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## THE THERMIONIC VALVE IN SCIENTIFIC RESEARCH<sup>1</sup>

By Sir AMBROSE FLEMING

EMERITUS PROFESSOR OF ELECTRICAL ENGINEERING IN THE UNIVERSITY OF LONDON

THE thermionic valve, which as a technical invention has made possible the great achievements of telephonic broadcasting and television, arose out of scientific research intended to elucidate certain observed phenomena in connection with the working of incandescent electric lamps in 1882 and 1883. It has also provided in itself a new and valuable instrument of research for physical investigation. The initial steps were taken in this invention when the writer as scientific adviser of the original Edison Electric Light Company of London began to study the projection of carbon atoms from the carbon filament of the then used Edison car-

bonized bamboo filament electric lamps, which, together with the carbonized cotton thread incandescent lamps of Swan, provided the first practical domestic electric lighting system for general use. It was soon found that these lamps had a black deposit made on the interior of the glass bulb in course of time which was fairly uniform and was doubtless due to an evaporation of the carbon, which substance like iodine and camphor and some others passes from the solid state to the gaseous without any intermediate liquid state.

On the other hand, in certain cases in which a line of no carbon deposit appeared on the bulb in the plane of the hairpin-shaped carbon filament, it was evident that the projection of carbon particles had taken place from one particular overheated point on the filament. This projection was due to a process of electric "splut-

<sup>1</sup> Abstract read by Dr. Howard McClenahan, secretary and director of The Franklin Institute, at Medal Day Exercises in the institute when Sir Ambrose was awarded the Franklin Medal.