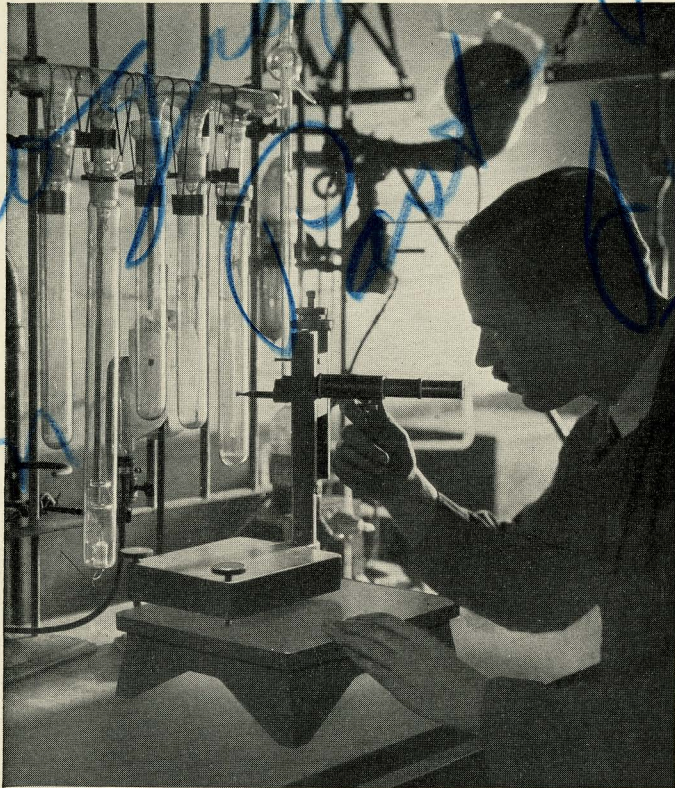


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BELL LABORATORIES RECORD

Prepared by J. Carty
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The Chemical Research Department measures the porosity of microphone carbon by weighing, on a fine quartz-spring balance, the amount of moisture it absorbs

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JOHN JOSEPH CARTY


who has retired after fifty-one years of service in the Bell System

GENERAL CARTY'S half-century of service in the Bell System was unique because of his intimate and uninterrupted contact with the vital technical problems of the telephone practically from its inception to its present stage of development.

No one contributed more to the technical development of the art of voice communications, but great as these contributions were they did not exceed his interest in and the power to analyze and contribute to the philosophy of the business and particularly to the spirit of service within the Bell System.

General Carty's vision, imagination, and loyalty to an ideal that found expression in the Bell System, advanced him steadily in usefulness, in power, and in the respect of his fellow workers. His spirit will be reflected in things we do and in the works of those who come after us.

Walter S. Gardner



The Dean of Telephone Engineers

By BANCROFT GHERARDI

Vice-President American Telephone and Telegraph Company

IN February, 1895, I was hired as an assistant in the Engineering Department of the Metropolitan Telephone and Telegraph Company (now the New York Telephone Company) by John J. Carty, then its Chief Engineer. For about half of the thirty-five years since that time, I reported directly to General Carty and for the remainder of the time our work was very closely associated. On the occasion of the retirement of General Carty, after more than fifty years of active service in the Bell System, I welcome this opportunity to state in the BELL LABORATORIES RECORD my impressions of his contributions to telephony and to the engineering profession. I am more than glad to have the opportunity to do this as I feel that I am under a personal obligation to General Carty, which I can never pay, for the guidance and instruction which I received from him for many years. As a beginner in the Bell System, I was fortunate to come under the influence of his great mind and personality. The Bell System was fortunate indeed from its early days to have such a man directing its technical development. At the time when the General received the John Fritz Medal, I endeavored to outline his contributions to the Bell System, to the science of engineering, and to the country as a whole in these words:

IN 1879, only three years after Alexander Graham Bell had first

publicly demonstrated his telephone invention, a young man eighteen years of age who had prepared for Harvard, but was prevented from continuing scholastic work by temporary impairment of his eyesight, entered the employ of the Bell Telephone Company in Boston.

It is difficult, if not impossible, for any of us now to visualize the telephone problem of that time and the conditions under which it had to be approached by the telephone pioneers of that day. Much of our scientific knowledge of today had not been discovered; there were no schools of electrical engineering to provide trained personnel; the American Institute of Electrical Engineers was not to be founded until five years later; there were no sources of electrical energy except primary batteries and magneto generators; no adequate theories of the transmission of electric currents over wires; no commercial applications of electricity except the electric telegraph and the infant telephone art. At that time there were in the whole of these United States fewer telephones than are to be found today in East Orange, and it was impossible to talk over distances greater than a few miles.

Practically nothing had been done and few of the essentials to the attainment of our present telephone system were known. But there was a small group of men of vision and of courage, confident of the possibilities of

the telephone and determined that it should attain the future that they saw for it in their dreams. One of these was John J. Carty.

To tell the story of his life and of his contributions is to tell a very large part of the scientific, technical and engineering developments of the telephone art, not only in this country but for the whole world. After early experience in the design, construction, maintenance and operation of telephone systems in and around Boston and with the Western Electric Company in New York City, Carty in 1889 became the Chief Engineer of the New York Telephone Company. In that position he was responsible for the technical problems of the city which is telephonically the greatest in the world and where new problems are most likely to arise. In 1907 he became Chief Engineer of the American Telephone & Telegraph Company, the parent company of the Bell System. At the outbreak of the War he was ordered to active duty as a Major in the Signal Corps of the United States Army. He saw active service in France and rapidly rose to the rank of Brigadier General. Since his return from France in 1919 he has been Vice-President of the American Telephone & Telegraph Company. These, briefly, are the positions which he has held. What did he do with the opportunities which they offered?

His personal contributions to the telephone art have been notable. He designed and installed the first multiple switchboard which contained the fundamental features of common battery signaling, and later was the first to show how to operate two or more telephone transmitters from a single source of electric supply. These, together, constitute the foundation of

the common battery system of today essential to every large telephone switchboard, whether automatic or manual.

From the start of the telephone business, one of the difficulties which had to be met was to prevent induction between closely adjacent telephone circuits, the result of which would be that speech taking place in any one of the circuits could be overheard in all. Closely related to this problem has been that of minimizing external inductive disturbances—those that come from electric currents in other than telephone circuits, and from atmospheric or earth currents. At a time when but little was known on these subjects, Carty made an important scientific investigation of their nature and set forth the view that under many conditions these disturbances were electrostatic and not electromagnetic in character. This view was so novel that it was not generally accepted until it had been checked and verified by others, but it was soon recognized as correct and served as a guide to much essential work in the minimizing of these disturbances. This work of Carty's made it possible to give scientific treatment to the twisted-pair and transposition problems and laid the foundation for keeping inductive disturbances within limits that permitted development of the industry.

Early telephone systems followed the usual telegraph practice of placing telephone instruments, including the signaling devices, in series in the line. The result of this arrangement—when there were several instruments on the same line—was to impair telephone transmission seriously and to interfere with satisfactory signaling. It placed severe limitations upon the number of telephones which might be connected

to a single line. Carty's scientific study of this question led him to the conclusion that the instruments should be placed in parallel and not in series, and should be re-designed so that the signaling apparatus would have high impedance. This invention is commonly known as "Carty's bridging bell." It removed many of the difficulties which had formerly imposed serious limitations on the development of the business, and made the party line and the rural subscriber's line a possibility.

Carty prepared the plans and immediately directed the work of converting the New York City telephone plant from open wire to cable, and later from the local battery switchboard system to the common battery system, at a time when the general development of the art was such that almost every move required invention, development and engineering along new lines.

If we were to take out of the present telephone system those things — a few only of which I have mentioned — which John J. Carty personally devised and contributed to the art, essential elements would have been removed and in many important respects the system would no longer be operative. This is some measure of Carty's individual achievements.

But he had qualities not always found in men of individual creative genius. He had the rare ability to organize progress as well as to contribute to it himself. As the telephone system grew and its problems multiplied in number and complexity, Carty early recognized that the work to be done required the development of a technical organization, and he was first in the telephone operating companies to employ technically-trained college graduates and to devote sys-

tematic attention to their training both in a thorough knowledge of the telephone system and in the correct principles of engineering.

No one who has ever worked in close co-operation with Carty for any considerable length of time can forget the frequency with which he asked the question, "What are the facts?" and the emphasis which he laid on it. Or the importance that he attached to studying all possible solutions of a problem and ascertaining which was the best, taking into account all relevant factors, including first cost, annual charges, service, and flexibility and adaptability to growth and expansion.

He recognized the interrelationship in the telephone business of operating methods, design of the plant, and the rate structure which would largely determine the volume and character of the telephones to be served. He had in mind that all of these factors must be considered in their relations one to the other and their relation to the final result if the system was to give the best possible, the most extended, and the cheapest telephone service. Always was his engineering dominated by this consideration for the final result, not only immediately but for the years ahead.

His methods not only developed telephone systems and service along sound and effective lines, but he has always been a great developer of people. He inspired them to give the best that was in them; he taught them to do better; and was always lenient to their shortcomings, and both constructive and kindly in criticism. His influence on others extended far beyond those working directly for him. All who had contacts with him felt the power of his keen analytical mind,

his breadth of vision, his sense of justice, and his kindly disposition.

The nature of Carty's early contributions to the telephone art showed his clear appreciation of the importance of scientific knowledge to the understanding of telephone problems. When he became Chief Engineer of the American Telephone & Telegraph Company in 1907 he was in a position to do so and he immediately consolidated all of the telephone laboratories and experimental work, which up to that time had been scattered both as to location and executive control, into a single organization which is now known as the Bell Telephone Laboratories. He greatly increased the number of scientists engaged upon this work. Of the many fundamental contributions which have resulted from this arrangement, I shall mention but two. He initiated and pushed to a successful conclusion the work necessary to make transcontinental telephony possible. Through its applications, telephone service has been extended to tie together not only every state of our Union, but to bring into the range of telephonic communication Canada, Cuba and Mexico. He likewise inspired and directed the work which resulted in the sending of the first articulate words across the Atlantic Ocean by radio telephony, and continued this work until today the barrier of the Atlantic Ocean has been overcome and commercial telephone service between the old world and the new is a daily fact. Already four nations of the new world can communicate telephonically with Great Britain and four nations of the Continent of Europe, and it is not too much to believe that through the further extension of these developments all of the principal nations of the world may be

brought into communication by the spoken word.

This organization of research and development was not only a service to the telephone art; it was a notable contribution to our present-day American civilization, for the organization of science to lead industrial progress now common in many industries received a tremendous impetus from Carty's work in the organization of the laboratories of the Bell System and in the obvious value of its accomplishments. It is in recognition of Carty's vision and achievement along these lines that he is a trustee of the Carnegie Institution and of the Carnegie Foundation, a trustee of New York University, a member of the National Research Council, and associated with other organizations whose object is the advancement of science and the applying of these advances to the welfare of mankind.

Until 1917 Carty's genius was devoted to the arts of peace. Then our country was plunged into the World War and it became the duty of every American citizen and organization to contribute their all to the successful outcome of the War. Recognizing the importance of communication and Carty's pre-eminent position in relation thereto, our Government which had previously commissioned him a Major in the Reserve Signal Corps of the Army ordered him to active duty. He devoted to the Signal Corps problem that same judgment, skill and knowledge which had produced such outstanding results in civil life, and largely through his efforts the resources of the nation's telephone personnel, laboratories, manufactures and supplies were brought to bear upon the problems of the War and in such a way as not to cripple the com-

munication on the home front which must also continue to function. In June, 1918, he was ordered to France, where he was one of the principal staff officers of the Chief Signal Officer of the American Expeditionary Forces. After the Armistice he remained in France for a time in charge of the communications of the American Commission to negotiate peace. In recognition of his services in the Army he received from our Government the Distinguished Service Medal and from France the Cross of the Legion of Honor.

General John J. Carty, who comes to us this evening in order that we may bestow upon him a token of the appreciation in which his distinguished achievements are held by his fellow engineers represented by the four national engineering societies is—

The creator of telephone engineering;

The discoverer or inventor of many essential methods and devices;

The organizer and director for many years of the Bell System technical and engineering work;

The father of the application of scientific research to the telephone art;

The director of the development of transcontinental and transoceanic telephony;

A pioneer in advocating scientific research in industry;

A leader in the application of the development of electrical communication—which he had such an important part in creating—to the national defense in the hour of our country's need;

The dean of telephone engineers.”