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LAW, DESCRIPTION AND HYPOTHESIS IN THE ELECTRICAL SCIENCE[1]

YOUR invitation to deliver the first Steinmetz lecture I consider a very great honor. The late Doctor Steinmetz was a dear friend of mine. I met him in Yonkers in 1889, and from that time on until his death we were tied to each other by bonds of personal sympathy and scientific interest, which was a source of uninterrupted pleasure to both of us.

This lecture is an attempt to describe briefly how Faraday and Maxwell, starting from definite laws which were discovered by experiment, created the modern electromagnetic theory by a prophetic use of description and hypothesis and how this theory furnishes the foundation of the science of electrical engineering. Our knowledge of electrical phenomena began its career as a science when it started to build upon a foundation of a quantitative law. Coulomb's law marks, therefore, the beginning of the electrical science. It says that two electrical point charges in a vacuum act upon each other with a mechanical force which is equal to the product of the two charges divided by the square of the distance between them.

In its mathematical form Coulomb's law is identical with Newton's law of gravitational action. Many theorems which the mathematical physicists of the eighteenth and the beginning of the nineteenth century had developed in their analysis of gravitational fields of force were, apparently, directly applicable to the analysis of electrical fields. This was very fortunate, because it attracted some of the best mathematical minds of those days to the electrical science. This raised its standing among the sciences which it badly needed.

Newton's great essay, "Principia Philosophiae Naturalis," published in the beginning of the eighteenth century, created a new school of natural philosophers which dominated during the eighteenth century the scientific mental attitude of the world. No natural philosopher of those days could expect to attract serious attention who departed from the rigorously mathematical methods of this school. Even so great a natural philosopher as Benjamin Franklin may be said to have been snubbed by the Royal Society, when it refused to publish in its transactions Franklin's communications describing his electrical experiments. These experiments, suggested by and clustering around

[1] The first Steinmetz lecture delivered on May 8, 1925, before the Schenectady section of the American Institute of Electrical Engineers.