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# ACHIEVEMENTS OF DR. RYAN

By. P. M. Downing

Salt Lake City Convention Sept 8/26

We are here this evening to do honor to one whom we all respect, admire and love, a man whose accomplishments in the field of scientific research and engineering have pointed him out as one upon whom the American Institute of Electrical Engineers should confer this particular mark of distinction. To those of us from the far west this is a particularly happy occasion because for more than 20 years we have had the pleasure and the proud privilege of claiming Dr. Ryan and his charming wife as residents of our sunny state of California. When I was asked to say something of Dr. Ryans achievements I hesitated about accepting the invitation because I knew that in the very few minutes at my disposal it would be impossible to more than touch upon a few of the high spots of the vast amount of splendid work he has done.

Born in Powell Valley, Pennsylvania, Dr. Ryan received his early education in Baltimore City College and Lebanon Valley College. Leaving the latter he entered Cornell in 1883, about the time that institution was inaugurating its electrical engineering course. After graduating from Cornell in 1887 he was for 2 years associated with J. G. White and D. C. Jackson then engaged in general engineering practice under the firm name of Western Engineering Company. In 1889 he returned to Cornell as instructor in charge of the electrical machinery laboratory. This change marked the turning point in his career in that he left the field of commercial engineering to enter that of scientific research. Advancement in his chosen line of work was rapid. In 1890 he was made assistant professor in electrical engineering at Cornell and in 1895, when only 29 years of age, he was honored by being appointed as professor in full charge of the electrical engineering Department. He remained in that position until 1905 when the "kid" professor as he was then known accepted the call of Stanford University to take charge of the electrical

engineering department of that institution, which position he still holds.

In reviewing Dr. Ryan's accomplishments one cannot help but be impressed by the clear foresight and unprejudiced manner in which he has approached every problem confronting him. Scientific investigation is by its very nature pioneer work. It differs from that of engineering in that the scientist must work away out in advance of the engineer. He must point out the way by blazing a trail along which the latter may follow perhaps years later and put to practical application the fundamentals that have been established by the scientist. It, therefore, follows that if a man is to be successful in scientific research work he must love his work, he must be a man of broad imagination, and he must have unlimited enthusiasm. Dr. Ryan answers all of these specifications.

Since 1889, Dr. Ryan has been a liberal contributor to technical literature, many of his papers having been presented before this institute. In reviewing his work one cannot help but be impressed with the fact that unlike many others engaged on more or less highly technical research work, Dr. Ryan has devoted his time and attention very largely to the scientific study of problems that have great practical and economic value to the electrical industry. As substantial evidence of this we find that one of his earliest contributions to electrical progress was a paper describing the development and pointing out the advantages of using balancing coils as they were then termed, designed to overcome field distortion and the shifting of the neutral point in direct current machines due to armature reactions. The first practical application of this principle was in the Thompson-Ryan generator which was the forerunner of the present day interpole type of construction now used almost universally in direct current generators and motors. This one improvement alone has been of tremendous commercial value to the industry not only in the improved operation of D.C. equipment but by its application, the size and weight of machines per unit of capacity has been materially reduced, thus reducing the price correspondingly.

But important as his studies in the field of direct current have been, those having to do with alternating current are of even greater importance. Looking back from our present position to the early 90's, it seems easy in the light of present day knowledge to imagine how a high voltage system might very easily have been brought into existence, but at that time the scientific world knew but little about alternating currents and less about high voltages. There were wide differences of opinion respecting the possibilities of developing and transmitting power over long distances and there were wider differences of opinion on the question of whether alternating current or direct current was best suited for transmission purposes.

It was in the laboratory at Cornell University that Professor Ryan began his studies in connection with the use of high voltages. Suitable equipment and facilities for carrying on his investigations were not available. Much of what he needed had to be built in the laboratory under his direction. Even at that time, when so little was known about high voltages, his foresight and wisdom in determining what the design and construction of such equipment should be were sound and it is interesting to know that the 90,000 Volt dry insulated transformer built by him many years ago is still in service and is an important part of the Cornell laboratory equipment.

His paper on transformers presented before the institute in 1889 is one of his outstanding accomplishments. It was received by the scientific world with an enthusiasm that immediately brought the author into the limelight of international fame.

In commenting on this paper, Mr. Charles F.Scott, a past president of this institute said: "The paper we have just heard read is a remarkable one and will probably be considered unique among the papers presented at our institute. Our papers usually deal with results that have been accomplished or with various methods of accomplishing ordinary engineering objects. This paper is of another order - it reaches into the future and explores the unknown field of

high pressure work. It deals with things outside the present range of commercial practice but toward which engineering work is now fast approaching".

How true that prediction was and how little did anyone at that time realize the broad field of practical application, those principles would have within the short space of less than 20 years.

No small part of the success attending the investigations covered by this paper is due to the development of the CathodeRay Wave Indicator, or as it is now generally called the Cathode Ray Oscillograph. Its development was more or less of an incident in connection with the solution of the bigger and more important problem being studied but it proved to be a most important factor in obtaining results that otherwise might not have been possible. It not only served a most useful purpose in connection with the work then in hand but during recent years it has found a broad field of usefulness in studying the high frequencies used in connection with the transmission of the human voice.

A few years after this paper was presented certain experiments conducted on certain lines operating in the Rocky Mountain region resulted in the announcement by transmission engineers that 40,000 volts was the limit for transmission lines and it was useless to attempt to go higher. Doubting the truth of this announcement, Dr. Ryan with a pioneer spirit born of that type of mind to which all attainment is but a challenge to further effort, definitely determined to prove that the use of much higher voltages was not only possible but entirely practical. His investigations and studies along this line continued until 1904 when he summarized the results in a paper presented before the institute entitled ,"The Conductivity of the Atmosphere at High Voltages". The fundamentals set forth in this paper were a distinct contribution to electrical science. By establishing the law of corona formation the problem of transmitting power at high voltage was materially simplified and the former theory that 40,000 volts was a maximum beyond which it was

impractical or impossible to go was completely disproved.

During recent years Dr. Ryan has devoted a great deal of his time and attention to the study of insulation and insulators for use on high voltage lines. The results of his investigations covering the distribution of voltage across the different units making up a string of insulators and the best manner of equalizing same, the cause and effect of aging of porcelain, the causes of failures and flashovers of insulators and other similar work have been of inestimable value to the engineering fraternity in the design and successful operation of present day high voltage lines. As a result of these investigations insulator manufacturers have been able to improve the design and quality of their product to a point where today we find 220,000 volt transmission lines operating more satisfactorily in every respect than do those of lower voltages constructed at times when we knew less about insulators and insulation than we do now.

No one will question the fact that during the past 30 years, transmission of electric power has been one of the very great, if not the greatest factors contributing to the growth of material wealth and the relief of labor. That growth has been made possible in a very large measure by the splendid work that has been done and is today being done by Dr. Ryan and others in working out the highly complicated problems that have confronted the industry without the solution of which progress would have been greatly retarded.

At this point I think it will be appropriate for me to briefly refer to the conditions under which research work is carried on by Dr. Ryan and his associates. Stanford University, and those having to do with the management of the affairs of that institution, realizing the tremendous educational and commercial value to the electrical industry of research work of this character have very generously offered to the industry the use of the University's facilities and its personnel in an endeavor to be of assistance in working out the highly technical problems that daily confront us. For this service there

is no charge, either by the University or by those engaged on the work. It is not costing the industry a dollar. The results of their investigations are published from time to time and are available for everyone. As evidence that the University authorities fully appreciate the importance of sympathetic cooperation with both manufacturers and operating companies, I quote the following from a public statement made by Dr. Ray Lyman Wilbur, President of the University:

"Our aim has been to provide to scientists, and those in the practical field, the opportunity to benefit by research work made available to all those interested. It will be our endeavor not only to continue to work under the guidance of Dr. Ryan but to build up under him a group of men who will maintain it into the years to come."

In a rapidly growing industry such as ours, new and more difficult problems are coming up every day. Their solution calls for additional facilities and equipment with which to carry on investigations. These facilities represent very substantial financial investments and the University authorities have very properly taken the position that to provide them from the rather limited funds at their disposal would call for the allocation of a dis-proportionately large percentage of the total to one particular branch of the University's activities.

In recognition of the importance and value of the work that has been done and as substantial indication of their desire to have it continue, a number of electrical companies, both manufacturing and central station, have contributed toward the establishment of a modern up-to-date high tension laboratory at the University where research work well in advance of the industry can be carried on. As a compliment to our honored past president and co-worker, this new laboratory, known as the Harris J.Ryan High Tension Laboratory, will forever stand a splendid monument to the untiring energy and ability of the man whose name it bears. So far as funds will permit

the laboratory is well along toward completion but it is not yet fully equipped.

That the electrical industry is willing to recognize and accept its indebtedness to Dr. Ryan and the University,not only on account of the splendid work that has already been done but also on account of the broad liberal policy concerning future work,is evidenced by the generasity of the donors without whose financialassistance and support the ideals of Dr. Ryan and his co-workers could not have been realized.

But beyond all of his accomplishments in the field of scientific work we must not over look other of his achievements that can be measured only in terms of human value. During the more than 30 years that Dr. Ryan has devoted to training the minds and habits of young men he has endeared himself to all with whom he has come in contact and in this brief resume of Dr. Ryans achievements as a scientist and a teacher, I could not properly conclude without paying a tribute to Mrs. Ryan. Along with Dr. Ryan she has always taken a parental interest in the work and welfare of their students. Their home has always been open and students have always been received with a hearty welcome. What this means to young men at college can best be judged from a statement of one of his former students at Cornell,a man now prominent in the electrical industry.

He refers to Dr. Ryan as a kindly and helpful man, an enthusiast who goes wholeheartedly into everything he undertakes, a teacher whose outstanding characteristic is his painstaking care in endeavoring to drive fundamentals into the minds of others, a man with modesty in his own achievements, yet with a personality that stimulates others to do their utmost, a man so intensely human that it is a delight to be near him.