Electrical Engineering Hall of Fame

EDWIN W. RICE, JR.

In 1931, the American Institute of Electrical Engineer (AIEE) selected Edwin W. Rice, Jr. (Fig. 1) as the recipient of Edison Medal. He was cited "for his contributions to the development of electrical systems and apparatus and his encouragement of scientific research in industry." Earlier, he had served as president of the AIEE during 1917–1918. He was an engineer–inventor who received more than 100 patents during his career. However, his greatest renown was achieved as an effective director of engineering research and development during his long tenure with the General Electric (GE) Company.

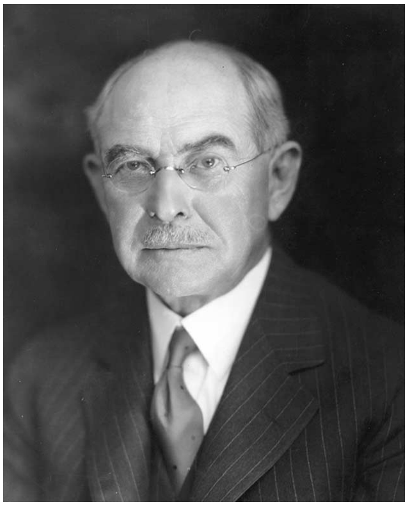

Fig. 1. *Edwin W. Rice, Jr. (courtesy of IEEE History Center, Piscataway, NJ).*

I. EARLY EDUCATION

Edwin Wilbur Rice, Jr. was born 6 May 1862 in La Crosse, WI, where his father, a graduate of Union Theological Seminary, was doing mission work for the American Sunday School Union. Rice was only about two years old when his mother died in 1864. His father remarried and the family moved to Philadelphia, PA, in 1870 where his father continued his career as a writer, editor and fund raiser for the Sunday School Union. The younger Rice developed an interest in electricity and its applications while attending the Central High School in Philadelphia where he graduated in 1880. His interest was inspired by Elihu Thomson (Fig. 2) who had joined the faculty in 1872 and already was becoming known for his expert knowledge in electrical power engineering. Thomson had visited electric arc-lighting plants during a trip to Europe in 1878. He became a partner with Edwin J. Houston (Fig. 3) who also taught at Central High School, and they began installing arc-lighting plants in Philadelphia during 1879. The following year, they organized the American Electric Company, and Rice was hired as Thomson's technical assistant soon after his graduation.

The AIEE awarded the 1931 Edison Medal to Edwin W. Rice, Jr. "for his contributions to the development of electrical systems and apparatus and his encouragement of scientific research in industry."

II. THOMSON-HOUSTON ELECTRIC

In 1882, a group of investors in Lynn, MA, purchased a controlling interest in American Electric and changed its name to the Thomson-Houston Electric Company. One of the investors, Charles A. Coffin, was selected as the company president with Thomson as chief engineer. A manufacturing

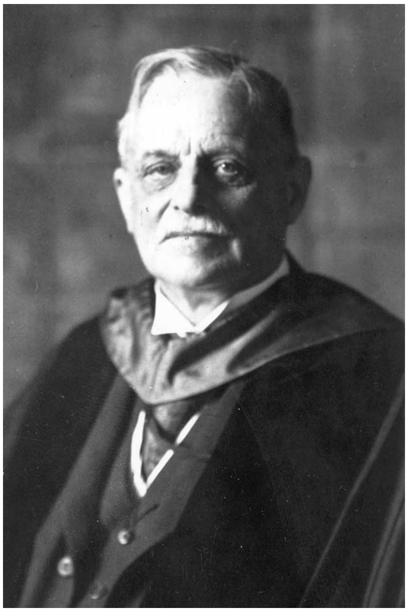

Fig. 2. *Elihu Thomson (courtesy of IEEE History Center, Piscataway, NJ).*

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Fig. 3. *Edwin J. Houston (courtesy of IEEE History Center, Piscataway, NJ).*

Fig. 4. *Charles P. Steinmetz (courtesy of IEEE History Center, Piscataway, NJ).*

plant was established in Lynn where Rice became plant superintendent and Thomson's principal technical assistant. During the next decade, Thomson-Houston acquired a number of electric light and street railway firms and became a strong competitor with Edison General Electric and the Westinghouse Electric Company. Rice gained knowledge and experience as Thomson-Houston diversified from arc to incandescent lighting and from direct-current motors and generators to ac applications and machinery. The company also produced electrical instruments and electric-welding apparatus.

In 1891, Rice attended an international electrical exhibition in Frankfurt, Germany. While there, he observed an impressive demonstration of three-phase power transmission over a distance of about 100 miles from a generating plant in Lauffen to Frankfurt. The demonstration also featured an innovative ac generator with a fixed armature and rotary field designed by the Swiss engineer, Charles E. L. Brown. Polyphase motors with ratings up to 100 hp also were operated using the power transmitted from Lauffen. Rice initiated developmental work on a polyphase system at Thomson-Houston soon after his return from Germany, and the work continued after the company merged with Edison General Electric to form General Electric in April 1892. Rice decided to continue his career with GE although Thomson became less active after the merger except as a consultant.

III. TENURE AT GE

Soon after the formation of GE, Rice participated in the decision to purchase the electric streetcar business, including patent rights, of the Eickemeyer and Osterhold Company of Yonkers, NY. Perhaps more importantly, the transaction resulted in GE's acquisition of the services of the gifted electrical engineer, Charles P. Steinmetz (Fig. 4), who had worked for Eickemeyer since arriving from Germany in 1889. Rice later recalled his first encounter with Steinmetz during a visit to the Eickemeyer shop. Rice wrote that Steinmetz's "enthusiasm, his earnestness, his clear conceptions and marvelous grasp of engineering problems convinced me that we had made a great find." Steinmetz joined the so-called Calculating Department in Lynn, MA, in February 1893. He first became known by American electrical engineers for his extraordinary experimental and theoretical investigations of hysteresis and eddy-current losses in ac apparatus. He also developed a comprehensive methodology for ac analysis based on the concept of impedance and the use of complex numbers.

In 1894, Rice and Steinmetz moved from Lynn to the GE plant in Schenectady, NY, with Rice as chief

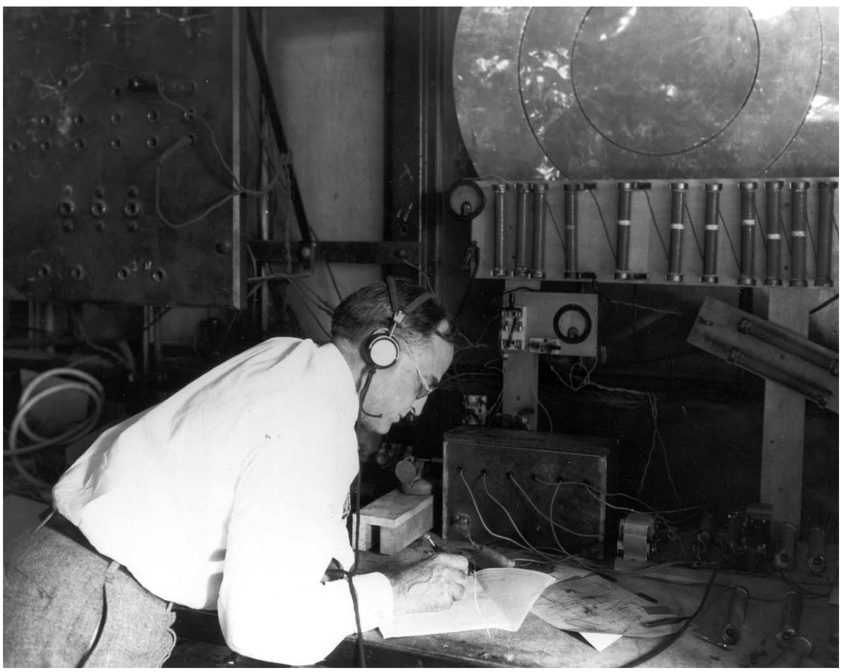

Fig. 5. *Willis Whitney (courtesy of IEEE History Center, Piscataway, NJ).*

engineer and Steinmetz as head of the calculating department. Rice also became a company vice president in charge of the engineering and manufacturing departments in 1896. He presided over a very talented group of engineers including such luminaries as William Emmet and Ernst Alexanderson as well as Steinmetz. Willis Whitney (Fig. 5), longtime director of the GE Research Laboratory, later wrote that Rice had assembled a "great, coherent group of electrical specialists" including "highly individualistic engineers, strong-minded egoists, weak-minded altruists, sanguine inventors, phlegmatic pluggers, systematic workers, optimistic spenders, and pure researchers." Whitney concluded that "it was a larger group of more varied personalities, more temperamental artists than any impresario ever tried to direct." Rice was said to have nurtured "teamwork of a spontaneous and joyous nature" inspiring a sense of "loyalty of the kind that men have for a cause." He recognized the importance of skilled shop work and actively encouraged creativity on the shop floor as well as among his design engineers.

Rice instituted the "development jobs" system of budgeting under which each project received a periodic appropriation. This system enabled a managerial review of the project when a new appropriation was requested by the project leader. This allowed the cumulative cost to be tracked and reflected accurately in the price of a resulting product. Rice also established a company publication unit with the responsibility of screening technical papers or bulletins written by GE employees to insure that proprietary information was not disclosed prior to the issuance of patents.

IV. ELECTRIC POWER, RADIO SYSTEM, AND VACUUM-TUBE ELECTRONICS

Rice's tenure at GE was notable for rapid technological change in the field of electric power and a continuing series of formidable undertakings by the company. In September 1893, GE completed the installation of a three-phase plant in Redlands, CA. The power generated by a 500 kW hydroelectric station was transmitted over a 7.5 mi long transmission line to Redlands at a voltage of 2.5 kV and a frequency of 50 Hz. The company also had an exhibit of three-phase motors at the Columbian Exposition (Fig. 6) held in Chicago in 1893. Sidney B. Paine, a GE sales engineer, played a key roll in convincing the textile industry to begin replacing its traditional belting and shafting system with ac motors during the 1890s. The company also became the industry leader in the manufacture of electric streetcar motors and had sold about 30 000 by 1898.

Fig. 6. *Columbian Exposition (courtesy of IEEE History Center, Piscataway, NJ).*

During the 1890s, GE also initiated development of electric-powered locomotives for interurban service and conducted successful tests of a prototype for the Baltimore and Ohio Railroad during the fall of 1895. Including the motors, this engine weighed about 95 tons and delivered a continuous tractive force of 47 500 lb. One of GE's more important traction projects was the electrification of the New York Central Railroad beginning in 1903. The first GE locomotive tested under this contract was completed in 1904, and it employed four motors with each rated at 550 hp. Reportedly, this type of locomotive "proved extraordinarily rugged, and at least one

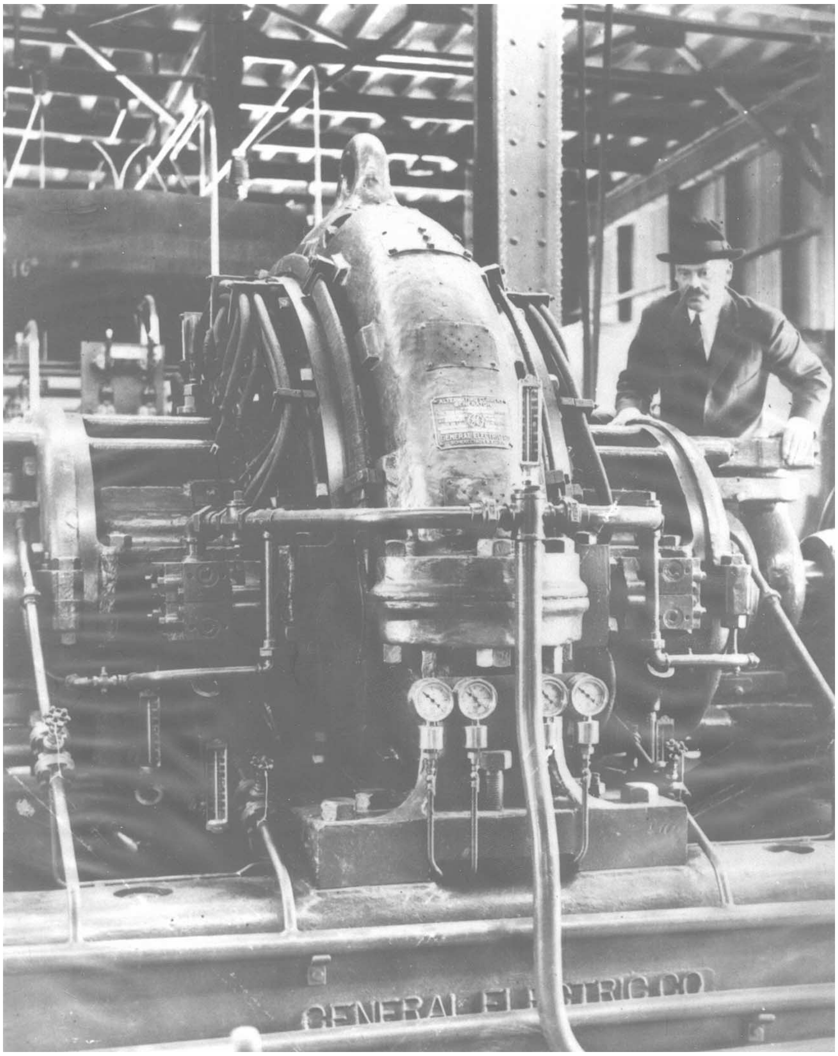

Fig. 7. *Ernst Alexanderson with generator (courtesy of IEEE History Center, Piscataway, NJ).*

was still in service as late as 1975." GE also became the industry leader in the development of high-speed turboelectric generators to replace slow-speed generators driven by reciprocating engines. In 1903, the company installed a turboalternator rated at 5000 kW in a power plant owned by the Commonwealth Edison Company in Chicago, IL. During the next five years, GE manufactured about 56% of the total installed capacity of 1.8 million kW of turboelectric generation. This compared to about 33% produced by the Westinghouse Company and 11 percent by Allis-Chalmers.

Rice strongly supported GE's entry into radio and vacuum-tube electronics during the first two decades of the 20th century. One of his group of engineers, Ernst Alexanderson (Fig. 7), became the company's lead innovator in this effort after being assigned to design a high-frequency radio alternator for an outside customer, Reginald Fessenden, in 1904. This beginning stimulated a continuing research and development effort which, by 1918, had produced a complete transoceanic radio system. It was based on a 200 kW radio alternator along with auxiliary apparatus including modulators, antennas and vacuum-tube receivers. The Alexanderson system provided the technological basis for the founding of a new company, the Radio Corporation of America (RCA), in 1919. Drawing on its years of experience with incandescent lamps, GE began its development of electronic tubes by 1913. The company manufactured a large number of triode tubes, which it initially called pliotrons, for use in military communication equipment during the First World War.

Rice became the president of GE in 1913 and held the position until his retirement in May 1922. In 1916, he delivered a speech at a meeting of the National Industrial Conference Board which included representatives from several associations of industrial employers. Rice predicted an economic struggle between the industrial nations following the end of the war in Europe. Consequently, he urged recognition that the "day of extreme individualism is past" and that greater cooperation between American industrial corporations would prove "essential to the maintenance of our industrial prosperity." Appropriately, one of Rice's last achievements as GE president was his participation in the successful negotiations of cross-licensing agreements for radio-electronic patents among GE, RCA, AT&T, and Westinghouse. A proportional allocation of radio equipment manufacture and sales became part of the overall agreement reached in June 1921.

Rice died 25 November 1935 at age 73. His long professional career had well demonstrated the importance of effective leadership in fostering creative engineering and innovation in the corporate environment. ■

James E. Brittain