

It is well known that these rays impress electrical conductivity upon gases which they traverse, and it is generally agreed that they consist of very small negatively charged particles of matter. Their presence within the cylinders would therefore account for the observed conductivity, and for the negative charges gained by the electrode at low pressures.

But there are difficulties connected with the supposed production of cathode rays within the cylinders which are not easily explained. That these rays travelled from the cathode of the discharge tube through the thick brass walls to the electrode *C*, Professor Thomson considered highly improbable. He suggested, however, that possibly the effects may have been due to secondary discharges between the cylinder and the inclosed electrode; that, in fact, the ends of the cylinders, when under bombardment by the cathode rays of the discharge tube, may have become negatively charged, and acting as new cathodes may have projected streams of cathode rays against the electrode.

As an objection to this explanation it may be pointed out that when the discharge tubes were excited, the cylinders were always connected to earth by wires of small resistance. It therefore seems probable that if portions of cylinders acquired potentials sufficiently high to produce discharges of cathode rays, these discharges would also have been accompanied by electric currents of considerable intensity along the earth wires. There appears, however, to be no indication that such currents existed, and in default of further experimental evidence the hypothesis of secondary discharges seems hardly tenable.

The object of the experiments described in this paper was to investigate this point more fully and to determine, if possible, a more satisfactory explanation of the effect.

The investigation was begun with tubes identical in construction with those used by Professor Thomson, but as these could not be taken apart to make changes in the cylinders the experiments were completed with tubes somewhat modified in form.

The experiments are described under the following subdivisions:—

1. Preliminary experiments.
2. Electrical conduction along the surface of glass.
3. Penetrating power of cathode rays.
4. Influence of bad earth connections.
5. Influence of small openings in Faraday cylinders inserted in vacuum tubes.