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EDWARD BENNETT ROSA

1861–1921

BY

W. W. COBLENTZ

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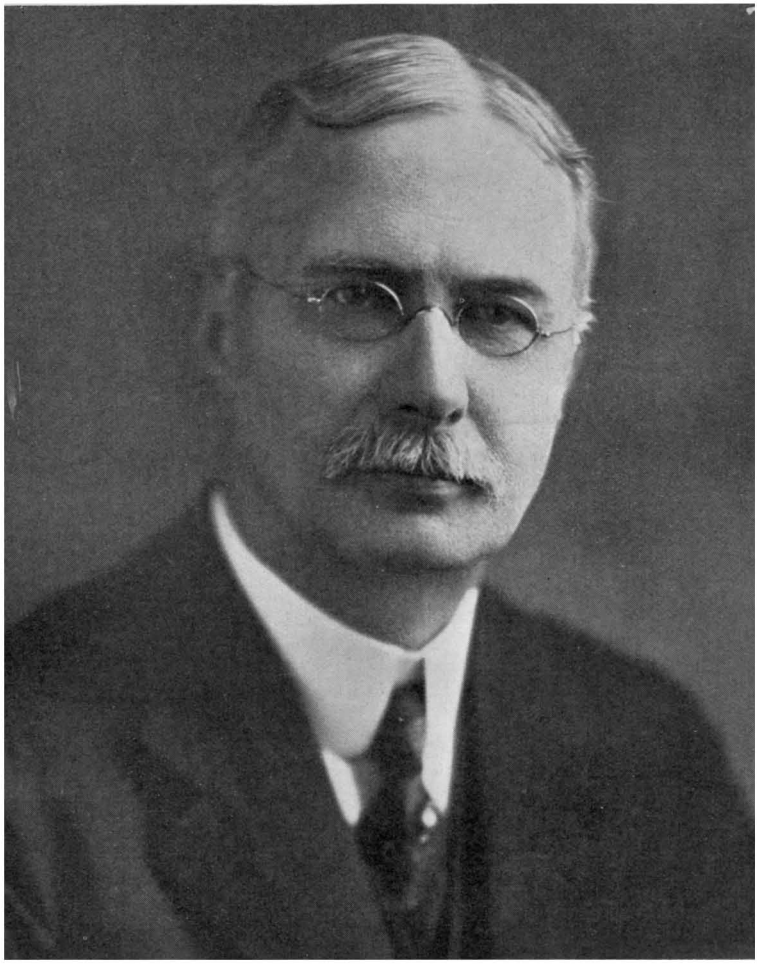

E. D. Rosa

EDWARD BENNETT ROSA

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Edward Bennett Rosa, physicist, was born at Rogersville, Steuben County, N. Y., October 4, 1861, and died suddenly while engaged in work in his office at the National Bureau of Standards at Washington, D. C., in the afternoon of May 17, 1921.

He was the son of Reverend Edward David and Sarah Gilmore (Roland) Rosa; the grandson of Cornelius and Mary (Doty) Rosa; and a descendant of Albert Heymans Roosa, who emigrated from Holland in 1660 and settled with his wife and family of eight children on the Hudson River, near Newburgh, N. Y.

He was married to Mary Evans, daughter of William W. Evans of Harrisburg, Pa., on March 22, 1894. There were no children.

As a son of a Methodist clergyman one can picture Rosa's boyhood days amid religious and educational surroundings that left an impress throughout his subsequent years. His college education was obtained at Wesleyan University, Middletown, Conn., from which he was graduated at the head of his class, receiving the degree of B. S. in 1886.

After leaving Wesleyan University he taught physics and chemistry in the English and Classical School in Providence, R. I., where he remained two years. He then entered Johns Hopkins University as a graduate student in physics (under Henry A. Rowland, elected to the Academy in 1881), and received the degree of Doctor of Philosophy in 1891. In 1906, in recognition of his contributions to science, the honorary degree of Doctor of Science was conferred upon him by Wesleyan University.

During the first part of the year 1890 Dr. Rosa was assistant professor of physics at the University of Wisconsin, leaving there to become associate professor of physics at Wesleyan Uni-

versity, in 1891, and professor of physics in 1892. He retained the professorship of physics (the Charlotte Augusta Ayers' professorship) for ten years, when, in 1901, he was called to the newly-organized National Bureau of Standards, at Washington. There, as physicist, and later on, as chief physicist, he continued through the remainder of his life. His was a short span of three score years—one score of which was spent at the National Bureau of Standards.

In stature Dr. Rosa was tall, well built, of distinguished and healthy appearance. His life out of doors was abbreviated to tennis playing. Its sudden termination was the result of a cardiac disturbance of short duration. The signature under his portrait, taken from an official report, was selected by one of Rosa's former colleagues, as being representative of his style when he was "feeling fine," and not overcrowded with work. But even then he was fairly deliberate in thought and action.

Dr. Rosa's interests in science and his outlook upon life were broad. While he was not of the jovial type he was not without a sense of humor. The writer recalls a staff meeting at which a fellow member described a complex electrical device, said to be capable of a wide range of uses. It was provided with a series of automatic blocking switches to make it "fool proof" from accidents. So much emphasis was placed upon the "fool proof" feature that Rosa finally interrupted the presentation with the comment that "fools should not be allowed to work with it." This remark represents more than humor. It represents Dr. Rosa's administration of his division of the Bureau with the best of equipment and the best of assistance to conduct a magnificent program of work, some of which was in competition with similar, older foreign institutions.

Dr. Rosa was fully conscious of the possible narrowing influence of high specialization, such as obtains in the National Bureau of Standards, and at a meeting of the Bureau's Physics Club (devoted to a general review of scientific papers), he once digressed from the topic under discussion, to emphasize that an inevitable consequence of high specialization is that "we grow taller and thinner." To the writer this condition seems prefer-

able to desiccation, or "flattening out" as a result of attempting to "broaden out"—a common failing. However, in the National Bureau of Standards, which owes part of its high standing to Dr. Rosa and to which Rosa, in return, was indebted for the opportunity to develop his latent abilities, the percentage of "flats" is relatively small.

In his personal relations with the other large subdivisions of the Bureau, Rosa was very human, guarding jealously the interests and accomplishments of his own division, yet withal proud and fair in his appraisal of the accomplishments of other divisions. The writer has reason to know this to be the case. For in his search for new thermoelectric material, and in his development of bolometers and of magnetically highly shielded Thomson galvanometers (all electrical instruments), "for use in radiometry," the writer was constantly overstepping the imaginary boundary between the Optical Division and the Electrical Division of the Bureau. While this sometimes appeared to be disappointing to Dr. Rosa, nevertheless he was evidently pleased with the development of these instruments, particularly the galvanometer; for he brought it to the attention of the members of his staff, who met at his home one evening for a discussion of work in his division.

Dr. Rosa's research work began at Wesleyan University, where in association with Professor Wilbur O. Atwater, he developed the physical side of the respiration calorimeter, known under the joint name Atwater-Rosa respiration calorimeter. The practical details of the construction of the instrument were chiefly Dr. Rosa's. This apparatus was of great value in the pioneer investigations of the value of foods, and in the study of problems in nutrition.

While at Wesleyan University he invented and developed a curve tracer (the Rosa curve tracer) for delineating the form of alternating electric currents, a problem of interest in the operation of alternating current machinery. The original curve tracer is still to be seen in the physical laboratory of Wesleyan University.

Probably the most important epoch in Dr. Rosa's scientific life began in 1901 when he undertook work at the National Bureau of Standards, under the directorship of Dr. Samuel W. Stratton (elected to the Academy in 1917). At that time the major divisions in the Bureau were: I, Electrical; II, Weights and Measures; III, Heat; IV, Optics; V, Chemistry—each subdivided into sections, which increased in number with the complexity of the work involved.

In those days, the second in command was Dr. Rosa, ranking physicist and chief of the electrical division, where from the start he proved his abilities as an efficient administrator. He kept in intimate contact with each section, and, in collaboration with his section chiefs and their assistants, he conducted researches; notably in photometry, inductance, capacitance, etc., as evidenced by the appended bibliography of published papers. While this did not "make men," it unquestionably was the best arrangement for the accurate determination of the fundamental electrical constants, which required the mature judgment of all who were engaged in that work.

When Dr. Rosa began his work in the Electrical Division of the National Bureau of Standards it was his ambition to determine a number of the fundamental electrical constants to a degree of accuracy far exceeding all previous determinations. To partly attain this goal he was singularly fortunate in having as a co-worker, Dr. N. E. Dorsey.

One of these determinations was the ratio of the electromagnetic and the electrostatic units. This work was started early in 1907 in conjunction with Dr. Dorsey, through whose skillful and painstaking experimental technique there resulted the most accurate determination yet made of this constant.

About 1907 Dr. Rosa with Dr. Dorsey started their determination of the absolute value of the ampere. This work extended over a period of years, and gave a more reliable value of the ampere than any previously obtained. In order to obtain a concrete representation of the ampere, Dr. Rosa with the assistance of Dr. G. W. Vinal carried on an investigation of the silver voltameter simultaneously with the absolute determina-

tion of the ampere, and it is largely as a result of this work that we are now able to define the ampere in a satisfactory manner.

Dr. Rosa served as secretary of the International Technical Committee on Electrical Units and Standards. In order to attain a better understanding of the methods used, and a better agreement in the results, he was instrumental in procuring an interchange of workers in the three national standardizing laboratories—Great Britain, France and Germany.

In the accompanying photograph is shown an informal gathering of part of the International Technical Committee on Electrical Units and Standards, (left, Dr. (now Sir) Frank E. Smith of the National Physical Laboratory of Great Britain; center, Prof. F. Laporte, of the Laboratoire Central d'Electricité; and right, Dr. Rosa) taken at the National Bureau of Standards in the spring of 1910, when this committee was engaged in an intercomparison of the silver voltameters, standard voltaic cells and standard resistances (in use in their respective countries) with those at the Bureau of Standards.

This interchange of workers, apparatus (standard incandescent lamps as standards of the luminous intensity, standard voltaic cells, and standard resistances, etc.,) and of ideas, has been of inestimable value in establishing the electrical and other units upon a high plane of accuracy.

About this time the problem of electrical capacity and inductance occupied Rosa's attention. He devised methods for measuring these quantities, and, in some cases, with the assistance of Dr. Louis Cohen, made calculations of the electrical characteristics of coaxial coils (Bibliography papers 60 to 66). The absolute measurements of inductance and capacity were made with Dr. F. W. Grover (papers 53 to 56). The final contribution consisted in collecting all the known formulas for computing inductance, which collection is reported to be in use the world over.

During this formative period of the National Bureau of Standards, Dr. Rosa contributed considerably to the establishment of units and a standard nomenclature in photometry. With E. C. Crittenden and A. H. Taylor he conducted researches on

the flame standards. He took a leading part in securing international agreement on a standard of luminous intensity, maintained by intercomparison of a series of incandescent lamps that are frequently interchanged among the national standardizing laboratories.

Looking back over all these years of activity in the National Bureau of Standards, it would appear that almost everything was happening in the second epoch of its history, beginning in the spring of 1905, when the Bureau was moved from its temporary quarters, located in old dwellings down town, into its new quarters in the then open fields, in the suburbs of Washington.

One of the "new things" was the observation by Dr. Dorsey that the value of the standard resistances, used by him in the determinations of electrical constants then in progress, underwent a seasonal change, which subsequently was found to depend upon the humidity. The writer vividly recalls Rosa's mental perplexity in describing the phenomenon as they rode to the Bureau—by street car, the mode of transportation in those days. The standard resistance boxes then in use consisted of coils of wires wound on wooden spools, covered with shellac, and sometimes paraffin. The shellac, being hygroscopic, evidently changed the tension on the wires (with change in humidity), and hence the resistance, by a sufficient amount to be detected by the observant Dorsey. Characteristic of his thoroughness, Dr. Rosa promptly started an investigation of this question (see Bibliography paper No. 69), and brought out a new design of resistance coil, wound on a metal form and sealed in kerosene oil, which became the model for subsequent standard resistances.

Dr. Rosa devised a new apparatus for determining the absolute value of the ohm. Models of this apparatus, which were tried in 1908 and 1909, gave promise of satisfactory results. However, the pressure of other work compelled the abandonment of this project; though he always hoped the time would soon come when it could be continued.

In 1910 under Dr. Rosa's direction an exhaustive investigation was instituted into the subject of electrolytic corrosion of

underground gas and water pipes, and lead cable sheaths, due to stray currents from electric railways. This problem has for years been one of major importance to public utility companies throughout the country, and prior to the work taken up under Dr. Rosa's direction at the National Bureau of Standards very little definite information was available as to the laws governing electrolytic corrosion or the methods of mitigating corrosion from this source. The work done under his direction included a definite establishment of laws governing electrolytic corrosion, and much progress was made in mitigating trouble of this nature. This work has for a number of years been carried on in close cooperation with the utility interests of the country through the medium of the American Committee on Electrolysis, of which Dr. Rosa was a member.

During the War, Dr. Rosa directed the development of a number of scientific instruments which were of great value to the American Forces in France. Among these were a sound ranging device for locating big guns; the geophone for the detection of mining operations; the development of aircraft radio apparatus; and the improvement of radio direction finders by which enemy ships and air craft could be located.

Under his direction at the National Bureau of Standards was established perhaps the finest radio research laboratory in the country, and he always showed an intense interest in improving apparatus and methods of radio communication.

In addition to his diversified work in the field of electrical research, Dr. Rosa was keenly interested in the prevention of industrial accidents and in the promulgation of safety standards for use by state, municipal and insurance organizations. He conceived the idea of a National Electrical Safety Code, and the present code is largely the result of his efforts. Similarly the Bureau undertook a number of other national safety codes, the Safety Code Section working under his direction.

His broad vision showed him the need of a central clearing house for engineering standards. For years he worked wholeheartedly to bring about the formation of such an organization.

It was due in no small measure to his efforts that the American Engineering Standards Committee is now functioning.

One of the popular diversions is the repeated portrayal of employes (Federal, state, and city) as a clamoring group of mendicants, ever ready to receive the semi-monthly dole of salary and ever ready to dodge service. The unfairness of the criticisms must have irked Dr. Rosa, as it has others. He alluded to it in his analysis of the employment policy of the Federal Government, in an address entitled "Civil Service Reform—a Reorganized Civil Service," before the Washington Academy of Sciences on October 23, 1920, and in his analysis of "Expenditures and Revenues of the Federal Government," presented before the American Academy of Political and Social Science, May, 1921. At the time they were issued these papers were quoted by leading periodicals, as well as in both Houses of Congress; and even after a lapse of almost fifteen years they are still commended for their accuracy and their freedom from political bias. While this sketch is being written the writer has before him a letter, dated July, 1934, in which the author (a civil service officer) expresses his surprise as to "how much of the (Rosa) article has a vital bearing upon present civil service problems."

According to one of the writer's informants, the analysis of government expenditures and revenues came about soon after the world war, when Rosa advocated, before the Congressional Appropriations Committee, the expenditure of more money on research, and was told that it would bankrupt the government. Characteristic of the man, Rosa then presented his charts, showing that, of the total net expenditures for the fiscal year 1920, amounting to $5,687,712,848, only $57,368,774 (1.01 per cent!!!) was expended on research, education and development, as compared with 23.7 per cent on the army and navy, and almost 70 per cent on obligations arising from previous and recent wars. In making these comparisons, which appeared somewhat invidious, Dr. Rosa distinctly emphasized his belief in adequate military preparedness. His analysis showed that in 1920, of the total of $53.46 per capita revenue collected through taxa-

tion, only 54 cents was spent for research, education and development; and he was led to wonder whether, instead of this 54 cents per capita, "if twice as much had been spent, it would not have made the burden of taxation lighter instead of heavier, by rendering a greater service to the people and creating wealth and aiding industry in larger measure."

In 1900 the Eliott Cresson Medal of the Franklin Institute was bestowed upon him in recognition of his work with the respiration calorimeter. That he did not receive more recognition is noticeable; but in these days, with the newspapers filled with pictures of people receiving trophies and medals for every conceivable achievement, however trivial, such recognition would probably have meant but little in Rosa's busy life.

Dr. Rosa was a charter member and one of the officers of the Federal Club, an organization of executives of the various governmental departments. He was a Fellow of the American Institute of Electrical Engineers, the American Philosophical Society, the American Physical Society, the American Association for the Advancement of Science (Secretary, Section B, 1898; Vice President, 1910); and a member of the National Academy of Sciences (elected in 1913), the Illuminating Engineering Society, the Philosophical Society of Washington (vice-president, 1907-12; president, 1912); the Washington Academy of Sciences, the American Engineering Standards Committee, and the (secretary) International Committee on Electrical Units and Standards. He was a member also of the Cosmos Club of Washington, and the Delta Kappa Epsilon Fraternity.

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