John J. Carty—a Biographical Note

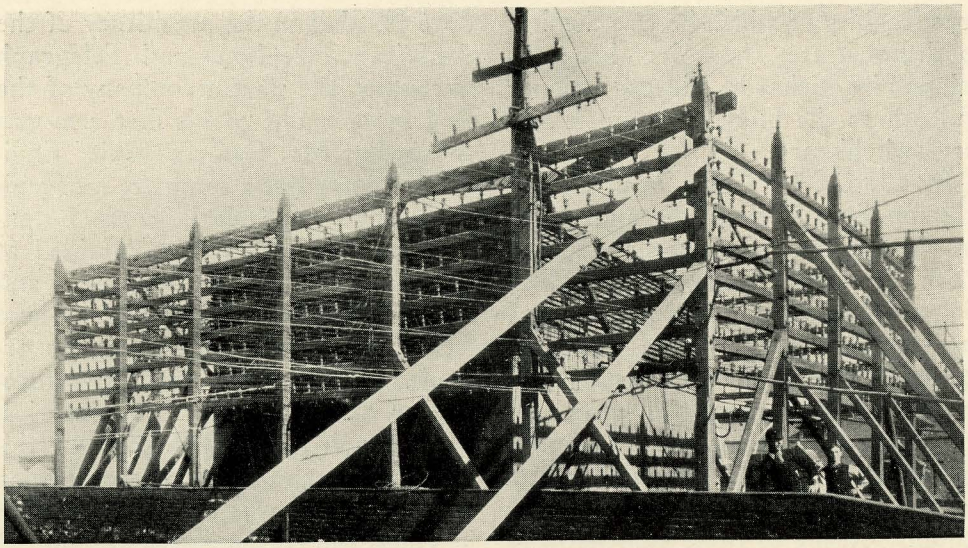
AFTER a career of unusual distinction in the telephone field, JOHN JOSEPH CARTY retired from active service in the Bell System on June 30. At the time of his withdrawal he was a Vice-president of the American Telephone and Telegraph Company, and Chairman of the Board of Directors of Bell Telephone Laboratories.

Mr. Carty was born April 14, 1861, at Cambridge, Massachusetts. Having finished his preparation for college, he was obliged, because of a temporary impairment of his eyesight, to discontinue further studies at school. The possibilities of the telephone which Bell, then residing at Cambridge, had recently invented, made such a strong appeal to his imagination that he sought an opportunity to participate in the development of this new marvel, and in 1879 he entered the service of the Bell company at Boston. With the exception of his service in the United States Army during the World War, he has been ever since actively engaged in the work of the telephone company in different parts of the country.

While at Boston, he designed and installed the first metallic circuit multiple switchboard to be put into service. Some of the fundamental features of this apparatus are employed in all of the multiple switchboards of today. This multiple switchboard employed a common battery at the central office for signaling. Supplying telephone transmitters from a common battery was at that time considered impossible. His services with the telephone company during this period were varied, and covered the entire range of practical telephony, including plant construction, maintenance and design, as well as traffic and operation.

In 1887, he removed to New York and took charge of the cable department of the Western Electric Company in the East. In this capacity he had charge of all the important cable-laying projects which were carried on for several years in the eastern cities During that period, cable manufacturing and laying and subway construction were in their infancy. Each project involved new and unsolved difficulties calling for much engineering skill and oftentimes invention. Metallic circuit cables doing away with cross-talk and extraneous noises had not been perfected, and talking through cables over lines of any considerable length was impossible.

Although charged with the carrying out of difficult practical engineering problems, Mr. Carty found time to follow his strong natural inclination for scientific research. He made an important original investigation into the nature of the disturbances to which telephone lines were subjected, and gave the first public acount of his work in a paper entitled *A New View of Telephone Induction* read before the Electric Club at New York on November 21, 1889. The view put forth in the paper was regarded as revolutionary at the time, but his experiments having been successfully re-



Roof fixtures leading into the office of the Telephone Dispatch Company of Boston, in 1883. *Here Mr. Carty made his first acquaintance with the serious problem of the open-wire plant*

peated by a number of scientists in this country and in Europe, his views were accepted.

In this paper, using the type of telephone instrument then in general use, he showed the importance of electrostatic induction as a factor in producing crosstalk, and proved that in his experimental telephone lines there was a particular point in the circuit at which no crosstalk could be heard. The paper gave directions for determining this silent or neutral point and described original experiments showing how to distinguish between electrostatic and electromagnetic induction in telephone lines.

On March 17, 1891, Mr. Carty made additional contributions to the knowledge of the working of telephone circuits in a paper before the American Institute of Electrical Engineers entitled *Inductive Disturbances in Telephone Circuits,* describing original experiments showing for the first time the precise manner by which twisting or transposing telephone lines rendered them free from inductive disturbances. This paper cleared the way for a rational treatment of a problem which had theretofore been attacked unsuccessfully by empirical methods.

Growing out of these investigations, he invented a method for neutralizing induction by the employment of condensers. The principle involved in this invention is of great practical value in the most highly organized modern cables for long distance work.

In addition to his cable work in the Western Electric Company, Mr. Carty was placed in charge of the switchboard organization, and once again returned to the common battery problem which baffled him in the early days at Boston. By using storage batteries of very low internal resistance, he was able for the first time to operate two or more telephone transmitters from the same source of current supply. Based upon this principle, the

practicability of which he was the first to demonstrate, there has been developed by Richards, Hayes, Scribner and others the modern common battery switchboard.

In 1889, Mr. Carty went to the Metropolitan Telephone and Telegraph Company, afterwards the New York Telephone Company, as Chief Engineer, where he reorganized all of the technical work of the company. He built up an engineering staff, and was the first among the operating companies to recruit their technical personnel from the graduating students of our scientific and engineering schools. Many of these students who were trained in his office have since become leaders in the telephone industry.

During his term with the New York Telephone Company, the switchboard and cable plant of the company was entirely reconstructed and converted from the grounded to the metallic circuit system. Overhead wires carried upon pole lines were removed and replaced by underground cable. New traffic, equipment, and construction methods were introduced, and the service was placed on a high plane not theretofore reached in any other city.

While in the service of the New York Telephone Company, he designed a telephone and signaling apparatus which made it possible to connect many stations upon one line without in any manner impairing transmission. Formerly two or three stations upon one line were sufficient to prevent commercial conversation. The development of this new apparatus made possible the extension of telephone service among farmers and rural subscribers everywhere.

In 1907, upon the return of Theodore N. Vail to the presidency of the American Telephone and Telegraph Company, the parent company of the Bell System, one of his first acts was to appoint Mr. Carty as Chief Engineer to carry out a complete reorganization of its technical forces. Extensive laboratories were maintained at Boston, New York, Chicago, and minor laboratories elsewhere. These Mr. Carty consolidated into one organization at New York, the forerunner of our present Laboratories.

Although the New York and Chicago telephone line composed of open wires on poles was opened to service in 1893, the transmission was not of a high grade, and by 1907 the line seemed to work more poorly than at the beginning. This was because of the constant addition of small sections of cable either overhead or underground. The problem of long distance telephony could not be solved until the difficulty of talking through cables was overcome.

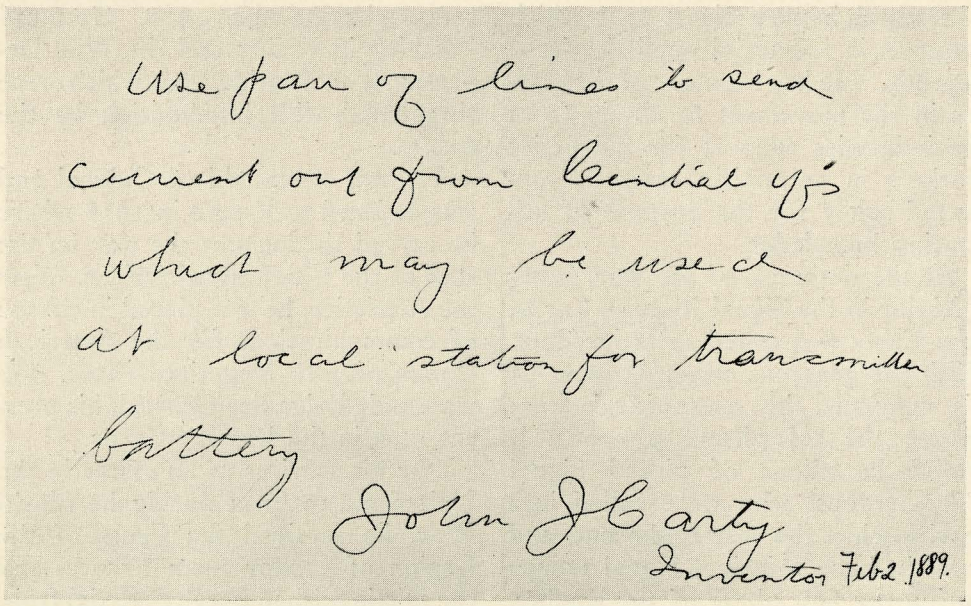
Although the epoch-making invention of the loading coil by Dr. Michael I. Pupin has proved to be one of the fundamental and permanent elements in successful long-distance cable telephony, numberless unsolved problems presented themselves in connection ith its practical engineering application. Talking across the continent from the Atlantic to the Pacific was a boyhood dream of Mr. Carty and his early associates, and now with the backing of Mr. Theodore N. Vail he had the privilege of heading that distinguished group of scientists and engineers who were to make a combined attack upon this problem. Among those who did most distinguished and responsible work were Mr. Bancroft Gherardi in charge of the engineering forces, and Dr. Jewett in charge

of the scientific and laboratory forces. Working under them or in association with them were found the names of Craft, Colpitts, Blackwell, Arnold, Stevenson, and a great many others whose work was essential to the solution of the problem. As a result of this organized attack, the problem was solved, and on the 25th of January, 1915, the New York-San Francisco telephone line was opened to public service with impressive ceremonies at New York, Boston, San Francisco and Washington.

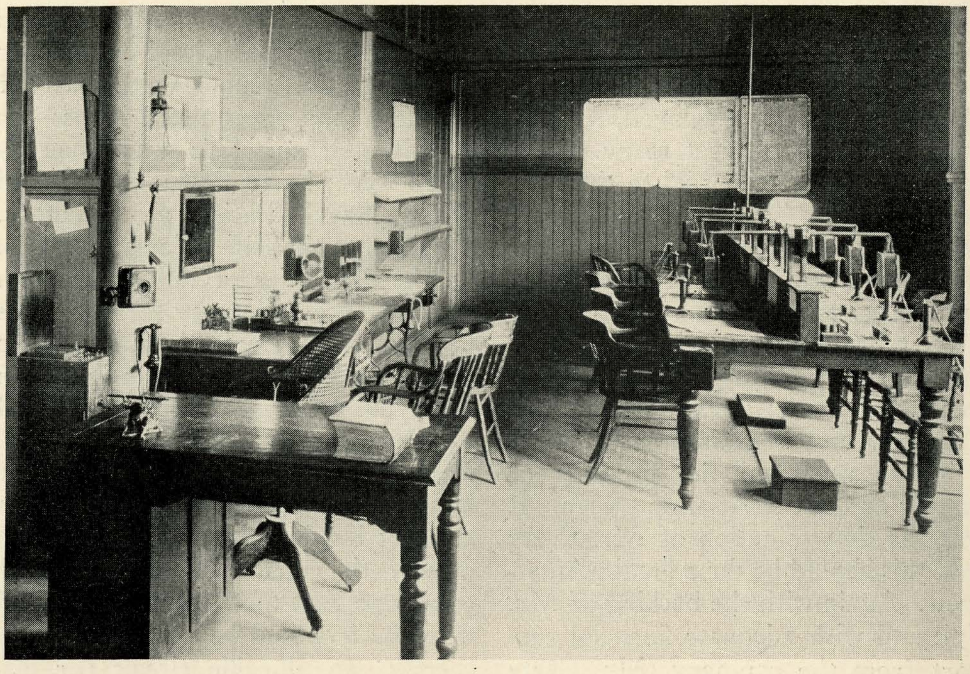
There remained the problem of talking across the Atlantic Ocean. It was the determination of Mr. Carty that this should be done first by Americans. Again with the backing of Mr. Vail and with adequate financial support from the company, Mr. Carty set to work upon the problem those engineers and scientists who had so successfully cooperated in overcoming the difficulties in transcontinental telephony. Again their efforts were crowned with success, and on October 21, 1915, the human voice was for the first time transmitted across the Atlantic Ocean. This was done by radio telephone from the United States Naval Station at Arlington, Virginia, to the Eiffel Tower in Paris.

The difficulties of talking through long distance cables, say for 100 miles or more, still remained, and with the increasing difficulty of erecting open wires on poles, it presented a vital problem, to the solution of which Mr. Carty again directed the energies of his staff. By 1916, as the result of a combined scientific and engineering attack, the difficulties were so far overcome that methods were devised whereby it would be possible to talk through an all-cable circuit for distances as great as 1500 miles.

Mr. Carty has been one of the foremost in urging upon the industries the necessity and immense value of scien-



A page from Mr. Carty's notebook recording his conception of the common-battery system



The desk at which General Carty, in 1883, *started his executive career; at* 40 *Pearl Street, Boston*

tific industrial research, and in encouraging in the universities the work of research in pure science upon which progress in industrial applied science depends. He has been one of the leaders in the movement to obtain from the industries support for university workers in scientific research conducted solely for the purpose of advancing knowledge.

At the outbreak of the war, being a Major in the Signal Reserve Corps, Mr. Carty was called to active duty. With the generous encouragement of his company, he organized from among the telephone personnel, twelve battalions of picked Signal Corps troops, who were called into service when the war broke out, and furnished the principal Signal troops during the first phase of the conflict.

He organized the Research and Inspection Division for the Chief Signal Officer, A. E. F., and was responsible for the maintenance of transatlantic communication between General Pershing in France and the War Department at Washington, which were threatened with interruption by the enemy.

He was promoted to Colonel and was ordered to France in 1918 where he served throughout the war on the staff of the Chief Signal Officer. After the Armistice, he was placed in charge of communications for the American Commission to Negotiate Peace. He was made Brigadier General, his present rank in the Reserve Corps.

For his services as an officer in the United States Army during the World War, he received the Cross of the Legion of Honor from France, and the Distinguished Service Medal from the United States which was conferred upon him by General Pershing at his

headquarters in France with the following citation: "For exceptionally meritorious and distinguished services. He was largely instrumental in securing from the telephone and telegraph companies of the United States the best talent available to meet the urgent requirements of the Signal Corps at the outbreak of the war. He has served with marked distinction as a member of the American Expeditionary Forces, and his brilliant professional attainments and sound judgment have rendered his services of exceptional value to the Government."

In 1919, upon his return from France, General Carty became Vice President of the American Telephone and Telegraph Company. With the incorporation of Bell Telephone Laboratories in 1925, he became Chairman of its Board of Directors.

He is a member of the National Academy of Sciences, National Research Council, American Academy of Arts and Sciences, American Philosophical Society, and other scientific and engineering bodies. He is an Honorary Member of the Franklin Institute, and has received the Franklin Medal and the Edward Longstreth Medal presented by that society, and the Edison Medal presented by the American Institute of Electrical Engineers, of which he was President in 1915 and 1916.

For his services in connection with Japanese electrical communications, he received from the Japanese government the decorations of the Order of the Rising Sun and the Order of the Sacred Treasure.

He has received the degree of Doctor of Engineering from Stevens Institute of Technology in 1915, and from New York University in 1922; Doctor of Science from the University of Chicago, and from Bowdoin in 1916, from Tufts in 1919, from Yale in 1922, and from Princeton in 1923; and LL.D. from McGill in 1917, and from the University of Pennsylvania in 1924.

In 1927, General Carty was awarded the John Fritz Gold Medal. In the accompanying citation, his career is effectively summarized: "for pioneer achievement in telephone engineering and in the development of scientific research in the telephone art."