PHYSICS

Bell Rings Down a Century

Telephones have served America for 71 years, and on March 3, the inventor's hundredth birthday will be celebrated. The story of the invention is told here.

By A. C. MONAHAN

➤ A SCOTCHMAN by birth, an American by choice, the father of the telephone—Alexander Graham Bell—would be 100 years old on March 3, 1947, if he were alive today. By the time of his death, August 2, 1922, telephony had made gigantic forward strides from the crude instruments and methods which carried in 1876, the first spoken words ever transmitted by wire.

In the 75 years of his life, and the 46 years of telephone history, Bell found that his discovery was far more important than even he could have dreamed in earlier days. Telephones had become common household and office equipment, one could talk across the continent from Boston to San Francisco, and during his last full year of life, underwater cable lines extended to Cuba.

Telephone Expansion

Five years after his death wire conversations with Europe were established and land lines connected American cities with those of Mexico. Radio sets had become common in American homes during his life, but the radiotelephone was only in development stages.

Few, if any, dreamed then that with the radiotelephone, within such a short period of time, an American could sit in his home and talk by wire and air with his "down-under" cousin in Australia or New Zealand.

The first complete sentence was carried by wire on March 10, 1876, a year later than Bell had succeeded in transmitting sound electrically by wire. The first two-way conversation was held on October 9, 1876, over a two-mile line between Cambridgeport and Boston. During the following years, telephony improved rapidly, and new developments are taking place almost continuously.

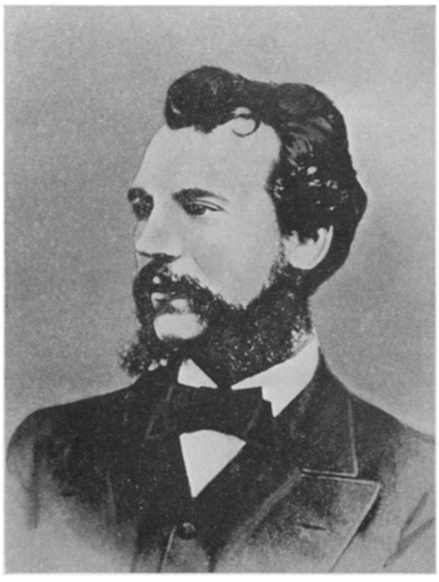
America now has about 32,000,000 telephones. Progressive nations all over the world have modern telephone systems, but not to the per capita extent of the United States. Round-the-world conversations dramatize the world-wide extension of telephone communication. Ships at sea, planes in the air, railroad trains on the track, and moving automobiles on highways, are all within telephone communication.

End Not Reached

The end has not been reached. Telephone transmitters and receivers will become as common in cars, trucks and buses as radio receivers are today. Isolated farms also will have phones, even those that can not be reached economically by telephone wires. Where power lines exist, they can now be used for rural telephones; other isolated spots will be served by radiotelephone.

Alexander Graham Bell was not a trained scientist as the term is used today, at least not in his early life. He came to America at the age of 24 to demonstrate a visible speech system developed by his father for training the deaf to speak. He came to Boston to teach the system to the instructors in the Boston School for the Deaf.

His interest in speech may be responsible for his undertaking a "talking telegraph" system. The idea of using telegraph lines for talking was not new with him; others had the same idea. However, it is to Bell that the credit is due for discovering the way, and carrying it through to success.



FATHER OF TELEPHONES— ***Alexander Graham Bell in 1876, the year the telephone was patented.***

Bell did not enter the world in a poverty-stricken Scottish cabin, but in a good home in Edinburgh. His father was a scholar, teacher, writer and lecturer on correct speech and elocution. His mother, a daughter of a naval surgeon, was an accomplished musician and portrait painter. Bell was a musician of modest ability, and at one time intended to make music his career. The science of speech, however, took priority over music.

Teaching Speech

In the five years in America before he developed a working telephone, Bell was engaged much of the time in teaching the visible speech system. In his spare moments, at first, he experimented with electrical currents and particularly with the thought of transmitting words over a wire.

His first idea was a harmonic telegraph instrument to send more than one Morse message over a single wire at one time. It had already been proved that musical tones could be transmitted by the make-and-break current of electricity. This led Bell to believe that developments might permit conversation transmission.

His work with the harmonic telegraph was successful, and he received a government patent on his instrument. It is not, however, a telephone instrument, but its development gave him the ideas that made telephoning possible. To transmit words he had to find a way to vary the intensity of the current as the sound waves, loud and soft, high and low, shrill and deep, vary in the way they disturb the air.

Another thought was that a single membrane, or diaphragm, somewhat similar to the eardrum, would gather the complexities of speech or sound in the air, and through its vibrations bring about vibrations in the current in the wire. These in turn would bring about vibrations in a membrane in the receiving end and create sound waves in the air.

These ideas were new; an important step in the development of the telephone had been born. Not an electrician by

training, Bell studied electricity, consulted experts, visited laboratories and picked up ideas from many sources.

The idea of the familiar telephone mouthpiece to concentrate the air waves of the voice on a diaphragm came from a laboratory at the Massachusetts Institute of Technology. Experimentation with a human ear from a dead body came from a Boston doctor. Certain fundamentals on electromagnets came from Joseph Henry, then secretary of the Smithsonian Institution and a leading electrical scientist of the day. Henry was known particularly for his work in electromagnetic induction.

New Idea

In 1874, while still working on harmonic telegraphy, it occurred to Bell that one of his telegraph reeds, vibrating over its electro-magnet, would induce wave-shaped currents corresponding to its vibrations, and that several vibrating reeds would induce a complex wave-shaped current that would be the result of the vibrations of all.

While working on this idea, the telephone break came. It was on June 2, 1875, that one of the reeds stuck to its electromagnet and, when plucked to free it, sent through the wire the twang of a plucked reed, a tone with overtones. Bell, fortunately, was on the receiving end and immediately recognized the significance of what he heard.

"The first Bell telephone" was the result of this experience. It did not come immediately, but was far enough advanced so that Bell applied for a patent early in 1876, and received it on March 10 that year. It was actually three days after the patent was issued that the first spoken sentence was transmitted by wire. By early June, however, improved instruments were developed and placed on display at the Philadelphia Centennial Exposition.

There the discovery was quickly appreciated. Included among the judges of scientific apparatus were Sir William Thompson of England, Joseph Henry of the Smithsonian, and several outstanding university physicists. Sir William Thompson, England's leading authority on electricity, went to Boston with Bell to learn more about the discovery. He pronounced it "the most wonderful thing in America." Four years later, nearly 50,000 Bell telephones were in use in the United States.

Science News Letter, March 1, 1947

CHEMISTRY

Enzyme Frees Phosphorus For Embryo Development

➤ A CHEMICAL "workhorse" which makes phosphorus available to the growing embryo has been discovered in research at the University of California.

This agent is an enzyme which liberates phosphorus from protein in the eggs of frogs, so that the embryo can use it in its development.

This is the first time such an enzyme has been reported. Now that the mechanism is known, scientists may find similar enzymes in higher animal forms, including man.

The research was done by Dr. Daniel Harris, formerly of the department of biochemistry at Berkeley and now at California Institute of Technology, who was studying the enzyme make-up of protoplasm. Using frog eggs, he noticed a big increase in the inorganic phosphorus content when the eggs were ground up. He traced the cause to the new enzyme, which is called phosphoprotein phosphatase.

The find may prove of immense value, in that phosphorus is essential to normal growth in all living tissue. Phosphorus is found in the nucleo-proteins, the basic substances of the cell nucleus; probably in chromosomes, heredity-determining units; and even in viruses.

The ovum is a storehouse of phosphorus, and the new research indicates that when the embryo is in need of phosphorus the enzyme pries it loose from the protein substances in which it is locked.

Science News Letter, March 1, 1947

AERONAUTICS

Small Airports to Benefit Flying of Private Planes

➤ PRIVATE FLYING will benefit particularly by the construction of 800 smaller airports in the United States for which federal aid has been allotted by the Civil Aeronautics Administration.

With them, flying farmers will be able to go to town by air, and city business men will be able to utilize their planes in reaching smaller centers.

During the past year some 35,000 private planes have been added by the American aircraft industry to the number already in use. Many of these will be used for business purposes, and many for family flying. The growth of private flying, for which air-minded America is now ready, depends upon the availability of local airports suitable for their use.

BELL'S BRAINCHILD—An important part of the telephone system, the main switching system at the Bell Telephone Laboratories duplicates every type of switching circuit in use in the telephone system today.

The federal government will contribute nearly $33,900,000 for the construction or improvement of these 800 airports. Local state or other sponsors will contribute about $37,693,000. Ports will be built in all states except Alabama. None is planned for the District of Columbia. Seventy are planned for Texas, 46 for Montana, 41 for Minnesota, 35 for Kansas, and 33 for California. In only a relatively few cases will the federal contribution per port exceed $100,000, and in some cases it will be but a few thousand.

Science News Letter, March 1, 1947