

THE PROGRESS OF SCIENCE

NIKOLA TESLA, 1857-1943

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With the death of Nikola Tesla in New York City on January 7th, 1943, there passed a man whose inventions in the field of alternating current power transmission exerted a profound effect upon the development of the electrical industry, whose investigations in the field of high-frequency currents brought him to the threshold of the discovery of wireless signaling, and whose prophecy of the advent of radio broadcasting nearly forty years ago, with all its social implications, has been fulfilled with an accuracy which is almost uncanny.

He was born of the Serbian race in 1857 at Smiljan, Lika on the border of Austria-Hungary. After attending the local schools, he finished his studies at the Polytechnic School of Graz, Austria, and at the University of Prague, specializing in physics and mathematics. It appears that at the Polytechnic School he became acquainted with the rotating electrical machinery of that day, and was much impressed with the mechanical weaknesses and general undesirability of commutators and brushes, an observation which was later to lead to his most important invention. After spending a few years obtaining practical experience in the electrical art at the centers of activity on the continent, in 1884 he came to the United States, and secured employment at one of the Edison companies, which were then engaged in the development of the direct current lighting system.

In the succeeding years, the idea of eliminating brushes and commutators by means of a rotating magnetic field began to take form in his mind, and resulted in the invention of the induction motor and the polyphase transmission system. In 1887 the Tesla Electric Company was formed to develop these ideas and shortly thereafter the Westinghouse organization, appreciating the possibilities of the system, took it up as a major project. The tremendous potentialities of the alternating current system were explored and extended, and its advantages became more clearly apparent, other organizations bent their efforts in the same direction. On this part of Tesla's career much will probably be written by men whose actual contact with the work qualifies them better than the writer to speak.

The work of practical design and exploitation having passed into hands more capable to carry it on, Tesla began a series of painstaking investigations of the effects of high-frequency, high-voltage currents, which were to bring him to the brink of the

discovery of radio signaling. It is not clear from his lectures what the motivating force was which initiated these investigations. He appears to have started by utilizing the ordinary spark induction coil, but energized it by specially designed alternators giving frequencies of the order of 10,000 cycles. Apparently he observed and understood the effects of resonance and distributed capacity in the equipment, for we find him, in order to produce currents of still higher frequencies, proceeding to the invention of the oscillation transformer with its primary excited by currents from the discharges of a condenser across a spark gap: the now well known "Tesla Coil." With this mechanism he produced brush discharges at extraordinarily high voltages, and demonstrated many new and striking effects.

His lectures, delivered in the years 1892 and 1893 in the United States and Europe, disclosed a long series of experiments relating to the application of these currents for the production of light in various ways from evacuated, filament-less, tubes.

There is in the lecture delivered before The Franklin Institute in 1893 a proposal of a method of signaling "without the use of wires," which, had it been followed up experimentally, might well have led to the discoveries which were later to be made by Marconi. It seems to have been some kind of intuition that led Tesla to propose nearly all the means by which radio signaling was originally practiced. He proposes to disturb "the charges the earth" by setting up alternating or oscillating currents in an elevated conductor connected to an alternating current machine, or to one of his, oscillators whose other terminal is connected to the earth. As a receiving means he proposes to set up an elevated conductor, resonated to earth, to respond to the transmitter. All that he failed to describe from an apparatus standpoint, was some suitably sensitive device to indicate or detect the received signals.

There is a very reasonable possibility that, had Tesla proceeded experimentally along these lines, he would have met with success. It would not have been the first time that an important discovery was made by following an erroneous theory.

For many years Tesla conducted experiments in a laboratory erected in Colorado, and later at a plant located at Wardenclyffe, Long Island, to follow out his theory, now extended to include also the transmission of power by "wobbling the charges of the earth." No technical account of these experiments has ever appeared.

Yet in his last publication on the subject there appears what might almost be termed a vision of the destiny of radio, so clearly did he forecast its all important field of utility and service: broadcasting. A part of it is quoted herewith from the Appendix of his book, published in 1904, entitled "Experiments with Alternate Currents of High Potential and High Frequency." Referring to his plans for the utilization of his own system he states:

"I have no doubt that it will prove very efficient in enlightening the masses, particularly in still uncivilized countries and less accessible regions, and that it will add materially to general safety, comfort, convenience, and maintenance of peaceful relations. It involves the employment of a number of plants, all of which are capable of transmitting individualized signals to the uttermost confines of the earth. Each of them will be preferably located near some important center of civilization, and the news it receives through any channel will be flashed to all points of the globe. A cheap and simple device, which might be carried in one's pocket, may then be set up somewhere on sea or land, and it will record the world's news or such special messages as may be intended for it."

Of course the instrumentalities for providing broadcasting were not then in existence. Tesla was classed as a visionary, and his prophecy was forgotten. What harsher terms might, with justice, be applied to many of us who helped produce the instrumentalities with which broadcasting was eventually accomplished! We applied them to point-to-point communication, failing completely to realize the significance of Tesla's words.

EDWIN H. ARMSTRONG

Recovered from oblivion by Al Klase, 6 April 2018.