are produced in the transmitter, as the source of electric waves may now be called, sparks of much smaller intensity are seen to pass between the knobs of the receiver. The farther away the receiver is placed the smaller the sparks between the knobs.

To detect the waves at great distances, instead of the spark gap between the metal rods, the coherer or magnetic detector must be inserted. The coherer depends in principle on the discovery of Branly and Lodge that a fine metal powder becomes a good conductor for electricity when under the influence of electric waves. When attached to a storage battery only a feeble current can find its way through the poorly conducting metal powder of the coherer, but as soon as a wave is received the resistance is enormously diminished and a stronger current passes which is sufficient to operate a telegraphic relay. This relay brings a second and more powerful battery into play which operates a telegraph sounder or electric bell. In order to produce the telegraphic code it is necessary to produce an immediate decohering of the metal powder after the waves have ceased. This decohering may be produced by the direct action of the trembling hammer of the electric bell or by other mechanical devices. By a long continued stream of sparks from the