

Telephone History

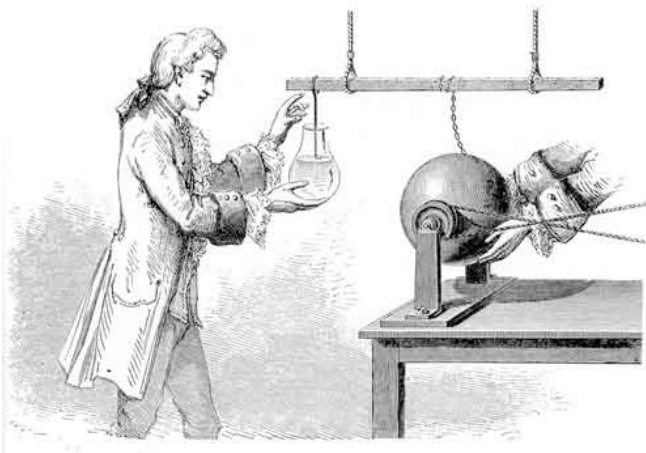
The story of the telephone is the story of invention itself. Bell developed new and original ideas but did so by building on older ideas and developments. Bell succeeded specifically because he understood acoustics, the study of sound, and something about electricity. Other inventors knew electricity well but little of acoustics. The telephone is a shared accomplishment among many pioneers, therefore, although the credit and rewards were not shared equally. That, too, is often the story of invention.

Telephone comes from the Greek word tele, meaning from afar, and phone, meaning voice or voiced sound. Generally, a telephone is any device which conveys sound over a distance. A string telephone, a megaphone, or a speaking tube might be considered telephonic instruments but for our purposes they are not telephones. These transmit sound mechanically and not electrically. Speech is sound in motion. Talking produces acoustic pressure. Speaking into the can of a string telephone, for example, makes the line vibrate, causing sound waves to travel from one end of the stretched line to the other. A telephone by comparison, reproduces sound by electrical means. What the Victorians called "talking by lightning."

Telephone history begins, perhaps, at the start of human history. Humans have always wanted to communicate from afar. People have used smoke signals, mirrors, drums, carrier pigeons and semaphores to get a message from one point to another.

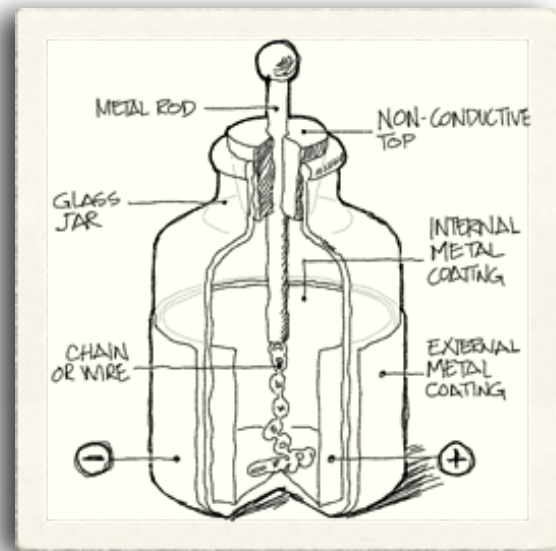
Early Telephone Development

In 1729 English chemist Stephen Gray transmitted electricity over a wire. He sent charges nearly 300 feet over brass wire and moistened thread. An electrostatic generator powered his experiments, one charge at a time. A few years later, Dutchman Pieter



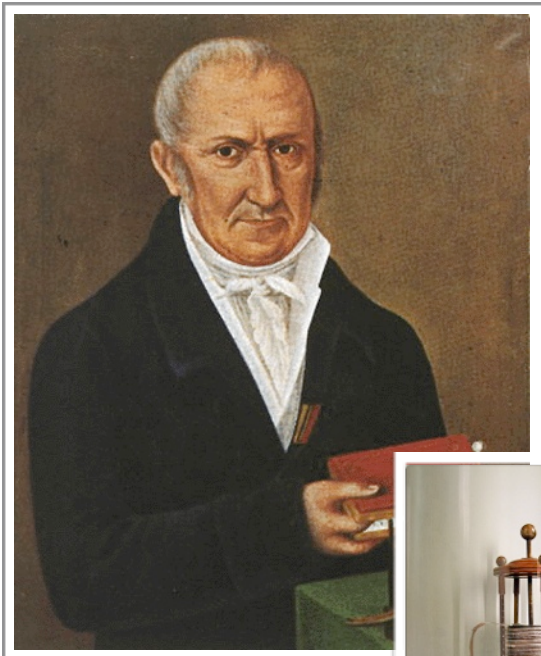
The Leyden Jar demonstrated

van Musschenbroek and German Ewald Georg von Kleist in 1746 independently developed the Leyden jar, a sort of battery or condenser for storing static electricity. Named for its Holland city of invention, the jar was a glass bottle lined inside and out with tin or lead. The glass sandwiched between the metal sheets stored electricity; a strong charge could be kept for a few days and transported. Over the years these jars were used in countless experiments, lectures, and demonstrations.



In 1753 an anonymous writer, possibly physician Charles Morrison, suggested in *The Scot's Magazine* that electricity might transmit messages. He thought up a scheme using separate wires to represent each letter. An electrostatic generator, he posited, could electrify each line in turn, attracting a bit of paper by static charge on the other end. By noting which paper letters were attracted one might spell out a message. Needing wires by the dozen, signals got transmitted a mile or two. People labored with telegraphs like this for many decades. Experiments continued slowly until 1800. Many inventors worked alone, misunderstood earlier discoveries, or spent time producing results already achieved. Poor equipment didn't help either. Balky electrostatic generators produced static electricity by friction, often by spinning leather against glass. And while static electricity could make hair stand on end or throw sparks, it couldn't provide the energy to do truly useful things. Inventors and industry needed a reliable and continuous current.

In 1800 Alessandro Volta produced the first battery. A major development, Volta's battery provided sustained low powered electric current at high cost.



Alessandro Volta and his battery

Chemically based, as all batteries are, the battery improved quickly and became the electrical source for further experimenting. But while batteries got more reliable, they still couldn't produce the power needed to work machinery, light cities, or provide heat. And although batteries would work telegraph and telephone systems, and still do, transmitting speech required understanding two related elements, namely, electricity and magnetism.

In 1821 Michael Faraday got a weak current to flow in a wire revolving around a permanent magnet. In other words, a magnetic field caused or induced an electric current to flow in a nearby wire. In so doing, Faraday had built the world's first electric generator. Mechanical energy could now be converted to electrical energy.

Faraday worked through different electrical problems in the next ten years, eventually publishing his results on induction in 1831. By that year many people were producing electrical dynamos. But electromagnetism still needed understanding. Someone had to show how to use it for communicating.

In a stunning demonstration in his Albany Academy classroom, Professor Joseph Henry created the forerunner of the telegraph. In the demonstration, Henry first built an electromagnet by winding an

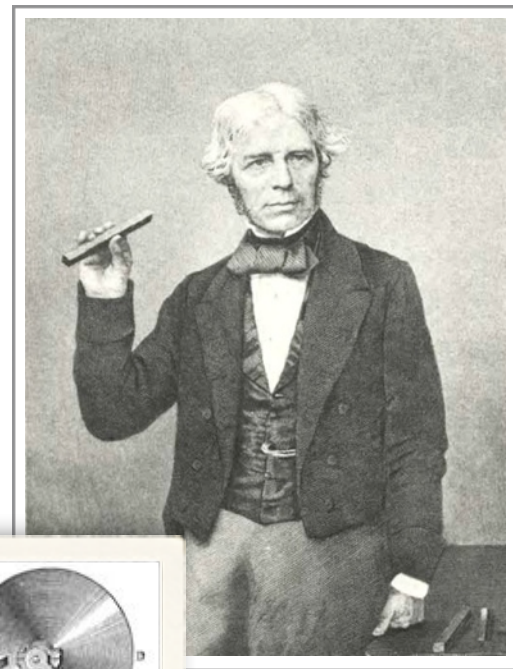


iron bar with several feet of wire. A pivot mounted steel bar sat next to the magnet. A bell, in turn, stood next to the bar. From the electromagnet Henry strung a mile of wire around the inside of the classroom. He completed the circuit by connecting the ends of the wires at a battery. The steel bar swung toward the magnet, striking the bell at the same time. Breaking the connection released the bar and it was free to strike again. And while Henry did not pursue electrical signaling, he did help someone who did. And that man was Samuel Finley Breese Morse.

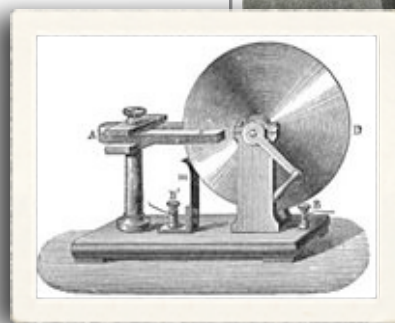
In 1837 Samuel Morse invented the first workable telegraph, applied for its patent in 1838, and was finally granted it in 1848. Joseph Henry helped Morse build a telegraph relay or repeater that allowed long distance operation. The telegraph later helped unite the country and eventually the world. Yet as the telegraph was perfected, thoughts turned to speech over a wire.



Henry's electromagnet



Michael Faraday and his electric generator



In 1861 Johann Phillip Reis completed the first non-working telephone. Tantalizingly close to reproducing speech, Reis's instrument conveyed certain sounds, poorly, but no more than that.

In the early 1870s the world still did not have a working telephone. Inventors focused on telegraph improvements since these had a waiting market. A good, patentable idea might make an inventor millions. Developing a telephone, on the other hand, had no immediate market, if one at all.

Elisha Gray, Alexander Graham Bell, as well as many others, were instead trying to develop a multiplexing telegraph—a device to send several messages over one wire at once. Such an instrument would greatly increase traffic without the telegraph company having to build more lines. As it turned out, for both men, the desire to invent one thing turned into a race to invent something altogether different.

"Major Telephone Breakthrough"

The principle of the telephone was uncovered in 1874, but it was the unique combination of electricity and voice that led to Bell's actual invention of the telephone in 1876. Convincing Bell's partners, Gardiner Greene Hubbard, a prominent lawyer from Boston, and Thomas Sanders, a leather merchant with capital from Salem, about the potential for

voice transmittal was not an easy task, and they often threatened to pull Bell's funding. Nonetheless, agreement was finally reached and the trio received a patent issued on March 3, 1876 for "Improvements in Telegraphy," which is now considered to be the most valuable patent ever issued.

Bell considered his invention's greatest advantage over every other form of electrical apparatus to be the fact that it could be used by anyone, as "all other telegraphic machines produce signals which require to be translated by experts, and such instruments are therefore extremely limited in their application, but the telephone actually speaks, and for this reason it can be utilized for nearly every purpose for which speech is employed."

Bell was nearly beaten to the patent office by Elisha Gray, who had independently developed a very similar invention. Gray arrived just hours after Bell at the Patent Office, filing a "caveat," a confidential report of an invention that was not yet perfected. Western Electric, co-founded by Gray, became one of the Bell System's major competitors. Western Union was another major competitor, already having established itself as a communications provider with the telegraph system.

Another famous inventor, Thomas Edison, took advantage of Bell's failure to secure a patent in Britain for the Bell receiver, and received a patent for a new receiver, the "electro-motograph," which required continuous cranking—or the conversation



Alexander Graham Bell

would end. However, by 1880, the Bell transmitter and the Edison receiver were combined and used throughout Britain.

The first permanent outdoor telephone wire, strung in 1877, covered a distance of three miles. Commercial telephone service began in the United States in 1877. The workable exchange, developed in 1878, enabled calls to be switched among any number of subscribers rather than requiring direct lines. Exchanges were handled manually, first by boys, then by women operators.

In 1879, telephone subscribers began to be designated by numbers rather than names—as a result of an epidemic of measles. A Lowell, Massachusetts doctor, concerned about the inability of replacement exchange operators to put calls through because they would not be familiar with the names associated with all the jacks on the switchboards, suggested the alpha-numeric system of identifying customers by a two-letter and five-digit system.

The dial phone was invented in the 1880s by Almond Brown Stroger, who was a Kansas City, Missouri undertaker and was convinced that the Bell Telephone operator was sending calls for his funeral home to other. Stroger invented the dial telephone and installed automatic exchanges in the US and Europe. In 1924, the Bell Telephone System decided that using operators was not the way to go, and they licensed Stroger's technology. The step-by-step switch used to receive the dial pulses was called a Stroger Switch, after its inventor.

The first coin telephone was installed in Hart-

ford, Connecticut in 1900. Party lines were soon developed to lower the cost of the telephone for individual families, especially those in rural locations.

American Telephone and Telegraph (AT&T) took control of Western Union telegraph Company in a "hostile takeover," in 1911, having purchased the Western Union stocks through a subsidiary. The two eventually merged, sharing financial data and telephone lines. In 1918, ten million Bell System telephones were in service.

Alexander Graham Bell had little interest in being a businessman. In July 1877, he married Mabel Hubbard, and set sail for what proved a long honeymoon in England. He left the growing business to Hubbard and Sanders, and went on to a long productive career as a scientist and inventor.

The impact of the telephone has been described as both positive and negative. On the negative side, wars are waged more easily, the scope of human conflict has been extended along telephone lines, the multi-generational household has been broken-up as living alone is no longer an experiment in isolation, and the time-space continuum seems to be compressed faster than previously thought possible. On the other hand, the invention of the telephone has resulted in the rapid and diffuse dissemination of technical and scientific information, saved lives through links to emergency services, made possible the modern city through telephonic connections, increased the speed and ease with which information changes place, and accelerated the rate of scientific and technological change and growth in industry.



Women telephone exchange operators, c. 1910