RESPONSE AND ADDRESS BY
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President Chesney, Vice President Downing, Secretary Hutchinson, Chairman Higson, members of the American Institute of Electrical Engineers and Guests: I appreciate profoundly the award of the Edison Medal and the opportunity that I have now had of receiving the certificate of award and the medal from the hands of those who have been my life long friends and virtual co-workers functioning as the officers of the Institute.

At this extraordinary moment in my life my mind goes back to the beautiful and inspiring resolution that the Edison Medal Association made a part of its deed of trust to the American Institute of Electrical Engineers for the award of the Edison Medal which reads:

WHEREAS: it seems to the (Edison Medal) Association that the most effective means of accomplishing the object for which it was formed would be the establishment of an Edison Medal which should, during the centuries to come, serve as an honorable incentive to scientists, engineers, and artisans to obtain by their works the high standard of accomplishment set by the illustrious man whose name and features shall live while human intelligence continues to inhabit the world".

Its full significance will be born in upon us when we remember the things of incalcuable value in the world today that would be absent had there been no Edison. No man ever lived to be a finer example of the glory of work for the amelioration of the conditions under which mankind must live and be happy.

The certificate of Award and the Edison Medal are received by me in a deep consciousness of their significance and most earnestly do I hope that I may continue to deserve them as long as life shall last.

It should not be difficult for another to realize the personal satisfaction

to me to receive the Edison Medal from the American Institute of Electrical Engineers here in the central far west. We are here in the State of Utah, a great pioneer patron/of the products of the electrical engineers. Utah by the courageous spirit of her pioneering people continues to look out upon her unique options for the best in life offered to all who will but look, think and work.

Besides all this I am personally indebted to Utah for one of her native sons as my co-worker, whom she raised, endowed him with a fine manhood, the spirit of the pioneers, and educated him in electrical engineering in her university. He has just been made a member of the faculty in electrical engineering of my university, with the title of Assistant Professor and will be assistant to the director of our new high voltage laboratory in charge of operation. The name of this young man is Joseph S. Carroll.

When everything has come to a man in the course of his life that he can possibly have hoped to have deserved, the feeling is almost inescapable that it is all a dream, that there must be some mistake somewhere and that he will surely wake-up one morning to find that it is all a myth, that such things have not actually happened at all and that it is for him to continue his way in earnest effort of helpfulness and cooperation, just as he has always been doing, and that no harm has been done by the passing dream - that the facts have found him out and that with them he must be content.

If I have deserved any consideration it must have been due to a determination on my part to help all who have wished to know and to understand more of the facts about things so that they could use them with greater facility or precision to get desirable results. To help them I had first of all to find out myself and then to put the results into the terms of mutual understanding of my students, coworkers and friends in applied electroscience.

It is eminently proper when a man has been awarded the Edison Medal by the American Institute of Electrical Engineers that he should be called upon to give an account of himself and that I now gladly do.

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 just referred to was one direct current generator invariably referred to as the Gramme dynamo that was built by Professor Wm. A. Anthony, the 1890-1 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 an ample size 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 others were announced some what less than ten years after the Centennial.

Anthony's Gramme dynamo was given at Philadelphia an award of merit for its novelty and enterprise. It was placed in the historical exhibit at the Chicago International Exposition only 17 years later, and was given an award for its historical merit. I was a member of another section of the Chicago World's Fair jury and had nothing to do with the award of historical merit for "Anthony's Old Gramme". However, I shall never forget the deep impression that the award made upon me. Even then after only 17 years of progress in our country the dynamo had become one of the great implements of our civilization. The lesson of the extraordinary progress that the electrical sciences and arts were making, was inescapable.

I had up to the time of the Paris Expösition in 1889 encountered the then traditional attitude of mind that dwelt much upon the historical background of things from out of which one looked with anticipation of few, out and out new expediencies and implements arriving at a slow rate as always - that the great worth-whileness of effort was to be put up the understanding of things of that background and with a corresponding outlook for widening their application. The atom was the smallest unit-entity of matter, electricity was a form of energy and nothing had as yet happened to make anyone conceive of the intimate component relation of electricity, matter and energy.

But the extraordinary personal exhibit of Edison at the Paris exposition of 1889 began to change all that sort of thing for me as it did for a host of others of my generation and the Chicago 1893 award to Anthony's Old Gramme finished the change of mind for me, as I know it must have for many others. From that time to this I have belonged to the group that with all the persistence and enthusiasm its individuals can muster have held steadily to the purpose of finding out about things from the depths of the unknown; of opening up new seams in the face of the rock that must be penetrated to know what is within and beyond.

Attitude of mind is an enormous factor of human progress - and progress there must be, so long as human beings will hold the option of changing this old world from what it is to what it ought to be. I will call up but two personal experiences to illustrate in a limited way the importance of this factor in the work of those who set out to win from nature useful knowledge of things. From my days in college I knew the helpfulness the indicator had always been for the study of the old reciprocating steam engine. We longed for a corresponding indicator for the study of the reciprocating of alternating electric current. The Braun cathode ray cyclograph had become generally known in 1889 and from that day on we might have had the desired indicator for

observing the cyclic relation of voltage, current and energy in the alternating current circuit, if only we could have assumed heartily that such a thing was possible with the implements and facilities then at hand. Twenty one years later we said let us assume that the thing is entirely feasible and that some unknown person has already accomplished it. How did he do it? After a few hours of real thinking one could then see just how the mythical person must have done it. The corresponding hook-up of equipment long on hand was made and tried out and it worked just as had been hoped for so long but with altogether too much timidity and faltering misgivings.

By 1902 there was hardly a high voltage worker in our land, or any other for that matter, who had not longed for a wattmeter and voltmeter that could be connected to any section of a high voltage circuit wherein losses or other things occur, for measurements, independently of the rest of the high voltage circuit aggregation including the source transformer, connecting leads and their insulator supports. The joy of working with wattmeter and voltmeter actually connected into the high voltage circuit, eliminating large and often uncertain corrections, just as was done from the beginning of the electrical arts in low voltage circuits, was thus hoped for also through a period of 21 years, i.e., from 1902 to 1923 under a like unfortunate attitude of mind. Finally in a spirit almost of desperation, the same mental treatment was employed, viz: a firm assumption was made that the thing had been done amply somewhere and somehow with the usual things available, and therefore, we ought to be able to do it too. Such an assumption arouses ones sporting proclivities if anything will and no option for doing as well as the other fellow is likely to be overlooked in that attitude of mind. It is a wonderful mental dose to take to escape from an orgy of self-hypnotism in which one goes along in the complacent assumption that because a highly needful

thing has not been done, it very likely can not be done.

Self-examination as to why one is in such a state of mental deadlock is assuredly the next step to take just as soon as one can discover that he may be in that state, and perhaps does not know it. For instance, in such self-examination in the last example it was found that one of the contributing causes of the hypnotism was the traditional understanding that the energy consumed in the potential circuit of a wattmeter is relatively small in relation to that consumed and to be measured in the loading circuit The recognition that this is a mere tradition and by no means a necessity admitted immediately a numer of options for the soltuion of the problem theretofore untried. It was found in the end that the tradition could be violated with propriety on the score of value of an expediency for the sake of the results compared with its cost. That done we said what does it matter if we do have to use 10,000 watts in a 150,000 volt potential circuit of the wattmeter to measure directly and correctly one watt in the loading circuit?

Even so the value of the results may be many times the cost of the expenditure of 10,000 watts during a time required to make the observation.

Assuming that the other fellow had already solved the problem and having cast aside hampering traditions, with some further thought we were prepared to go ahead with the things we found available. We then told our young men what we thought and why, and soon we found them leading us a long way into no man's land getting results quickly and easily and by routes that we had never dared to attempt before.

In the fourth year of the Institute I began my work as a faculty man at my alma mater. I soon found the real meaning and value of the American Institute of Electrical Engineers to all in the electrical arts and sciences. 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 by 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 V 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. Then to me the entirely unexpected thing happened. The paper interested most of the trained workers in the electrical industries everywhere. It was republished seventeen times in America and Europe including Russia. From that time to this I have had friends everywhere throughout the electrical and related industries who have always wished me well and were ready with their helpful cooperation at all times. It was to me in relation to the Institute a wonderful lesson in many ways, particularly in two:

I. The worth-whileness of getting at the facts singly and in their aggregate relation concerning phenomena and equipments for which uses are being found in the industries.

II. The extraordinary value of the American Institute of Electrical Engineers to its individual members and the electrical industries they promulgate.

The direct current dynamo was put forward by the Italian Paccinoti in 1864 and first developed for engineering duty as already stated by the Frenchman, Gramme, in 1872. Like every great implement upon which our civilization is today established and maintained the direct current dynamo arrived as a product of the minds and industry of Paccinoti and Gramme complete in a sense and highly useful, but little understood as to details and as to their relation to the aggregate result. The lack of adequate knowledge of such details individually and collectively was a great handicap in education and for the progress of the art. To understand this one needs only to go back to the many distortions of the rational forms of continuous current machines that were put forward in many illusory efforts to make improvements nearly forty years ago.

With the aid of my students we began in 1892 a series of studies of commutation and characteristic behavior in relation to the shape of poles, length of air-gap and related factors. The results clearly indicated the helpfulness of the pole-face winding and commutating pole as they are now known. We were not the only

persons to discern these helpful results, - though we did enjoy with others the privilege of pioneering in these things. The final approach to perfection of the continuous current machine was not feasible in "the late nineties". That approach has been quite dependent upon the arrival of a good working understanding of polyphase current circuits.

The continuous current machine in recent years has rounded out its first great cycle of development. When in American it will enter upon its obvious second cycle, or better its second round on its spiral of evolution, cannot today be foreseen. It is assuredly worth while for some engineers to remember always the wealth of expediency now available for such second round of evolution of this form of generator or motor. Should long distance transmission of power ever demand the use of the constant continuous current generator and motor, there will be found a veritable mine of discernable expediency for evolving its success.

A third of a century ago from a faculty man's point of view, that of helpfulness to his students, I began the study of high voltage phenomena by constructing an oil immersed 30,000 volt transformer. The first decisive experimental result with it was soon obtained. It "burned out?", but why, one could not tell. The most significant thing about the tragedy was a large smoke bubble that came to the surface of the dark heavy oil that was generally used at this time for insulating transformers. That was in 1893. During the following year we rebuilt it, using air in lieu of oil for immersion so that if it burnt out again we could see the fire and perhaps learn some thing of the cause. We kept the same core and coils and rebuilt the transformer the sixth time in 1899, air immersed and to have an output of 10 KW at 90,000 volts, 133 cycles. The major insulation between the high and low voltage circuits was made by the Corning, New York, Glass Works of refractory glass. Each of the 30 high voltage coils was equipped with a 6000 volt non-arcing spark arrester. After that the transformer rendered satisfactory service at my alma mater through many years. It is a trivial incident in the telling but it made a real beginning for me as a high voltage worker.

In 1897 we learned through the Pioneer high voltage studies of past Presidents Chas. F. Scott and Ralph D. Mershon, that at 40,000 volts, more or less dependent upon a variety of obscure factors, the electric current would escape into the atmosphere and a serious waste of power would in consequence occur.

The success of the long distance transmissions of power in the Far West and from Niagara Falls to Buffalo caused a large division of the electrical engineers to set out upon the route that lead to the establishment of the modern power industry. This division was directed on the right and left by the economic guidance of Kelvin and Sprague. The former asserted that the transmission of power is accomplished most economically when the existence and lost costs of the transmission conductor are equal. The latter asserted that economy in electrical power transmission varied directly as the voltage and inversely as the distance.

The discovery of Scott and Mershon that at a comparatively low voltage electric power would escape from the power transmission line sent a strong mental shock to this power division. As a faculty man greatly interested in the welfare of students preparing for service in the power division, I felt the shock keenly. For the cause of those students there was but one thing to do and that was to get at all the material facts as quickly as possible and then to study them for strategy in action. By February 1904, we had some of the facts and their relations well enough in hand to present a paper to the Institute that was received everywhere by the power division in such a whole hearted manner of appreciation that I could not do otherwise than hope to have the privilege of being its permanent recruit.

I must interrupt this narrative in regard to my contacts as a faculty man with those who are establishing the power industry to say that through brief but highly appreciated years I have seen and enjoyed detached services in the large division of communication. In so doing I cooperated with those of my students who established the arc converter system of continuous wave radio telegraphy at home and abroad. My war work in the Supersonica laboratory of the National Research Council, the purpose of which was aid of the allies in the perfection of the echo method for submarine defence, netted an experience in mechanical radio that has been highly valuable

because of the many uses I have found for the same in my work with students. Thus it has been that I have learned abundantly in both the power and communication divisions of the electrical industries how enormously welcome a faculty man is to ask the privilege of cameraderie if he will but play the game right mindedly. He must remember that he is a faculty man at all times and see to it that he is acting as such and that he is not acting to replace an engineer on the firing line of practice.

And now, my narrative must come to a close. I have five years more to go in active serfice when I will be called up for retirement. You can well understand how I wish there might be many times five years to go. If I had my life to live over again and a choice as to what it should be, I would ask that it be just as it has been with all the interesting turns in the road that the electrical engineers have made. Thus I am at this moment most forcefully reminded of a beautiful verse by an unknown author that reveals at once so much that is like the electrical engineers and again that unlike them. It is:

There'x a legion that's never been listed,
That carries no colors nor crest,
But split in a thousand detachments
Is making the road for the rest.

Some one who has the gift of saying things beautifully will rewrite this verse to make it fit the spirit and work of the electrical engineers, - he will leave its beauty unimpaired and yet somehow contrive to make it say:

There's a legion thats ever been listed,
That carries both colors and crest
And joins in a thousand detachments
In making the road for the rest.

I thank You!!