Seat of a Famous 1901 Wireless Experiment

It was in this tower that the first wireless signals (the letter "S" in quick succession) were received across the Atlantic. Photograph, posed just after the completion of the test, shows Marconi, standing on the steps of the tower with his two assistants, Messrs. Paget and Kemp; tower keeper at lower right

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Thirty-Seven Years of Radio Progress

The development of wireless telegraphy and telephony, from its inception as a revolutionary theory to the perfection of present-day radio broadcasting; an important and historical outline of radio progress from the lips of——

Senatore Guglielmo Marconi

IT can truly be said that the seed from which wireless has sprung was the discovery made by Michael Faraday, 100 years ago, that it was not necessary for two electrical circuits to be in actual physical contact in order that electrical energy might pass across the small space between them. This great discovery was followed by the magnetic theory of Clark Maxwell, published in 1865, in which he visualized the existence of electrical waves in space, of which experimental proof was given by Heinrich Hertz in 1888.

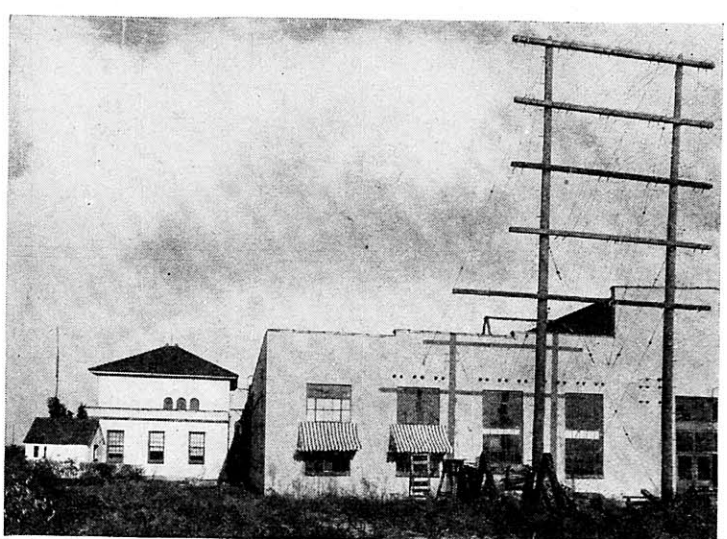
In 1895 I commenced my own researches, with the express intention of utilizing electric waves for telegraphing across considerable distances and succeeded at that early date in transmitting and receiving intelligible telegraphic signals, across space, over distances of about one and three-quarter miles.

These first tests were soon followed by more important improvements and by new discoveries such as that of the enormous distance over which these waves traveled and were detected, notwithstanding the intervening curvature of the earth, which discovery enabled scientific investigators subsequently to learn something new about the constitution and condition of the atmosphere at great heights, thus opening up vast and fertile fields of useful research which have lately allowed us to scrutinize still more effectively some of the mysteries left up in the strata which surrounds the earth.

The beginnings of telephony, as we know, whether operated by line or radio waves, naturally date from the invention of the electro-magnetic telephone receiver and the carbon microphone. This takes us back to the days before Hertz, actually to the time of Maxwell, for it was in 1861 that Philip Reiss, of Germany, using a primitive form of electro-magnetic receiver, with an imperfect electric contact, obtained, by means of instruments connected together by wires, the first experimental result that was ever recorded.

From 1871 to 1874 Elisha Gray, among others, took out patents for the apparatus which was built to transmit speech, though not very perfectly. But it was Alexander Graham Bell, in 1876, who evolved the first practical form of telephony. This was later modified for commercial use, employing a magnetic speech cone on one end and an iron diaphragm which was given the well-known bell shape associated with his name. Many of the present-day desk telephone receivers retain this shape but a horseshoe magnet is used instead of a bar magnet.

For the microphone, which was invented two years later, we are indebted to Professor Howes and Thomas A. Edison, for their discoveries in this field made public in the same year, that is, in 1878. From that time the telephone commenced its conquests of communication and later speech was transmitted by submarine cables across narrow channels. But there, for the time being, developments stopped.



R. C. A. Photo

THIRTY YEARS AGO—AND TODAY

The little shed at the left is the first commercial wireless station built by Marconi in the United States. It is now completely overshadowed by the new buildings and antennas of the modern transatlantic station at Rocky Point, L. I.

MARCONI AND BRAIN-CHILD

An early photograph of the inventor of wireless and one of his first receivers set up for the long-distance test

That was the position in 1900 when Professor Fessenden made a first attempt to transmit speech through space by electric waves and was able to effect some sort of communication over a distance of one mile. As is well known, the speech currents are formed and superimposed on a high-frequency wave which must be unbroken. Transmission by the induction coil and interrupter of that day, although quite practical in radio for telegraph work, was impossible with the telephone because the dead intervals between sparks was quite unsuitable for telephony. To approach the required condition of carrier current, Professor Fessenden endeavored to make the waves more continuous and overlapping by increasing the number of sparks to 10,000 per second, and he obtained some measure of success.

By the year 1902, a distance of twenty miles had been covered, and then in 1906 Professor Fessenden made a real advance by employing for the first time the high-frequency alternator which gave him a useful carrier wave of 20,000 cycles per second. This enabled him in the following year to transmit speech a distance of about two hundred miles.

First Transatlantic Wireless

It is interesting to note here the development of wireless telegraphy during this period. In December, 1901, I was able for the first time, by means of stations especially constructed for that purpose, to transmit and receive telegraphic signals across the Atlantic Ocean to St. John's, Newfoundland, a distance of about 1800 miles, thus discovering that really big distances were possible because the electrical waves follow the earth's curvature around the globe.

Early in 1902, during a voyage on an American liner going to New York, I was able to receive, from Poldhu, signals at nighttime, although during the day the transmission range fell to 700 miles. I was therefore enabled to discover the now well-known fact that signals transmitted by wavelengths of a few hundred meters can be received over much greater distances by night than during the hours of daylight.

On my subsequent voyage to the United States on the *S. S. Laconia*, during the following year, news messages were received by wireless daily. This is worthy of note because the results were so successful that a number of other ships were fitted with long-distance receiving apparatus and a wireless broadcast news service was officially opened in 1904. This telegraphic news service has continued without a break up to the present time. The broadcasts during the War were, of course, of an official nature only, but the news broadcasts were resumed immediately after the war. Poldhu continued to send out news until May, 1922, when the telegraphic broadcasts were taken over by Clifton.

It was about 1906 that my company put up a proposal to the British Post Office that they should be allowed to broadcast news to all newspapers in the country. However, this was not agreed to at the time.

While I was personally very much occupied in improving my transatlantic stations at Clifton and Glace Bay, Captain A. H. Round, one of my associates, had a small transmitter working near the Battery in New York City, from which speech and phonograph records were transmitted to the Times Building and liners in their docks.

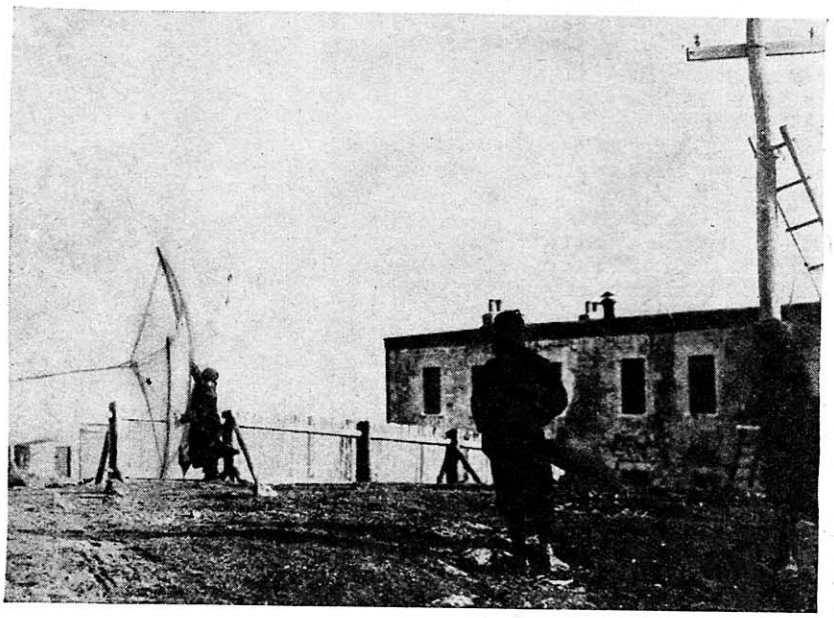
Senatore and Lady Marconi on their private yacht Electra when they inspected "beam stations

"ON BOARD"

There were, of course, at that time, no amplifying tubes and the rectifier was connected to the aerial circuit. In order to utilize the power in the aerial, microphones were required. Among the best of these were the liquid microphones. With these transmitters, in 1908, messages were transmitted from Rome to Sicily, a distance of 300 miles, and finally in 1912 communication was made from Rome to Tripoli, a distance of 600 miles.

The invention of the Fleming tube in 1904 and the three-electrode tube of Lee De Forest in 1907 enabled the disability, which had delayed the commercial development of wireless telephony, to be removed. As was to be expected with a new system, the early results were obtained working over short distances.

It was in June, 1913, that Dr. Meisner employed the oscillating tube as a carrier wave generator for transmitting speech a distance of 23 miles. My first tests (*Continued on page* 608)



THE KITE THAT PICKED UP EUROPE

One of Marconi's assistants at St. John's, Newfoundland, releasing the kite that carried the receiving antenna used to receive the "S" signals across the Atlantic from Poldhu. Marconi is seen in the foreground

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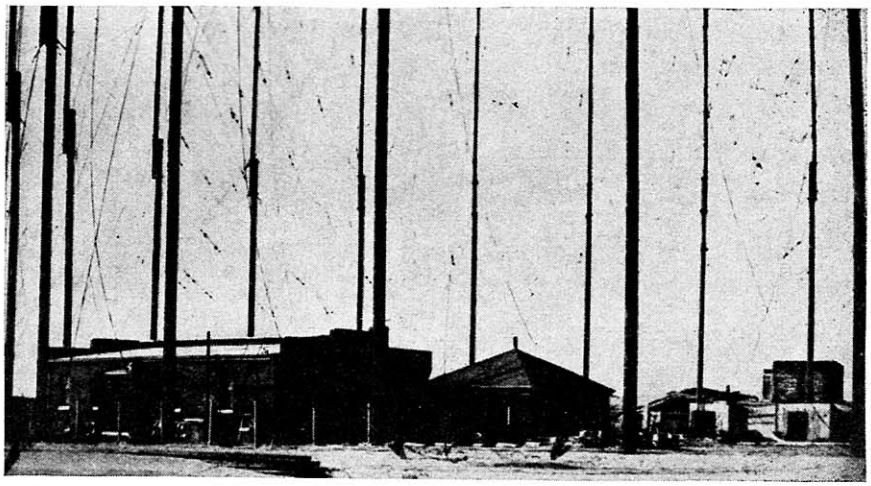
of the tube generator were made in the following year. In March, 1914, I had the apparatus installed on an Italian warship, in Sicily, and speech was received on a second vessel. The two ships steamed out to the high seas for further tests off the Sicilian coast and consistently perfect reception was registered over a distance of 35 kilometers, a distance subsequently increased to 70 kilometers, with a very limited power. Communication was constantly maintained throughout a period of twelve hours. The experiments were entirely satisfactory when signals were transmitted entirely over the sea, and also when land intervened. One complete wireless installation was sent to New York and communication was established between New York and Philadelphia by telephone, working both ways.

At the outbreak of the War, experiments in wireless telephony were discontinued commercially and were carried out only in connection with the military forces as far as this country was concerned. But in America, commercial research continued and in 1915 the American Telephone and Telegraph Company, working in conjunction with the Western Electric Company, succeeded, when conditions were favorable, in transmitting speech from the United States Naval Station at Arlington to the Eiffel Tower station in Paris, a distance of 3800 miles. On this occasion over 300 valves (or tubes) were used in the oscillator and modulator circuits.

At the conclusion of the war it became possible for European countries to resume their tests and in March, 1919, with the object of demonstrating that transatlantic telephone could be achieved, and using comparatively small power, one-way communication was established and satisfactorily maintained for ten days with Lewisburg in Canada, from my station in Ireland, using a tube transmitter with only two and a half kilowatts output from the generator, a wavelength of 2800 meters and an aerial 500 feet in height.

In the same year, my assistant, Mr. Franklin, carried out a short-wave telephony beam test on very short wavelengths, a wavelength of 15 meters, across the English Sea, a distance of 80 miles. Work on this wavelength was carried in 1921 when two-way telephone communication was established between Hampden and Birmingham, a distance of 97 miles, in which case, however, a series of projectors were used.

Then, in 1921, following the successful tests of telephony on 100-meter waves between Chelmsford and Southend, stations were erected using only 1 kilowatt of energy in the aerial circuit. In Norway, good quality telephony was received from these stations both at night and during the day. At Oslo, a distance of 700 miles, very loud and constant signals were received all night, but the day reception was variable and uncertain.



ANTENNAS OF FIRST TRANSATLANTIC STATION

The complicated system of wood masts and the station buildings of the Poldhu transmitter, heard by Marconi in America

The year 1920 is memorable for a number of important wireless-telephone transmissions which had both news and entertainment value and that had the same characteristics that broadcasting has today. To encourage public interest, demonstrations were given to show that no special skill was required to talk into the telephone and that musical programs could be transmitted and satisfactorily received with ease. But in the summer of 1920 a program of vocal and instrumental music for two half-hour periods each day, for a fortnight, was broadcast from the Chelmsford station, using about five kilowatts in the aerial and the same wavelength of 2800 meters, which was the same wavelength being employed by Poldhu for the news flashes. This was in order to test the range of the transmitter. Amateurs and shipping companies were advised to send in reports. World-wide interest was aroused by this program of broadcast concerts and good reception was reported as far away as Persia and Canada.

In November, 1920, the Westinghouse

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(*Continued from page* 608)

Company of America, having given due notice beforehand, broadcast the returns of President Harding's election from their Pittsburg station. Many thousands of people were ready with radio receivers when the results came through. They were thus enabled to anticipate the newspapers and this caused a great sensation.

During the year 1921 amateur and commercial interests in the United States erected broadcast stations in considerable numbers and the public demand for receivers grew at an extremely rapid rate, resulting later in the enormous development of broadcasting in the United States.

At one time it was a stock argument against the use of wireless that messages sent by this means could be picked up in all directions. This characteristic, however, has made it an ideal method for communication with moving objects, such as ships at sea or airplanes in flight. With the advent of broadcasting, this radiation has become a most valuable feature. There are, however, many services for which a more confined channel has distinct advantages and this requirement, I am able to say, is effectively met by the beam system, by means of which signals can be concentrated and directed in any desired direction and the power necessary reduced to a minimum. Directional or beam wireless transmission has made world-wide telephony possible and today we can speak to our friends at the ends of the earth, on ships at sea or wherever they may be and recognize the pleasure of personal contact with the familiar intonations of their voice.

On May 30, 1925, I was able to speak, direct, from here to Sydney, thus conveying intelligible speech from England to Australia for the first time, and last year, when aboard my yacht, *Electra,* in the Mediterranean (you can imagine one of our small ships with its wireless-telephone installation), whenever I wished to do so, I could talk to friends in Australia, over a distance of 9000 miles. I also spoke to others in London, Buenos Aires, Rio, New York, Montreal and Capetown, a range covering practically the whole world.

The great need of the present day is for a better understanding between men and nations, and this understanding can be fostered and helped by improvements in our communications. The most direct and satisfying means of communication between men is the spoken word, and in this respect broadcast telephony occupies a unique position as being the most potent means that the world has ever known.

I am happy if by any efforts of mine I have been able to make some contribution toward international sympathy and understanding.

Note: From a talk by Senatore Marconi, in London, during the Faraday Centennial exercises, transmitted to America by the British Broadcasting Co. and rebroadcast by the Columbia and National Broadcasting Co. systems.

Reducing Noise in Talking Pictures

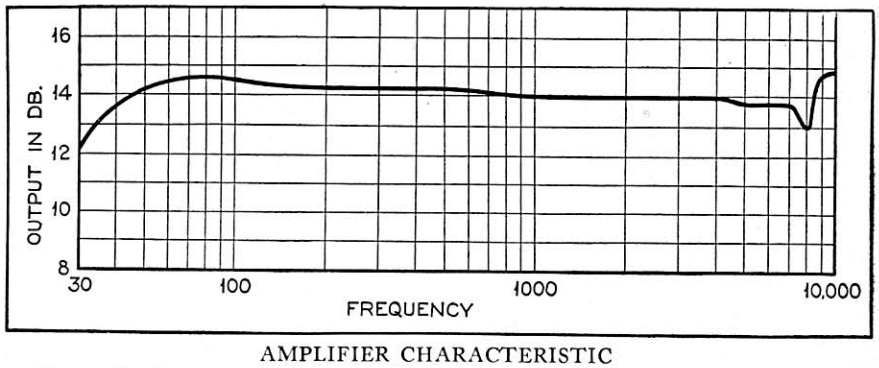
(*Continued from page* 570)

form which allows it to be used either as a portable unit or to be incorporated into standard recording channel racks. The external supply voltages necessary are 6 and 90 volts.

Figure 10 shows the shutter as it is used with the cover in place. A rear view of the shutter control unit with the dust cover removed is shown in Figure 11. Figure 12 shows the unit as it is used when mounted on a rack.

With a "zero modulation" track width of 5 mils. on a print of the usual density an actual reduction in "noise" of 12 db. may be obtained in practice. With a smaller width of track and an increased density this figure may be made larger if desired.

Figure 13 shows an actual speech syllable recorded with "noise reduction" equipment of this type. Note the narrow width of clear portion before the sound starts (at the left) the widening of this portion during the period of maximum amplitude of the sound, and the slow closing of the track as the sound intensity decreases until the clear portion is once more a 5 mil. strip, as at the start.



AMPLIFIER CHARACTERISTIC

Figure 9. Frequency response curve of the amplifier in db. up to 10,000 cycles