THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA

For the Promotion of the Mechanic Arts

Committee on Science and the

Arts Cases No. 3009 and No. 3010.

Hall of the Committee,

Philadelphia, January 8, 1936.

Report of Special Sub-Committee on recommending awards of The Franklin Medals.

Sub-Committee: Dr. Frederic Palmer, Jr., Chairman

Dr. James Barnes

Mr. Theobald F. Clark

Dr. H. Jermain Creighton

Mr. Clarence A. Hall

To the Committee on Science and the Arts:

Your Sub-Committee entrusted with the duty of selecting candidates for the Franklin Medal this year wishes to recommend that two such medals be awarded; one to

DR. FRANK BALDWIN JEWETT
Vice President of the American Telephone and Telegraph Company,
President and Director of Bell Telephone Laboratories, Inc.

"In recognition of his many important contributions to the art of telephony, which have made conversation possible not only from coast to coast, but from this country to the other side of the world, -- contributions of which some were made by him alone, and some by him in collaboration with other workers in the great laboratory of research which he organized and which he has directed with such signal success,"

and one to

CHARLES FRANKLIN KETTERING
Vice President and Director of the General Motors Corporation,
General Director of General Motors Research Laboratories,
Vice President of the Frigidaire Corporation.

"In recognition of his significant and timely contributions to the science of automotive engineering, -- a science out of which has grown the greatest industry in this country, whose manufactured product has in only a quarter of a century changed the face of the civilized world."

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Dr. Frank Baldwin Jewett

Dr. Jewett was born at Pasadena, California, on September 5, 1879, the son of Stanley P. and Phebe Mead Jewett. He comes of a long line of New England ancestors, the first of which settled in Rowley, Massachusetts, in 1632. He received his undergraduate training in electrical engineering at Throop Polytechnic Institute (now the California Institute of Technology), Pasadena, from which he graduated in 1898 with the degree of Bachelor of Arts. The next four years he studied physics, chemistry and mathematics at the University of Chicago, from which he obtained the degree of Doctor of Philosophy in 1902. During his last year there he was Professor Michelson's research assistant. In 1903 he went to the Massachusetts Institute of Technology, where he studied electrical engineering and at the same time acted as instructor in physics and elec-

trical engineering. During this period there was aroused in him an intense interest in the problems of telephone engineering, and the possibilities for research work in the telephone business.

In 1904 Dr. Jewett entered the employ of the American Telephone and Telegraph Company, and three years later was placed in charge of its Electrical Department. At this time the telephone field was on the threshold of a great expansion and the value of scientific research to industry was just beginning to be appreciated. Dr. Jewett brought to the telephone industry a mind thoroughly trained in scientific procedure and a contagious enthusiasm for surmounting difficulties.

From 1908 to 1912 Dr. Jewett was Transmission and Protection Engineer of the American Telephone and Telegraph Company. Soon after his appointment to this position the president of the company requested that every effort should be made to extend the longest distance over which commercial speech was possible from the 950 miles between New York and Chicago to the 3000 miles between New York and San Francisco. The president hoped that by the time of the Exposition in 1915---six years ahead---it would be possible to speak from coast to coast. Thus it came about that Dr. Jewett was called upon to organize a research laboratory in order that new scientific facts and procedures might be brought to aid in the solution of the many problems involved in such an extension of the maximum distance of telephonic communication. In two years this distance was doubled, and service was in operation between New York and Denver. Still it was not known how to span the remaining 1000 miles. Nevertheless, in January, 1915, before the opening of the Exposition, there was established a completely successful service between New York and San Francisco, thus making a reality of

the president's brilliant dream of six years before.

This phenomenal extension of commercial telephone service in such a short time was accomplished, under Dr. Jewett's direction, by the introduction of phantom loading and the loading of large-gauge and open-wire circuits, by the use of telephone amplifiers on loaded lines, and by the development of phantom duplex cables. To talk from coast to coast is one thing, but to transmit speech across the Atlantic Ocean is quite another. Nevertheless, before the end of 1915 the first spoken words went across from Arlinton to Paris. It was twelve years more, however, before commercial telephone service was opened between England and the United States. All of these achievements were the direct outcome of the scientific work carried on in the laboratory under the administration of Dr. Jewett.

From 1916 to 1925 Dr. Jewett had charge of the research laboratories of the Western Electric Company which carried on the experimental work for the Bell System. Under his charge also was all the engineering work required in connection with the manufacturing activities of the Western Electric Company. In 1922 his duties were extended to include the supervision of all the manufacturing operations of this company in America, together with the direction of its sales and the distribution of its manufactured product.

During this period many of the most important advances in the field of communications were made, including the development of the vacuum tube, improvements in the art of inductive loading, building of transcontinental telephone lines, development of the telephone repeater, introduction of machine switching on a large scale, and development of high speed submarine telegraph cable. While credit for such advances as these should be given whole-heartedly

to many of the workers in the research laboratories, nevertheless it is true that as an engineer Dr. Jewett had a large personal share in all of these developments, and as an executive helped to weld diversified units of the Bell System into a well balanced whole, thereby achieving for the telephone system of this country a position of world leadership.

In 1925 Dr. Jewett became Vice President of the American Telephone and Telegraph Company, in direct charge of the Department of Development and Research, a member of the Board of Directors of the Long Lines Department of this company; and at the same time was elected President and a member of the Board of Directors of the newly formed Bell Telephone Laboratories, which now conduct the laboratory and research work formerly done by the Engineering Department of the Western Electric Company. This is the largest research establishment in the United States, employing more than 2500 scientists in the development of new forms and the improvement of existing forms of apparatus and equipment for electrical communication.

During the World War the United States Government utilized the research organization of the Western Electric Company for the solution of many problems having to do with electrical communication. Dr. Jewett was commissioned Major in the Signal Corps, U.S. Reserves, early in 1917, and before the end of the same year was promoted to the rank of Lieutenant Colonel in the Signal Corps of the regular Army. In addition to the research work for the War Department, Colonel Jewett served on a special advisory board on submarine problems for the Navy Department, was a member of the Industrial Research Committee, the Engineering Committee and the Physics Committee of the National Research Council, and of a special committee on cables organized by the State Department. He received the Distinguished Service Medal "for exceptionally meritorious and con-

spicuous service in connection with the development of the radio-telephone and the development and production of other technical apparatus for the Army."

Dr. Jewett's scientific attainments have been recognized by the bestowal of the honorary degree of Doctor of Science from New York University and Dartmouth in 1925, from Columbia University and the University of Wisconsin in 1927, from Rutgers University in 1928, and from Chicago in 1929; by the honorary degree of Doctor of Engineering from Case School of Applied Science in 1928; and by the honorary degree of Doctor of Laws from Miami University in 1932. The Japanese Government awarded him the Fourth Order of the Rising Sun in 1923 and the Third Order of the Sacred Treasure in 1930. He received the Edison Medal in 1928 from the American Institute of Electrical Engineers, whose president he had been in 1923. In May, 1935, the Faraday Medal was presented to him by the Institution of Electrical Engineers.

Dr. Jewett is either a Fellow or a member of a dozen scientific and engineering societies including the American Academy of Arts and Sciences, the National Academy of Sciences, the National Research Council, and the Elektrotechnischer Verein. For six years he was Vice Chairman of the Engineering Foundation. For five years he was Chairman of the Division of Engineering and Industrial Research of the National Research Council. He served on the Electrical Standards Committee of the American Standards Association, and during the latter part of this time was Chairman of the committee appointed by the Association to draw up the By-laws and Constitution of the Electrical Standards Committee. He was a Vice Chairman of the American Committee of the World Engineering Congress held in Tokyo in 1929, and a member of its Executive Committee. He was also Chairman of the National Research Council's Science Advisory Committee for the

Chicago Century of Progress Exposition. In addition to the above, he has served, often as Chairman, upon some twenty other committees dealing with scientific, engineering, and educational matters. The institutions of learning which he has served in an advisory capacity of one kind or another include Massachusetts Institute of Technology, Carnegie Institute of Technology, California Institute of Technology, New York University, and Harvard University.

It is impossible to estimate Dr. Jewett's achievements from his technical scientific publications alone. These number less than half a dozen. For the most part his papers bear titles such as the following: Wireless Telephony, Recent Advances in Long Distance Telephony, The Development of Radio, Permalloy Loaded Cable, The Telephone Switchboard - Fifty Years of History, The Philosophy and Practical Application of Industrial Research, Science and Industry in the Coming Century. Of such titles there are roughly a hundred. In this way Dr. Jewett has laid before the public the signal advances made by the corps of research workers in the laboratory organized and administered by him, and has summarized in an authoritative manner many of the problems encountered in the field of electrical communications.

Fortunately for the advance of civilization, the scientific destinies of the American Telephone and Telegraph Company for the last quarter century have been largely in the hands of the late J. J. Carty and F. B. Jewett, both characterized by remarkable clarity of vision, unusual ability in organization, and tenacious will to succeed. Twenty years ago the Franklin Medal was awarded to J. J. Carty. This year your Sub-Committee recommends a similar award to F. B. Jewett.

Charles Franklin Kettering

Charles Franklin Kettering was born near Loudonville, Ashland County, Ohio, on August 29, 1876; the son of Jacob and Martha (Hunter) Kettering. He grew up on his father's farm where he was an expert in doing chores around the place. In order to enter near-by Wooster Normal School, he had to study Greek. On account of his farm duties there was little time available for study; consequently, he attached a book-rack to the handle of his plow and studied his lessons while the horse followed the furrow. His freshman year at Wooster was interrupted by a breakdown in health, from which he recuperated sufficiently to enter Ohio State University where courses were offered in engineering, a subject much more to his taste than Greek. There followed a second more serious breakdown which kept him out of college for nearly three years. He regained his health by getting a job with the telephone company which kept him out of doors all day planting telephone poles.

At the age of twenty-five he reentered Ohio State University as a sophomore and graduated in 1904 with the degrees of Mechanical and Electrical Engineer. After a short period as the teacher in a country school, he went to Dayton as an engineer in the electrical department of the National Cash Register Company, where he took out the first of the more than 160 patents which he now holds. His most important contribution to the Cash Register Company was the construction of a small electric motor powerful enough to rotate the mechanism automatically, thereby doing away with hand operation. The general manager of the Cash Register Company, Colonel E. A. Deeds, recognized Kettering's genius and promoted him to the head of the Inventions Department, a position which he held for several years in spite of being periodically discharged by the president

of the company, since each time he was discharged he was immediately re-engaged by Colonel Deeds.

In 1911, with the backing of Colonel Deeds and other Dayton capitalists, Kettering organized the Dayton Engineering Laboratories Company and prepared to handle any problems in electrical and mechanical engineering practice. For a long time Kettering had been working over in his mind the idea of an electric self-starter for automobiles. He believed that the same power which switched on an automobile's lights and exploded its gasoline-air mixture could also be used to start the engine, thereby eliminating the nuisance and the danger of hand cranking. The organization of Delco gave him the opportunity of putting this idea into practical form. ~~Storage battery men said no battery could be built with enough capacity to turn over the motor.~~ Electrical engineers said the enormous current demanded would burn out any electric motor that could be made. Automobile manufacturers said it could not stand up for long, even if successful, and then - what about ignition and lighting?

An accident gave Kettering his chance. A friend of Henry M. Leland, founder of Cadillac, was seriously injured while cranking his automobile, the ~~clutch~~ gear-shift of which he had forgotten to disengage. Mr. Leland's grief at the accident drove him to offer Kettering the opportunity for a demonstration of his electric self-starter. The apparatus was installed in a Cadillac car and they drove for an hour in and out of traffic, stopping and starting at will. The delighted Mr. Leland was left at his office thoroughly convinced by the success of the demonstration. Kettering entered the car to drive home, but it absolutely refused to start! Nevertheless, in 1912 Delco was standard equipment on all Cadillac cars, for which it won, in 1913, the Dewar Trophy awarded by the Royal

Automobile Club of London for the greatest advance by any motor car during the year.

One day a customer who, in an emergency, had backed his Cadillac up to the door and used it to light his summer cottage, wrote in to buy a Delco starting and ignition system for use in domestic lighting. Delco was quick to capitalize on the idea. The result was Delco-Light, an electric power plant especially designed for farm and rural residences, another company being formed for its manufacture and sale. The immediate success of this company soon led to the organization of the Domestic Engineering Company, which manufactured other electric power adaptations for the rural market. In 1920 the business of the Guardian Frigerator Company, pioneers in electric refrigeration, was taken over by the Dayton concern. Kettering redesigned the product into Frigidaire and became vice-president of the Frigidaire Corporation.

Another early off-shoot of Delco was the Dayton Metal Products Company, which, at the time of the war, branched out as the Dayton-Wright Airplane Company. This company installed in its planes a new motor, known as the Liberty Motor, for the design of which Kettering was largely responsible.

In 1916 W. C. Durant took over the Dayton Engineering Laboratories Company as part of his United Motors merger, and with that group it became part of General Motors in 1918. The associated companies in which Kettering was a leading factor followed the Laboratories into the General Motors fold within the next few years. Meantime, Kettering had been commissioned to set up and direct research operations for the Corporation at Dayton, under the name of General Motors Research Laboratories. This was incorporated as General Motors Research Corporation, June 12, 1920, and transferred to Detroit in 1925, where it now

occupies a specially constructed building directly back of the central offices of the parent corporation." General Motors Research Corporation has followed other subsidiaries and is now known as Research Section, General Motors Corporation; of this latter corporation Kettering is now Vice President and Director.

Mr. Kettering is a member of the Society of Automotive Engineers, and a Past President of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the National Gas Engine Association. He is a founder of Moraine Park School, Dayton, Ohio, and a trustee of Antioch College, Yellow Springs, Ohio. He is the author of more than fifty articles, both technical and popular, on scientific research and the various products which he has been instrumental in designing and manufacturing. He has received the honorary degree of D.E. from Brooklyn Polytechnic Institute in 1930, and the degree of Sc.D. from Cincinnati, Michigan, and Brown in 1932.

Mr. Kettering is the kind of man who accepts theories from nobody. Above all he must get at the facts for himself. "Research," he says, "is finding out what we're going to do when we can't go on doing what we're doing now."

A dozen years ago he decided we couldn't go on having our automobile engines knock every time they went up hill. But nobody knew just what made them knock. Kettering took the problem to his laboratory and found the knock was not due to the valves, as stated by one half the world; nor was it due to the piston-rods, as stated by the other half of the world. It proved to be caused by too rapid an explosion of the gasoline-air mixture. He tried mixing with the gasoline one chemical after another, till in Detroit his name became almost as noxious as the fumes exhausted from the cars which experimented with his fuel mixtures. At last he found the addition of a small quantity of tetra-ethyl-lead to each

gallon of gasoline slowed up the explosion by just the right amount without unpleasant by-products. "Ethyl gas" is now widely sold throughout ~~at every gasoline station in~~ the country.

But Kettering believes that crude oil is a better fuel than "ethyl gas" and much more economical. So for twenty years he has been making over and improving Diesel engines for ultimate use in transportation by land as well as water. His first patents on an internal combustion engine were taken out ten years ago. His latest patent, granted July 9, 1935, was on a two cycle engine, similar to that which brought the Union Pacific's streamline train into New York on October 25, 1934, with a transcontinental record behind it. General Motors purchased the Winton Engine Company in 1930 in order to make Diesel engines, the latest of which weighs only twenty pounds per horse power.

Not content with having revolutionized transportation by automobile and by airplane, Mr. Kettering, who is now at the height of his powers, believes that in the near future the improved two-cycle Diesel engine will bring about another revolution in transportation, this time both by rail and by water.

Respectfully submitted,

Frederic Paulucci Jr.
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Chairman.

Clarence A. Hall
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H. Freeman Matthews
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