

DEMONSTRATION OF THE WIND IN THE
CORONA DISCHARGE

JAKOB KUNZ, UNIVERSITY OF ILLINOIS

The characteristic pressure increase observed in the corona discharge can be explained by the assumption that the positive ions arising from the luminous layer surrounding the positive wire transmit their momentum to the gas molecules, according to the principle: $ne E dt = dp_2 nr$.* It was found that the mobility of the positive ions in various gases is remarkably low, and therefore the pressure increase rather high, amounting in several experiments to 2 and 3 cm. of water. If the corona discharge takes place in an open gas between parallel wires, then we observe the mechanical momentum as a wind away from the positive wire, whereas in a closed cylinder the wind makes itself felt as pressure increase.

The experimental arrangement was very simple. Two wires of 0.12 mm. diameter, 30 cm. long, and 3 cm. apart, were stretched between two hard rubber plates and a potential difference was applied from 0 volts up to 18000 volts from a battery of dynamo machines. In a wash bottle was put a small quantity of ether, so that no bubbles were formed by the slow stream of air which was driven through the bottle, carrying ether vapors with it. This stream of air and ether vapor passed through a stop cock, a glass sphere of 10 cm. diameter, and escaped through a capillary of about 1 mm. opening into the air between the parallel wires, forming a beautiful regular jet of arbitrary length. This jet between the wires was projected by means of an arc without lenses on a screen. The distance between the arc and the wires was about 1.5 m., and this was also the distance between the wires and the screen.

When a potential difference of 15000 volts was applied no deflection of the jet could be observed; there was, however, a small deflection for a potential difference a

* On the Pressure in the Corona Discharge. Phys. Rev., Vol. 19, p. 165. 1922.

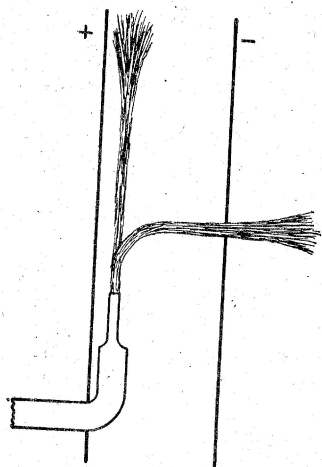


Fig. 1

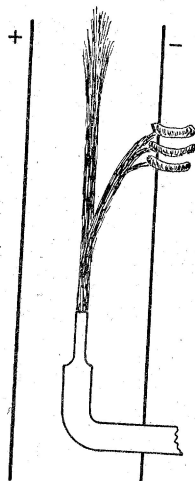


Fig. 3.- Jet 2 cm. in front of plane of wires.

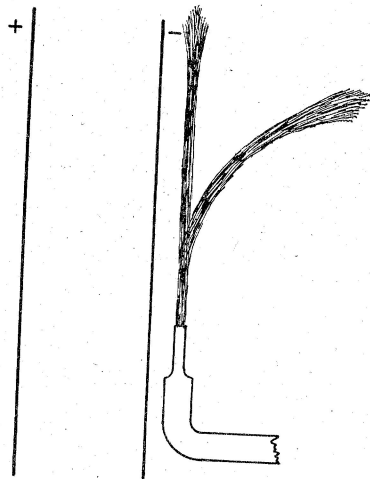
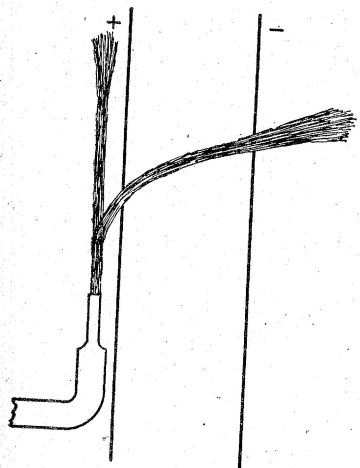


Figure 2

little below the critical difference for which the positive corona became visible. As soon as the corona appeared in the form of a uniform layer of weak light surrounding the positive wire, then the deflection of the jet of ether was very marked, as indicated in the following photographic picture and in the drawings made on the screen directly. The deflection could be varied at will by changing the air current through the ether; or the potential difference across the wires. The two variables could easily be adjusted so that the originally vertical jet was directed at right angles and passed a long distance beyond the negative wire. The largest deflections were obtained when the capillary was set between the two wires about 5 mm. away from the positive wire. See Fig. 1. But even when the capillary was placed behind the negative wire or in front of the positive wire, a marked deflection was obtained, as can be seen from Fig. 2. Finally, if the capillary was placed about 2 cm. outside the vertical plane containing the wires, a considerable deflection was observed as indicated by Fig. 3. These 3 figures indicate the strong wind blowing from the positive to the negative wire.

Instead of ether a jet of ammonium chloride or of water vapor can also be used. The water vapor jet appeared darker with the corona discharge than without it, indicating the condensation of water vapor around the ions. In the photographic picture the corona took place between a positive wire of 0.3 mm. diameter and a negative wire of 1.25 mm. diameter. It was observed that when the potential difference was applied in the first instant the positive wire was surrounded by diffused streamers of light, which disappeared suddenly, giving rise to the uniform positive layer of light. This observation may help to explain the beginning of the corona.

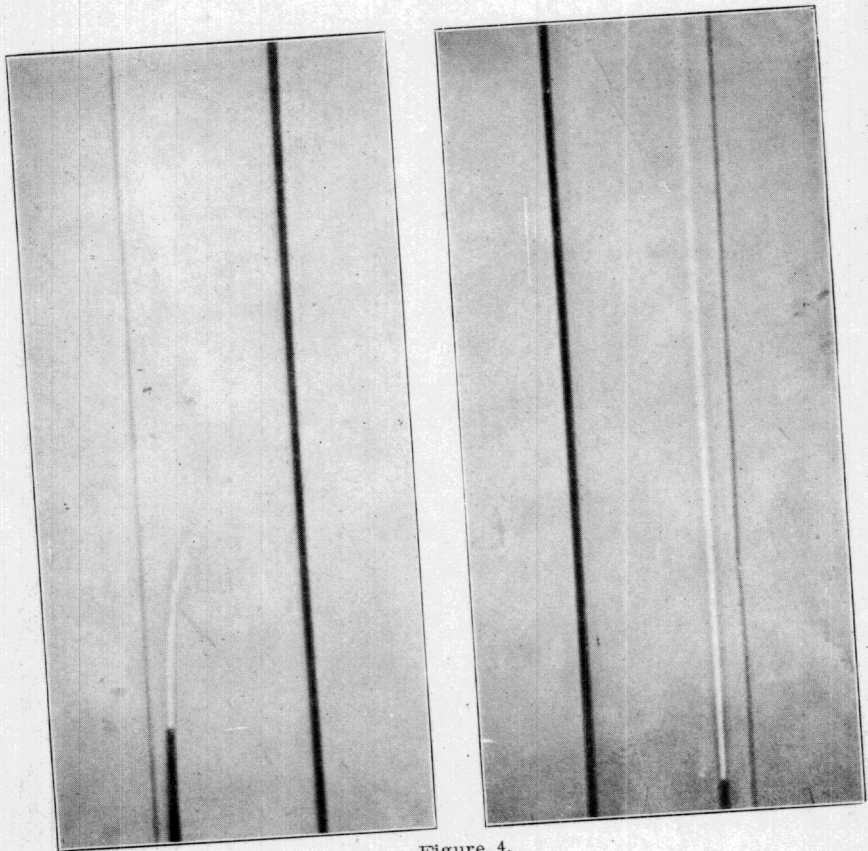


Figure 4.