How Broadcasting Grew from an Idea

Story of Radio from Maxwell to To-day

Told by
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IT is indeed difficult to get a true perspective of the history of broadcasting, for the science, as we know it, is only a few years old. To go right to the fundamentals would take us very far back in history, back perhaps, to 600 B.C., when the magnetic effects of the lodestone were discovered. We cannot speak of the work of Faraday, of Volta and Ampere, whose researches in electricity made radio possible, but we must start with James Clerk Maxwell, the greatest theoretical physicist, Newton excepted.

Maxwell was a brilliant Cambridge mathematician, and was able to formulate a mathematical theory of the inner relations of magnetism and electricity. Maxwell likened electricity to an immaterial fluid pervading all space, and in 1865 deduced the possibility of electrical waves in space travelling onward in all directions from any electrical or magnetic disturbances, and was even able to calculate the travel rate of these waves, pointing out the remarkable fact that it coincided with that of light.

The full experimental proof of the acceptance of Maxwell's mathematically demonstrated waves did not come for 20 years, although during that time an Englishman came very near to a working system of broadcasting.

This was Professor David Hughes, who, in a series of experiments between 1879 and 1886, actually listened on a microphone of his own invention to waves that were generated as far distant as 500 yards.

Hughes was a familiar figure crouching about the London streets, bending over his telephone listening for the precious sounds. But he did not receive encouragement, and all his work went for naught. It has taken years to realise the value of his work. Of him Sir Oliver Lodge says:

"He was a man who thought with his fingers, and who worked with the simplest home-made apparatus—made of wood and metal, stuck with cobbler's wax and sealing wax. Such a man, constantly working, is sure to come upon phenomena inexplicable by orthodox science, and orthodox science is usually, too, ready to turn up its nose at phenomena which it does not understand and so thinks it simplest not to believe in."

And orthodox science turned up its nose at Hughes's work and he directed his creative brain to more profitable channels.

BUT Maxwell's astounding statements were not to go unchallenged, and to prove or disprove these theories the German scientist Hertz crossed over to England and commenced the first real researches in wireless telegraphy.

Hertz constructed a coil which fed high voltage surges to two balls of metal and, at a distance of some 20 or 30 feet was able, through the medium of a bent wire, to get a spark moving in resonance with the current in the balls.

This was the first oscillator, and it proved Clerk Maxwell's theory, but Hertz's discovery, limited though it was as far as voice transmission was concerned, enabled the use of the code of dots and dashes introduced earlier by Samuel Morse. Hertz did not know of Hughes's microphone, but did know the apparatus was unsuitable for commercial work, so he left the field of wireless. He had done enough to show scientists that radio transmission was possible.

Shortly afterwards, in 1891, Brandley, a Frenchman, invented the coherer—an instrument which detected the presence of wireless waves, though probably he did not then realise that the effect was produced by the waves which Hertz had discovered, a few years previously. Lodge, however, grasped the significance of Brandley's work, and in 1894 he repeated all Hertz's experiments with a Brandley coherer as detector, and signalled by wireless over distances of up to 150 yards. He also introduced the tuning coil by which stations can be separated.

AND now we come to Marconi, the father of radio, but before him we must mention Preece, the English telegraphist who, in 1892, transmitted speech across the Bristol Channel, but not on the Hertzian wave. When Marconi, the brilliant young experimenter, came to English shores it was Preece who introduced him to the English Post Office, and assured his footing in England. By doing this he was signing the death warrant of his own invention, for Marconi was only 15 when Hertz published the results of his experiments.

The accompanying account is, in the main, the reproduction of a talk broadcast from 2YA on Saturday last by our Technical and Associate Editor.

"I could scarcely conceive," he says, "that it was possible that their application to useful purposes could have escaped the notice of eminent scientists."

The boy had seen in a flash what remained unseen to all those great scientists who had been working on the fringe of the subject for several years. As Sir William Preece said: "They all knew the egg, but Marconi showed them how to make it stand on end."

Marconi, using part of the Hertzian generator, hooked up to an aerial, and a coherer for detector, developed a system which later was used to transmit the Morse code from England to France. This was in 1899, and in December 1901, just about 29 years ago, Marconi set out to accomplish his dream to conquer the Atlantic. He had built at Poldhu, in Cornwall, a powerful wireless station. The antenna system was supported by a ring of 20 wooden masts, each 200 feet high, for he had found out that the higher the mast the greater the distance that messages could be transmitted. 2YA's masts are 154 feet, so you can see that it was really a big undertaking at that time. A similar station was erected at Cape Cod, in Massachusetts, but the unforseen happened. Storms swept both stations and destroyed the aerial systems. The inventor was not to be sidestepped by an accident, and he decided to make a preliminary test with a much more simple aerial.

On November 26, 1901, Marconi and his two assistants sailed for Cape Cod on the greatest adventure of their lives. The morning of December 12—that set aside for the great experiment—broke cold and rough. With the aerial system destroyed, a kite, carrying an aerial wire some 400 feet long, was flown in a raging gale, and at the appointed time the operators strained for the first signal to cross the Atlantic. It was arranged that this should take the form of the letter "S"—three dots. We will let Marconi relate his own version of what happened. "Suddenly, at about half-past two, a succession of three faint clicks on the telephone sounded several times in my ear beyond the possibility of a doubt. I asked my assistant for corroboration, and he replied that he had heard the same signal.

"I knew then I had been justified in my anticipation, and that the enormous distance of 1700 miles had been bridged by radio. They had been unimpeded by the curvature of the earth, which so many considered to be a fatal obstacle, and they were now audible in my receiver in Newfoundland."

This ended the first chapter in the Romance of Radio. The Atlantic had been bridged. Now voices traverse the world, and a conference in London can be heard on a crystal set in New Zealand.

Speech Transmission.

BEFORE wireless could be made commercially possible the relatively insensitive detector must be improved. However, although Sir Ernest Rutherford, the eminent New Zealand scientist, and Marconi each invented a detector, no serious advance was made until the crystal detector was developed by two Americans in 1906. Speech, however, could not yet be transmitted, and attention was concentrated on it. Fessenden, of America, was the first to achieve substantial success, and in 1900 he used an alternator for transmitting wireless telephone messages in Maryland, over a distance of a mile. In 1906 he had greatly increased the range of working and he even spanned the Atlantic, being heard at a station in Scotland. In 1908 he was working on a practical wireless telephone circuit over a distance of 400 miles. Another device for transmitting speech was the Polsen Arc, invented in 1903, and used until 1925.

The Valve.

IN the early 'eighties of last century Edison noticed that when electric lamps burnt out the glass bulbs became blackened. In investigating this phenomenon Sir Ambrose Fleming, an Englishman, found the space between the hot carbon filament and a metal cylinder in a vacuum would pass current more readily in one direction than in the other.

In other words, detection could be carried out as it was with the crystal.

This was the next great advance in radio, and filled in the gap left by Marconi. Two years later, in 1906, Dr. Lee de Forest introduced a third electrode in the form of a perforated metal plate or grid.

It was the addition of the third electrode or "grid" intermediate between thet other two which converted the valve into the marvellous instrument as we now have it.

For the invention of the three electrode valve, Dr. Lee de Forest, of New York, deserves well to stand in the ranks of the world's greatest inventors. For the addition of this third electrode, combined with a local battery to drive a stream of electrons from hot filament to plate through the intervening "grid" not merely enables the valve to function as an efficient converter of high frequency electrical oscillations into direct currents of proportional strength; it permits it also to function as a "relay," infinitely surpassing the delicacy of control and faithfulness of reproduction the finest mechanical relay ever yet constructed. (*Concluded on page* 28.)