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OF

HARRIS JOSEPH RYAN

1866–1934

BY

W. F. DURAND

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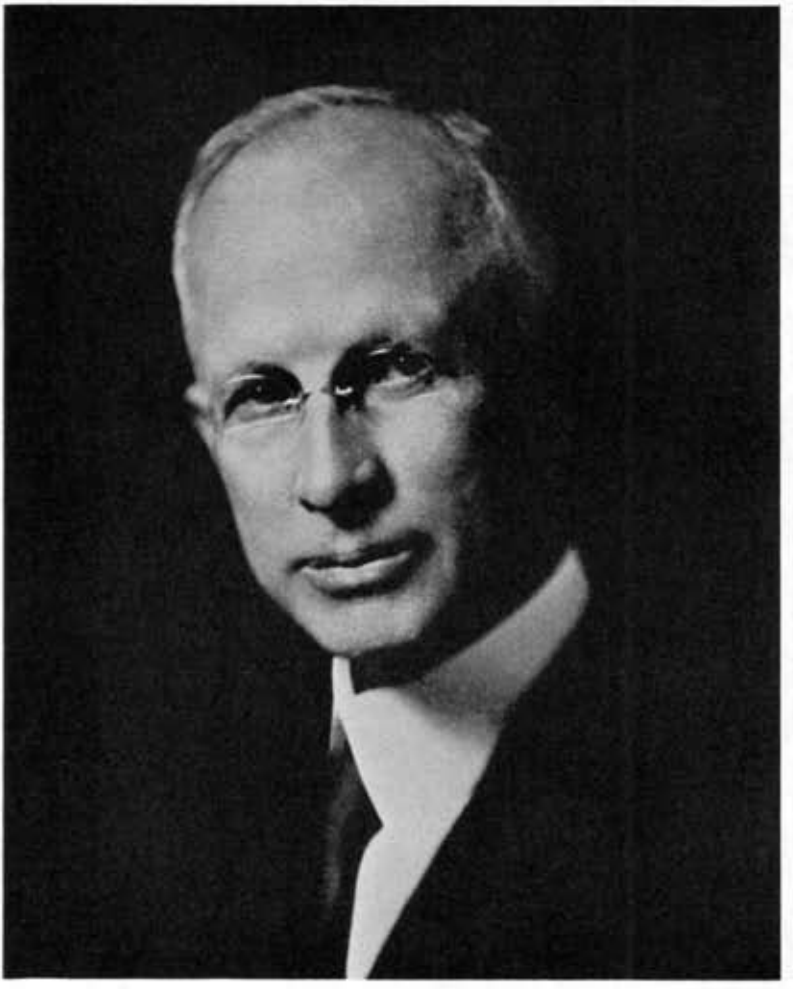

Harris J. Ryan

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The family of Professor Harris Joseph Ryan on his father's side traces back to pre-revolutionary Irish stock in the person of an enterprising lad who, sometime perhaps about the middle of the eighteenth century, came to this country and took up land in Pennsylvania, married and finally settled down in what later became the little town of Matamoras (post office, Powells Valley). The family flourished, and some three or four generations later, on January 8, 1866, there was born to Charles W. and Louisa M. (Collier) Ryan, a son who was christened Harris Joseph. On the mother's side, the Colliers traced back to early Scottish stock which, intermarrying with the German and other early Pennsylvania stocks, furnished much of the sturdy backbone of the rural population in east central Pennsylvania as found there during the nineteenth century.

When Ryan was still a small boy, his father moved from the farm in Matamoras to Halifax where he had interests in lime kilns and later became cashier of the Halifax National Bank, which position he retained until his death in 1901.

Ryan's first schooling was in a country school in Matamoras, following which he passed a few years in the schools of Halifax, and later in a school at Mt. Airy, Philadelphia. These earlier periods of schooling covered what would now be called the "grades," following which he covered the requirements for college entrance, partly at the Baltimore City College and partly at the Lebanon Valley College.

It is always fascinating to speculate on what might have been the future career of a man of mark if, when at some crossroads of life, he had taken a turning different from that actually followed. So here, the natural turn for young Ryan, with college preparatory in Baltimore and vicinity, would have been to plan ultimately for Johns Hopkins (then a post graduate institution only) and this would presumably have been the course followed

but for an accidental meeting with an enthusiastic young student from Cornell at home on a vacation.

The picture of life at Cornell and of the opportunities to be found there proved so alluring to young Ryan that all other plans were put aside and he entered Cornell in 1883.

His interest in science had early begun to appear. There is extant in the family a story of demonstrations which, as a school boy, he carried on with a miniature chemical outfit which his father had given him, much to the interest and wonder of friends and relatives.

There was growing interest likewise in the field of physics, or "natural philosophy" as it was then often called, and with increasing maturity, especially in the domain of electricity which, in the early eighties was just beginning to give some faint indications of the part it was soon to play in our modern civilization. With these trends of interest, it was only natural that at Cornell, his immediate objective would be the course in electrical engineering just at that time announced in the Department of Physics under Prof. Wm. A. Anthony.

In 1926, on the occasion of the award of the Edison Medal to Professor Ryan, referring in his response to this period of his life he said:

"Forty-three years ago this fall I entered Cornell as a freshman to take up the curriculum in electrical engineering, that had just been established and for which students were being admitted for the first time. The electrical engineering laboratory of the University was little more than the electrical section of the physics laboratory of that day. The little more was one direct-current generator invariably referred to as the Gramme dynamo that was built by Professor Wm. A. Anthony, the 1890-1891 President of the Institute.

"Professor Anthony visited France immediately after 1872 when Gramme had completed his direct-current generator, generally conceded to have been the first direct-current dynamo of size adequate to reveal its possibilities in the engineering industries. Professor Anthony visited Gramme, saw his generator, and on returning to Cornell immediately set about to construct a replica thereof. It was completed in 1874 and exhibited just a half century ago at the Centennial in Philadelphia. Curricula in electrical engineering at Columbia, Cornell and other uni-

versities were announced somewhat less than ten years after the Centennial."

In this way the young student Ryan came under the stimulating leadership of Professor Anthony, who, perhaps more than any other of his teachers, exercised a guiding influence into and along the lines of work which later became his chief life interest.

In this connection a letter which he wrote to Mr. F. J. Sprague under date of June 7, 1932, on the occasion of a birthday dinner to Sprague in New York City, is likewise of interest. In this letter he recalls a visit made by Professor Anthony to the Sprague Works in New York in the winter of 1886-87 with a small group of his students, among whom he (Ryan) was present. He then recalls to Sprague that, in the conversation between himself and Anthony, he (Sprague) said in substance, "In my studies I have found that economy in the electrical transmission of power will be directly proportional to the voltage and inversely proportional to the distance." And then continues Ryan to Sprague, "Thus this started me out in life with a never ending enthusiasm for the study of high voltage phenomena."

The Cornell of 1883 was an institution of only slightly over four hundred students. There was only one building available for dormitory purposes and this was mostly occupied by younger members of the teaching staff. Most of the students lived down near the foot of the hill or in the nearer parts of down town Ithaca. Ryan's life at Cornell was much like that of other students of those days. Naturally studious and with his interests continuously stimulated by his environment, he gave himself with enthusiasm to his studies.

During this period of student life he evidently made a deep impression on Professor Anthony as a young man of exceptional promise. This resulted in his being selected by Professor Anthony, in his senior year, as his immediate assistant in much of the special work with which he was engaged in those days. The "copper house" and the great tangent galvanometer therein were for many years landmarks at Cornell, recalling Professor Anthony's pioneer work, especially in connection with the establishment of electrical standards. The copper house and the

tangent galvanometer were built during Ryan's student days and he was privileged to work directly with Professor Anthony, not only in the building and installation of this equipment, but also to share with him in some of his pioneer work in which this equipment played a major role.

So passed the years until 1887, when, graduating with a high record, he was offered an instructorship in physics; but, during his later years at Cornell he had made the acquaintance of two students there for graduate work, J. G. White, founder later of the engineering firm of J. G. White and Company of New York City, and Dugald C. Jackson, later distinguished educator and author in the field of electrical engineering. In these years electrical engineering as a profession was the youngest of the great divisions of engineering work. The American Institute of Electrical Engineers was organized in 1884, the year after Ryan's entrance into Cornell. Nevertheless there were then men of vision who foresaw, even though dimly, some part of the great role which it was destined soon to play in carrying forward the developments of the next half century. White, Jackson and Ryan had such faith and such vision; and White and Jackson, planning for the period following the completion of their graduate work, had gotten from Ryan a promise that he would join them in the formation of a company for the active development of projects in the field of electrical engineering in some promising section of the country.

White, having finished his work in 1886, had taken a teaching position in the University of Nebraska at Lincoln and the following year, in 1887, Jackson and Ryan joined him in Lincoln, and White, resigning his position in the State University, these three young pioneers organized themselves into the "Western Electric Company" and carried on actively in Lincoln and the surrounding territory.

This association lasted for about a year; but in the meantime the call of the class room and of life at Cornell had begun to assert itself with growing strength, and, the offer of the instructorship having been repeated, Ryan returned to Cornell in 1888 and took up his work as Instructor in Physics.

In 1885 Dr. Robert Henry Thurston had come to Cornell

from Stevens Institute, as Director of the Sibley College of Mechanic Arts. Dr. Thurston came to Cornell with large plans for widening the scope of Sibley College, for improving its standards and for making of it an engineering school of the highest standing—plans which in gratifying degree were realized, as witness the reputation which this college has enjoyed in later years. Among his first moves for such widening and improvement was the plan of giving distinct recognition to electrical engineering, and of laying down a distinct course in Sibley College, leading to a degree in electrical engineering, and sufficiently divergent in requirements from those for the course in mechanical engineering, to permit of suitable training in electrical theory and correlative laboratory practice.

By the summer of 1888 the time seemed ripe for a definite move toward the realization of these plans.

As noted earlier, the first announcement of special instruction in electrical engineering at Cornell was in the University Register for 1883-84. In that year the trustees gave formal recognition to the earlier work of Professor Anthony and authorized the faculty to "announce a course of study in electrical engineering leading to a degree". The Register, in outlining this course, refers to the "demand for thoroughly trained engineers conversant with electrical science" and to "special studies embracing the construction . . . of dynamo machines and the methods of electrical measurements, electric lighting and the electrical transmission of power." In accordance with these plans, Professor Anthony continued in the direction and development of this work in electrical engineering until 1887 when he left Cornell to undertake electrical development work along industrial lines. At Cornell, Professor Anthony was succeeded in the Department of Physics by Professor E. L. Nichols, and a year later an Assistant Professor of Electrical Engineering was appointed in Sibley College. By understanding between Sibley College and the Department of Physics, it was agreed that the work in electrical engineering would be divided between the two, the former taking over what might be called the more professional aspects of electrical engineering, while the latter would continue to give courses in the scientific background, in

electrical measurements and in dynamo laboratory practice. This general arrangement continued for some years, with a gradual further shift of the work from the Department of Physics to Sibley College. In the meantime, as noted, Ryan, during the year 1888, held his position as Instructor in Physics, but his work, in pursuance of the arrangement noted above, was almost wholly in electrical engineering subjects.

At the beginning of the academic year 1889, the incumbent in Sibley College leaving to take up other work, Ryan was appointed to his place as Assistant Professor of Electrical Engineering in Sibley College and took up his work in the fall of that year in such capacity.

No attempt will be made at this point to appraise in detail his work during the next sixteen years at Cornell. It was characterized by intense activity, notable achievement, and phenomenal growth in the number of students seeking instruction under him. This was due in part to the rapid growth of electrical engineering in those days, but also in no small part, to the faculty which he had of inspiring and stimulating all who came into contact with him in the relation of pupil and teacher.

In the closing months of 1903, Dr. Thurston, Director of Sibley College, died, and in the spring of 1905 there came from Stanford University, California, an offer to head the Department of Electrical Engineering in that institution. The head of his department in Cornell and a full professor in rank, no prospects could have seemed fairer. Beloved by both students and colleagues and with a distinguished record of success both as a teacher and in his personal contributions in the domain of electrical engineering, there was no reason for making a change beyond what may perhaps be termed the call of the West. Stanford University, California and the wide Pacific, all beckoned, and resigning from Cornell he took up his duties in Stanford in the fall of 1905. Here he remained in active service until his retirement as Emeritus Professor in 1931. Following his retirement, with health somewhat impaired, he spent most of his time quietly at his home in Palo Alto, much occupied, among other things, with studies relating to the deaf and the application of electrical aids to hearing for the alleviation of

this all too common handicap to human activity. He had, himself, in his later years suffered from this limitation, and had obligingly submitted himself as a subject to the successive forms of equipment devised in the research laboratories of the American Telephone and Telegraph Company as aids to hearing. Helped as he was by the improving efficiency of these devices, he was anxious that others, so far as possible, should share in such benefits and from this desire came the studies which occupied much of his time in these later years.

However, these studies and other matters on which he was thinking were brought to an end in the spring of 1934 by a cerebral hemorrhage which left him with partial paralysis on one side of the body. Following this came a gradual improvement and he was making fair progress toward a comfortable condition of recovery, when on July 3, 1934, a cardiac weakness placed a period to his life.

Such, in bare outline, are the more controlling features of the life of Professor Ryan.

In approaching some account of his professional and scientific achievements, attention is immediately arrested by the third item in the list of his published papers. It is rare, in the scientific work of a man of mark, that so wide a recognition is gained by his third published paper. Speaking of this period of his life, on the occasion of the award of the Edison Medal in 1926, Ryan said:

"In the fourth year of the Institute [A.I.E.E.] I began my work as a faculty man at my alma mater. I found that I was wholly unprepared to assist my students effectively to an understanding of things without end, encountered everywhere; particularly was this so, as matters stood in that day, for the transformer in the alternating-current circuit and the armature reaction effects in the continuous current machine. The alternating-current system for economic incandescent lighting so well suited for the needs of the new rapidly growing American towns and cities had been introduced three years before, i.e., in 1885-6 and its use was being extended rapidly.

With the aid of a friend of my student days, Ernest Merritt, past president of the American Physical Society, I worked through the summer of 1889 upon the problem of systematic measurement upon a particular transformer in sufficient detail

to meet our requirements for teaching. The work was done at Buffalo, New York, through the courtesy of C. R. Huntly, Executive, and H. H. Humphreys, Engineer, of a lighting company of that city. We selected for our specimen a 10-light, 2000 to 50-volt, 133-cycle transformer.

Through Dr. E. L. Nichols, past president of the Institute, I was invited to present a paper based upon our work on the transformer and the results obtained. The paper was duly prepared and presented at the December, 1889, meeting of the Institute in New York City and was published in the Proceedings in January, 1890."

This paper attracted wide attention, both in this country and abroad, and marked the author out as a pioneer in the effective application of the scientific method to the study of the alternate-current transformer, just then beginning to take an established place in the forefront of electrical industry.

In this investigation by Ryan and Merritt, there was obtained, so far as is known, the first complete record of the instantaneous values of the voltage throughout a complete cycle of an alternating current circuit.

In Ryan's work on alternating current phenomena, following soon after his work on the transformer noted above, much use was made, as a tool of research, of the cathode ray indicator or oscillograph, as it has since come to be called. The cathode ray—an indicator without sensible inertia and susceptible to influence by either a magnetic field or an electrostatic field—was, of course, known since the time of Crookes, and had been used in some forms of scientific research. But, so far as is known, it had not been put to use as a tool in connection with the study of alternating current phenomena. Early in his studies on alternating currents, Ryan adopted the cathode ray as a laboratory tool, developing his own form of apparatus and devising an effective means of magnetic control for bringing the beam to a focus. The application of the cathode ray to the study of alternating current phenomena was, after all, more or less an incident in connection with his wider purposes; but it proved a most valuable agency of research, serving for the exhibition of phenomena which could scarcely have been detected otherwise. It has since, of course, become a common-

place in the investigation of complex periodic electrical phenomena, but to Ryan may be credited its first introduction as an agency in the field of electrical engineering with special reference to the phenomena of alternating currents.

Another outstanding result of Ryan's investigations was given to the public in his paper with M. E. Thompson, "A Method for Preventing Armature Reaction," in the Transactions of the American Institute of Electrical Engineers under date of March 20, 1895. This paper dealt with the results of studies begun in 1892 with his students, on commutation in direct current machines and characteristic behavior in relation to the shape of poles, length of airgap and related factors. The first practical application of the results of these studies was in the Thomson-Ryan generator with pole-face winding, which was the forerunner of the present day interpole type of construction now almost universally used in direct current motors and generators.

But Ryan's chief work, especially in his later years, was focused on problems arising in connection with the long distance transmission of power. In the early nineties of the last century, there were wide differences of opinion regarding the possibilities of transmitting power over long distances and likewise whether direct or alternating current offered the greater promise.

Ryan's first approach to the laboratory study of high voltage phenomena was in 1893 when he constructed at Cornell an oil immersed 30,000 volt transformer. This, on trial, promptly burned out and was replaced by one with air insulation. This was again rebuilt in 1899 for 90,000 volts and continued to give good service for many years thereafter.

It was about this time, in 1897, based on the results of tests made on certain power lines operating in the Rocky Mountains, that serious doubt was cast on the possibility of exceeding 40,000 volts for the long distance transmission of power. These tests indicated that, dependent on a number of obscure factors, electric energy at this voltage would escape rather freely into the atmosphere, thus affecting seriously the efficiency of transmission. The whole future of the long distance transmission of power seemed at stake.

Ryan felt that the conclusions based on these results were too hasty and that the matter called for more extended study. He accordingly undertook a series of investigations continuing until 1904 when he presented a paper entitled "The Conductivity of the Atmosphere at High Voltages". The fundamentals set forth in this paper were a distinct contribution to electrical science. The law of corona formation was established, and the conditions under which corona leakage could be controlled were set forth. The limitation of 40,000 volts was shown to be non-existent, and the way was cleared for the advances in more recent years to a present maximum * of about seven times that earlier apparent limit.

Ryan's studies on insulation and insulators for use on high voltage lines also formed a notable contribution to this phase of power transmission. These were carried on especially over the period 1915-25. These investigations covered the distribution of voltage across the different units making up strings of insulators and the best manner of equalizing the same; the cause and effect of the ageing of porcelain, the causes of failures and flashovers, and allied problems. These studies have been an important factor in those improvements of insulators, both in design and in product, which have made possible the operation of great modern transmission systems with voltages of 220,000 and 275,000.

In connection with his various studies of the problems of high voltage and long distance transmission, Ryan developed a number of new and improved methods of observation and measurement. The adaptation of the cathode ray to the study of periodic phenomena has been mentioned. Another notable example was the high voltage wattmeter. This was a device planned for the more accurate measurement of line losses in high tension power transmission than had been hitherto available. With measurements made on an energized open-circuit line, the results should give, of course, the line losses, or, specifically, the so-called corona loss. And by making such measurements under a series of operating conditions (especially as regards size and character

* The Boulder Dam Power Line Transmission to Los Angeles.

of cable and operating voltage) a relation could be developed between the loss per thousand feet, or per mile of line, and such operating conditions.

The device comprised the necessary current and potential coils, as found in the usual type of low tension wattmeter, the former supplied by a few turns of the main circuit, the latter by a suitable coil and circuit, carrying in series with the coil a special form of water resister. In addition, special shielding arrangements were used in such way that the losses in the leads up to the main line were supplied directly from the transformer and thus eliminated from the indications of the instrument.

By means of this type of wattmeter it became possible to measure with satisfactory accuracy the losses involved in high tension power transmission, and long series of such measurements were made, and related to voltage, type, form and size of conductor, atmospheric conditions, etc., and a vast amount of information obtained of the greatest value in the design of modern high tension transmission lines and their equipment.

In connection with his various studies—on pole face winding, cathode ray magnetic focusing, etc., Ryan took out a number of patents, but he was never one to follow these to his own personal advantage and their benefits went, for the most part, to the industry at large.

In recognition of Ryan's outstanding work in the field of high voltage long distance transmission and as an evidence of the desire for its assured continuance, the leading public service companies of California together with manufacturers of electrical equipment, in 1923-24, provided funds for the establishment of a modern up-to-date high-tension laboratory at Stanford University where fundamental research in connection with these problems could be carried on in advance of the industry. This laboratory, with equipment complete and in working order, was opened in 1926, with demonstration of its capacity for producing and handling electricity under tensions up to 2,000,000 volts. In compliment to the man whose work was recognized by this splendid memorial, the laboratory has been given his name and is known as the Harris J. Ryan High Tension Laboratory.

Ryan continued actively in this laboratory his researches on various phases of long distance power transmission until his retirement from active status in 1931 with passage to the Emeritus role. In further honor, however, he was named Honorary Director of the Laboratory and so continued until his death in 1934.

While Ryan's chief work has lain in the domain of the long distance electrical transmission of power, he made many interesting and effective contacts in other directions. Thus in the domain of radio transmission, it was a student of Ryan's, Mr. C. F. Elwell, who brought the Poulson Arc patents to the United States and in frequent helpful conference with his professor, made the initial experiments which laid the foundation for the Poulson arc radio system as later developed in this country and abroad.

In 1893 Ryan served as a member of the Jury of Awards in the Department of Electricity at the Chicago International Exposition, and again in the same capacity in 1915 at the Panama Pacific Exposition in San Francisco. In 1904 he was a delegate to the International Engineering Congress at St. Louis held in connection with the Louisiana Purchase Exposition of that year.

Again, during the war period, Ryan headed a group of researchers at the California Institute of Technology in Pasadena, dealing with the problem of supersonics as applied to the detection of the submarine. This work was carried on under the National Research Council as the agency for the mobilization of the scientific effort of the United States on war problems. The special problem with which this group was concerned was the investigation of ways and means for the increase of energy per unit area of radiating crystal surface, as compared with the values previously obtained. Good progress was being made on the elements of this problem when the Armistice brought the effort to a close.

From 1909 to about 1923 Ryan served as a member of a board of consulting engineers to the Los Angeles Municipal Bureau of Power and Light, especially with reference to the pioneer work of this Bureau in connection with the design of the hydro-

electric generating stations in San Francisquito canyon along the line of the Los Angeles Owen's River Aqueduct. Still later, in 1932-34, important studies relating to the transmission line for power between Boulder Dam and Los Angeles were carried on in the Ryan High Tension Laboratory to which he contributed through frequent consultations regarding the principles involved and the strategy to be employed. As a result, largely of these studies, the practicability of a transmission voltage of 275,000 was clearly indicated for the controlling conditions presented, including in particular, the length of transmission line and the amount of power per circuit. This voltage was adopted for the line, a definite step in advance beyond the then maximum of 220,000, a choice which has been fully justified by the successful operation of this line since the autumn of 1936.

Many opportunities came to Professor Ryan in the way of private consulting practice, but for the most part, they were declined due to physical health and strength none too rugged, and to his absorption in his work of research. He felt that he could not do justice to both and he considered the latter as by far the more important. With the organization and equipment of the High Tension Laboratory, however, and through cooperative arrangements, it became possible to carry on investigations of great fundamental importance, not only to the organization in which the special problem may have arisen, but to the entire profession at large, as witness the investigations relating to the Boulder Dam transmission line and others of similar character.

While Ryan's contributions in the domain of electrical engineering have been of outstanding importance and value, his chief contribution to his day and age is to be found, after all, in the lives and works of the men whom he influenced through the relationship of teacher and student. He viewed his function as a teacher with the utmost seriousness. He was fond of referring to himself as a "Faculty Man" and he considered his work always from the standpoint of helpfulness to his students. For more than forty years one class followed another; in the aggregate a goodly company, taking with them to all parts of the world something gained from their contacts with this man whose first thought always was for the good of his students.

Through this human product the successful teacher achieves an immortality; he lives on in the lives of those whom he has influenced and helped.

Growing out of conditions in what may be termed the new era of Japan, it was but natural that, during the period 1900-30, there should have been a large influx of Japanese students to the United States, seeking instruction in subjects relating to engineering and technology. Especially was this true in electrical engineering, the youngest of the great divisions of engineering activity. Naturally a goodly share of such students gravitated to Stanford University with its convenient location on the Pacific Coast and with opportunities for instruction under Ryan as the immediate goal. Most of these, after graduation, returned to Japan, taking positions either in the industry or in teaching, thus forming a considerable segment of the field of electrical engineering in Japan tracing its training back to Stanford and Ryan, with a few tracing still earlier to Cornell and Ryan.

In addition to students from Japan and from other foreign countries, a number, in the years following the Great War, came to Stanford University on "Commonwealth Fund" and "C.B.R." (Commission for Belgian Relief) fellowships, in order to follow the work in electrical engineering under Professor Ryan.

As evidence of the high regard with which Ryan was held in Japan and especially by his former students both at Stanford and Cornell, he was the first scientist from the United States to be invited to give a course of lectures in Japan on the Iwadare Foundation of the Institute of Electrical Engineers of Japan. This was in 1933. The invitation was accepted, but ill health compelled a cancellation or perhaps rather a postponement of the plans. Later, improving health gave promise that he might be able to make the long anticipated trip to Japan and carry out the program of lectures; but the return to adequate health and strength was denied, and Professor Ryan passed on without having seen his "Carcasonne".

The deep affection felt for Ryan by his former students and the fine sense of personal friendship which they cherished for him, were further shown by an impressive memorial service

held in Tokyo, Japan, on the evening of October 3, following his death.

The gathering was sponsored by Dr. Shibusawa of the Imperial University and attended by twenty electrical engineers and educators in Japanese universities who had studied at Stanford or Cornell and under Ryan.

In a letter to Mrs. Ryan from Mr. S. Motomura, the following paragraph descriptive of this occasion may be quoted:

"After dinner together, the group adjourned to a separate room where a photograph of the late Dr. Ryan was placed in front of a wreath donated by the Stanford Alumni Association of Japan. Reminiscences of their days at Stanford were given by many, in which the greatness of Dr. Ryan as both scientist and man was brought out. That the electrical industry in Japan, especially in fields of high voltage, owes a tremendous debt to him was emphasized. A memorial photograph of the group was taken, and after all had silently bowed before the photographic likeness of Dr. Ryan, as a last tribute, the meeting adjourned."

Further evidences of the love and esteem in which Ryan was regarded by his colleagues and former students were shown by a notable dinner given him on the occasion of his retirement from active service in 1931; and following his death in 1934 by resolutions of the Academic Council of Stanford University, of the Governing Body of the American Institute of Electrical Engineers, and by the many letters, telegrams and messages of condolence received by his widow.

The American Institute of Electrical Engineers was organized in 1884. Ryan, as a young graduate of Cornell University, joined in 1887, was advanced to the grade of Member in 1895 and in 1923, on the organization in that Society of the grade of Fellow, he was immediately, with others in a selected group, advanced to that grade. He served the Society on numerous committees, was elected Manager for the period 1893-96, served as Vice-President 1896-98 and as President, 1923-24.

In 1925 he was awarded the Edison Medal of the Society under the citation:

"For his contributions to the science and the art of high-tension transmission of power".

The ceremonies of award were held on the occasion of the Pacific Coast Convention of the Institute in Salt Lake City on September 8, 1926. Ryan's life work was reviewed by Mr. Paul M. Downing, Vice President of the Society, and the award was made by President C. C. Chesney. In his reply, Ryan made references to some of his earlier work in terms from which quotations have been given at earlier points.

Besides the American Institute of Electrical Engineers, Ryan was a Fellow of the American Association for the Advancement of Science, and held membership in the American Society of Mechanical Engineers, the American Electro Chemical Society, the Institute of Radio Engineers, the American Physical Society and the Society for the Promotion of Engineering Education. He was also a member of Sigma Xi and of Tau Beta Pi. In 1920 he was elected to the National Academy of Sciences. In matters of technical society activity, however, his chief loyalty was always with the American Institute of Electrical Engineers, and practically all of his papers dealing with original investigations were given to the public through the Transactions of that body.

On graduating from Cornell, Ryan received the degree of M.E., (E.E.), one of the earliest to receive a distinctive degree in electrical engineering from an institution of higher learning. In 1925 he was awarded the honorary degree of LL.D. by the University of California.

In approaching any general integration of Professor Ryan's outlook on life or his attitude toward his professional work, note must first be taken of his friendliness with all with whom he came in contact, and of his capacity for making and holding friends. This was evidenced not only by the continuing warm friendly relations maintained with those who had come to know him as a teacher, but by all with whom he came in contact in the various relations of life. There was always a pleasant greeting, a kindly word and a friendly interest in the problems and troubles of others.

In his scientific and technical work, he was always thinking of the future. His problems and his chief interests were centered on the long look ahead. His was distinctly the spirit of

the pioneer as witness his early work on pole face windings and on the transformer, on the electrical properties of the atmosphere with reference to the high tension transmission of power, his studies on insulation and insulator chains and other like problems. Much of the development of the applied art in electrical engineering followed upon and was conditioned by the results of these studies.

On September 12, 1888, the young Instructor Ryan married Katherine E. Fortenbaugh, a girl of his home town, Halifax, Pa. Mrs. Ryan joined most heartily with her husband in making their home a place of cheerful welcome for students, and the Ryan house was always a shifting scene of friendly calls from students past and present, with always a warm greeting and kindly interest in their welfare. Mrs. Ryan must share with Professor Ryan in the making of this atmosphere of friendly welcome which was always so characteristic of the Ryan home.

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