In the winter of 1887-88, while in the employ of the Westinghouse Electric Company as Assistant Electrician, I was sent from Pittsburgh to Philadelphia to investigate a situation which had arisen in connection with an alternating current plant installed to light the shops and offices of Baldwin Locomotive Company. The commercial representative of the Company, who had sold the plant, was an optimist and had mentioned to the purchaser transformer efficiencies of a high order. The purchaser had observed that when the lights were cut off, the switch board ammeters did not, as expected, register in the immediate vicinity of zero, but continued to testify that the primary current still was appreciable.

While engaged in this interesting research and in the effort to reconcile the purchaser to the apparent discrepancy in the testimony of the salesman and that of the ammeters, I met the contractor who had installed the wiring. He asked me if I knew a young man named Charles F. Scott. At that time, I had not met our distinguished Past-President and the contractor proceeded to tell me that shortly after the work on his contract had begun, a tall young man who claimed to have learned something about electricity at the Ohio State University and at Johns Hopkins, had applied to him for a job. The contractor had offered to take him on for a week without salary with the understanding that if at the end of that time his usefulness had been demonstrated, he would receive pay as a wireman. The contractor went on to relate that the tall young man had appeared promptly in a suit of overalls, that he had demonstrated his willingness and ability to explore out of the way places in the shop where the accumulation of dust was not less than four inches in depth, and that at the end of ~~two~~ a week~~s~~, he, the contractor, being satisfied that the apprentice knew more about wiring than he himself knew, ~~had~~ he hired him and later appointed him foreman of the wiring gang.

A few months later, when Mr. Scott appeared in Pittsburgh and looked me up, I recalled the story of the contractor. Also, there was something in Scott's modest narration of his training and experience and in his personality which convinced me that the Westinghouse Company needed his services. Accordingly, I presented him to the executive authorities and he was entrusted with the highly responsible duty of watching the bearings of an engine and a rather long line shaft to see that none of them attained an unreasonably high temperature. He worked on the night shift and his salary was fixed at $30. a month.

Few contributions that I have been able to make in the electrical field have been to me a source of greater satisfaction than the small part I was able to play in enlisting Mr. Scott's services for the Company. It was not long before an opportunity for better utilization of his ability presented itself. Nicola Tesla, whose patents covering the ~~Polyphase~~ induction Motor, had recently been acquired by Westinghouse was endeavoring to develop a line of commercial motors. I was asked to find a competent man to assist him. Scott was suggested and within a few months his painstaking analytical ability resulted in notable progress. While a thoroughly satisfactory motor was not produced at that time, his work threw much light upon the subject and paved the way to the brilliant success later achieved by Lamme with whom Scott effectively cooperated. Within two years of his arrival at Pittsburgh, his standing as one of the ablest engineers and designers in the alternating current field was widely recognized.

Appraisal of the contributions of individuals in developing from the discoveries of the scientist the art by which those discoveries are utilized for practical purposes, is possible only when we realize the state of that art at the time when those contributions were made. In brief, the situation in 1888 was as follows:

Edison's incandescent lamp was nine years old, and his system of direct current distribution was in successful commercial operation in a considerable number of our larger cities. The alternating current transformer, essentially in its present form, was about three years old. The ~~polyphase~~ induction motor was a year old, but it was still in the laboratory and could not be used in commercial service. Direct current motors were in use to a very limited extent, while a commercially successful alternating current motor did not exist. The first single-phase alternating current commercial lighting plants had been installed less than a year. They employed a primary potential of 1100 volts at 133 cycles, and were used exclusively for incandescent lighting, all efforts to develop a satisfactory motor for single-phase operating at this frequency having failed.

It was obvious that the transformer was the key to power transmission, as well as to electric lighting at distances far beyond the range of the direct current system, a fact which greatly emphasized the importance of prompt development of an effective alternating current motor.

The next great step toward realization of our present widespread and intensive use of electricity was the invention of Tesla's motor to which I already have referred. However, before that motor was ready for commercial service an incident occurred which exerted a considerable influence upon the development of transmission by electric power.

In 1890, a man from the west came east with a definite power transmission problem. His company was operating a stamp mill in the mountains of Colorado. Fuel was very expensive and three miles from the mill was an adequate water power. The man from the west wanted to know whether electricity could transmit 100 horse power a distance of three miles and rep lace the steam plant which he was using. After investigating the possibilities of 220 volt direct current transmission and satisfying himself that the amount of copper required was prohibitive, he visited Pittsburgh. In connection with, and immediately following his work with the poly-phase motor, Scott had been experimenting with a 50 horse power single-phase alternator used as a motor. When brought up to speed and synchronized with a generator it functioned as expected with high efficiency. He thought he could design a split-phase motor which, when supplied with single-phase current would develop sufficient power to bring a 100 horse power single-phase motor up to speed. The executive officers of the Company were induced to authorize a contract and early in 1891, at Telluride, Colorado, the first alternating power transmission plant in America began operation. From the outstart, it was a complete success and attracted wide attention. Many who had been doubtful regarding the practicability of electric transmission of power, now became convinced of its advantages.

The four year period ending with the year 1892 was a busy time for the engineering staff in Pittsburgh numbering at that time not more than a dozen men. The incandescent lighting business of the Company was expanding rapidly. The Thompson-Houston Company became increasingly active in the alternating current field and installed a number of single-phase lighting plants using 125 cycles. The Edison Electric Company, which then manufactured and sold Edison apparatus and which ultimately merged with the Thompson-Houston Company to form the General Electric Company, opposed the introduction of the alternating current with great vigor, even going so far as to seek legislation by various states prohibiting the use of any potential in excess of 800 volts and this situation for a time made considerable demands upon some of the engineering staff at Pittsburgh. It happened also that for a considerable part of the period referred to financial stringency imposed serious limitation upon development work. Nevertheless, during the four years to which I am referring, the work of developing the poly-phase system for commercial service progressed. Toward the end of the year 1892, the Company announced to the Niagara Falls Power Company and others that it was prepared to supply complete installations of two-phase apparatus. Sixty cycles and thirty cycles were adopted as standard frequencies; the latter to be used when a large part of the output must be converted to direct current for street railway or other purposes. In 1893, the Chicago Exposition was lighted by two-phase alternators of 750 k.w. rating and the Company exhibited in Chicago a complete power transmission installation comprising alternators and convertors of 375 k.w. rating, step up and step down transformers, transmission circuit, two-phase motors and direct current motors for railway purposes and arc lights supplied by direct current through convertors. This demonstration plant embodied the essential elements of electric power transmission as used today and from that time, the single-phase system gradually became obsolescent.

Tesla's first motors were designed for two-phase current and the one fundamental feature which now is accepted as standard practice, but was not adopted at Pittsburgh during the period referred to, is the three-phase current. When the General Electric Company entered the alternating current field with great vigor and ability in 1892, it promptly adopted the three-phase system which now is almost universally used. This is neither the time nor the place to recite the reasons why the Westinghouse engineers in 1892 were adhering to the two-phase system, and I refer to it only in order to relate the story of Scott's invention of the well-known two-phase, three-phase trans-

Time does not permit detailed reference to other important work accomplished.

He was the first man to measure Corona losses. This was done in the laboratory at Pittsburgh and led to the work which Mershon subsequently carried on in Colorado where field measurements were made. Scott's paper on the subject suggested to Professor Ryan at Palo Alto the idea of further investigating the phenomenon, an investigation which Ryan so admirably carried out.

At Pittsburgh, Scott was the first to suggest the use of water to cool oil insulated transformers.

More recently, as Consulting Engineer to the New Haven Railroad, he investigated and recommended the three wire plan - 22,000 volts between feeder and trolley with the track as the middle wire - which plan is now used by that Railroad.

Nearly twenty years ago, as President of this Institute, I had the honor and pleasure of presenting to that great inventor and dean of the electrical engineering profession, Elihu Thompson, the Edison medal upon the occasion of its first award. This evening, I am greatly endebted to your President, whose courteous invitation has enabled me to participate in awarding this médal to your distinguished Past President, my long time friend, Charles F. Scott.