

## Inventor of the Year Award Address

I AM VERY APPRECIATIVE OF THE HONOR bestowed upon me today in designating me the "Inventor of the Year, 1965." To my associates must go a share of this recognition, for any achievement represents the integrated efforts of many, from the time of experimental proof of the imaginative concept to the completed reality. I am particularly gratified to note that this award is given in the spirit of recognition of an inventor, for in these days of massive organized research and development the work of an individual can be readily obscured.

Recognition and encouragement is a necessary factor for stimulating imaginative rather than merely memory-oriented thinking. In review of my own efforts, the attempts at imaginative thinking extend back more than 50 years of my life.

I was born in New Jersey in 1900, and shortly thereafter my family moved to New York, where I attended public schools. From an early age I was an avid reader of scientific literature and had an almost compulsive desire to read and to analyze what I read. I owe a great debt to the public libraries. Next was the great pleasure derived from chemical and electrical experimental work, particularly stemming from my interest in radio as a licensed amateur for several years prior to World War I. These interests helped materially to develop experimental methods and persistence for translating imaginative thoughts into practical realities.

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\*A speech delivered by Samuel Ruben upon his acceptance of the Inventor of the Year Award presented to him by The PTC Research Institute at a reception held in his honor on April 14, 1966, at the Shoreham Hotel in Washington, D.C.

Since adverse personal economic conditions required means for support not only for myself but also for family assistance, I could not plan formal college training. This was supplanted by constant home study and later, non-credit evening courses on such basic subjects as mathematics and chemistry.

The most important event in the development of creative endeavour came after I had acquired my first job in the winter of 1917 as an assistant in a laboratory of the Electrochemical Products Company. This development company was engaged in perfecting a patented process for the fixation of atmospheric nitrogen by high frequency electrical discharge.

I obtained this job because of my familiarity with high frequency radio transmitters. My amateur radio transmitter experience was directly applicable to the understanding of one phase of the work. The project had been started in a Brooklyn laboratory under the direction of the inventor of the process, but in order to progress they engaged the services of an authority in the field of electrical discharges; namely, Professor Bergen Davis of the Physics Department at Columbia University. Professor Davis was the technical consultant, and he directed the experimental work. To allow him to devote more time to this war effort work, the laboratory was moved, by arrangement with the University in 1918, to the basement (Room 110) of Fayerweather Hall which housed the Physics Department. Professor Davis took a keen interest in me during the time I was associated with this process and for many years thereafter, up to the time of his death in April, 1958. During these 40 years he was always interested in my progress, giving me valuable and appreciated counsel. In the earlier days he spent considerable time in guiding my studies, and in our many hours of discussion I learned a great deal. He arranged for my attending some of his lectures relating to electrical discharges through gases, and the use of the Physics Department library in the same building. Professor Davis' life and career were themselves a great inspiration to me.

The understanding and appreciation of the electronic structure of matter and its relation to chemical and physical properties was an important result of my relation with Professor Davis. Its application to practice can be noted in my early rectifier patents (1925) in which I classify the desirable electrode materials in accordance to their valence position as elements in the Periodic Table. The nature of materials, particularly of the elements, has been a guiding factor in all my work, and so essential to the successful solution of problems involved in my inventions. In my recent book entitled *The Electronics of*

*Materials*, the stress is on the importance of the electron configuration in relation to the valence electron potential arrangement of the Periodic Table of Elements so as to supply a quantitative character to electric parameters. This concept, arranged in chart form, has been useful in our laboratory since 1940.

The honorary degree "Doctor of Science" was conferred on me in 1959 by Butler University for my work in electrochemistry, and on June 9, 1966, the honorary degree "Doctor of Engineering" will be conferred by the Polytechnic Institute of Brooklyn.

Besides encouragement, an inventor needs financial support in carrying out his development to completion. I was fortunate in obtaining such support, for in 1922 Professor Davis suggested to Malcom W. Clephane, (incidentally a former Washingtonian) a patent attorney who had been president of the development company, that he set up an independent laboratory for the investigation of several of my patentable ideas. In 1923 a laboratory was established in New York City, after a temporary set-up in my home. Since 1930, the laboratory has been in New Rochelle, N. Y. Mr. Clephane's support and enthusiastic cooperation contributed greatly to the success of the laboratory.

In order for the inventor to obtain commercial realization of his work, it is desirable to gain the support of a company that has the courage, imagination, and foresight so necessary in carrying an invention to a production stage through the trials and tribulations that most inventions incur before the product has production stability and is commercially sought after. In this matter I was fortunate to contact the P. R. Mallory Company and particularly its founder, P. R. Mallory, whose interest in reasearch and development is inherent to his make-up. My relationship as licensor and consultant to the company has been maintained over the years with a number of products manufactured on a large scale.

The time and state of the technology are most important, for one can experience the limitations of acceptance if ahead of the art and find that at or after the expiration of a patent, large-scale use is made of one's development. I have experienced both the advantage of having developments at a time when a need existed, and others which went into large volume use after expiration of my patents. My solid state magnesium rectifier was introduced at a time when charging storage batteries to operate the radio set of the early twenties was a problem. The use of the rectifier as a continuous trickle charger eliminated the necessity of removing the storage battery from the living room for

charging. However, my development of the dry electrolytic condenser or capacitor eliminated the need for the storage battery entirely.

The further development of the capacitor for higher voltages later eliminated the need for the B-batteries. In 1928, the use of the A-eliminator was supplanted by the introduction of the indirectly heated A.C. tube. This tube was constructed with a ceramic rod which insulated the heater from the electron emitter and had some limitations, such as a rather long time to heat the element, and thermoconductive effects which limited the operating life of the tube. The introduction by the industry of the indirectly heated A.C. tube materially reduced the royalties received from A-eliminators. In order to meet this challenge, the integral heater element tube was developed, and rapidly reached large-scale production. I accomplished this by coating and sintering to the heater wire a pure nonconductive oxide which reduced the heating time from several minutes to seven seconds. The elimination of unstable ceramic materials increased the operating life several fold. Development of the refractory insulated copper wire followed. This refractory wire coating was the forerunner of an electrodeposition process which I developed for multilayer wire-wound resistors which were in large production during World War II. These resistors were capable of withstanding military test requirements which could not be met by any of the previous types.

Timing was again important when the sealed alkaline cell was developed at the onset of World War II. This provided the miniature high capacity mercury cell capable of withstanding severe storage and operating conditions that could not be met by the standard dry cell which had been manufactured for about 60 years. It will be noted that there has been a sort of chain reaction between the first commercially successful invention and those that followed.

I believe the independent inventor will always be important because he is in the position of being able to think away from or independently of popular trends with respect to a given project; he does not have the problems of possibly jeopardizing his position if he is wrong. An employee in an organization, unless he is in the top echelon of research and development, may fear to be wrong and thus affect his record or status with his associates and with the company.

The advantage of independent operation is that it forces one to more thoroughly study the problem and allows the freedom to concentrate on a project without interference or the need to utilize time on unrelated matters. It requires a more practical consideration of the problem in order to obtain the necessary data with a minimum

amount of equipment; it forces one to depend upon a certain amount of ingenuity to use what he has to the best advantage.

The disadvantages, in respect to technological processes, are that in an organization it is possible to obtain assistance on some phase of the development from sources more competent in some specialty and to have available more complete equipment.

One hurdle an independent inventor sometimes has to overcome, even with demonstrable models or data, is the inherent reluctance of the technical staff of his prospective licensee to accept outside ideas. In industry this is known as the N.I.H. (not invented here) factor. Some managements will override the opinions of their engineering department and depend entirely on trial results.

The recognition and encouragement of the organizational inventor is going to grow in importance for many reasons. The philosophy today seems to be to obtain the safest job with all insurances until death, and many individuals become permanent organization men at an early age. In the years prior to World War I, the opportunities for obtaining employment in research and development projects were very limited. Individuals endowed with that inner sense of direction, with persistence to carry imaginative thinking to practical reality, were willing to take the risks to acquire the rewards of a successful invention.

The American patent system is a basic source of encouragement to the inventor, for it provides him with a means of protecting the practical results of his imaginative thinking by the issuance of a patent which can give him the hope for recognition and reward. This system has enabled me to function as an independent inventor and maintain a development laboratory for the past 43 years with support, except for the first three years, entirely derived from the license or sale of patents. I am most grateful for the opportunities afforded to me by our American system.

