A FURTHER STUDY OF PRESSURE REVERSALS IN THE CORONA DISCHARGE.

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Last year K. B. McEachron presented a paper before this Academy, entitled, "Some Characteristics of a Siemens Ozonizer,"[1] in which a number of experiments with a corona discharge in stagnant air were described. Some very peculiar results were obtained which are not well understood. Further work seemed desirable and an account is given here of some experiments which have been made under somewhat dif-

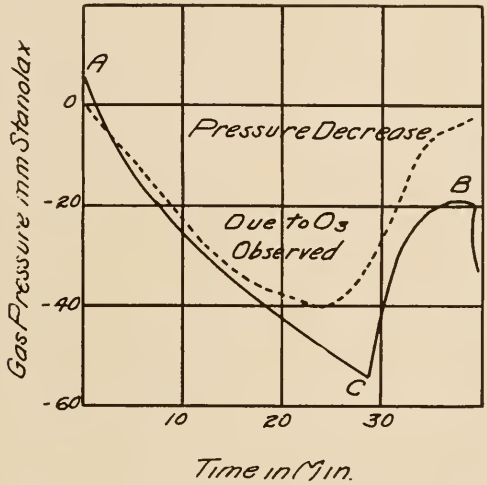

Fig. 1. There is usually an initial jump in the pressure on turning on the discharge due to the ionization pressure (Kunz). At C there is a reversal in pressure which is rather abrupt. When the current is turned off at B there is a sudden decrease in pressure due to the removal of the forces which produce the ionization pressure.

ferent experimental conditions. New facts are added to our knowledge of reversals and the foundation is being laid for an adequate explanation of these peculiar effects. It seems almost certain that the effects are catalytic in nature but the mechanism needs further elucidation.

Experimental: A No. 36 aluminum wire was placed at the axis of a Liebig condenser and was surrounded by four glass rods each two mm. in diameter. From the dielectric constant of the glass it is possible to calculate their dielectric effect on the discharge (Cf. preceding article). Air, dried and freed from carbon dioxide, was enclosed within the tube and the discharge was allowed to pass under definite conditions. The method of making analysis of the gases for ozone and oxides of nitrogen has been described.[2] A small transformer was used to step

[1] McEachron. Proc. Ind. Acad. Sci. 1921, p. 171.

[2] Anderegg. Proc. Ind. Acad. Sci. 1921, p. 159.

up 110 V. alternating current. The voltage was taken from the primary voltmeter reading and the transformer ratio. The gas pressure in the tube was measured by means of a manometer filled with "stanolax", a heavy paraffin oil with a density of 0.857. Some of the results obtained are given in figure 1. It is to be noted that there is a critical voltage above which there is no pressure decrease under the given conditions. At the lower voltages the first part of the decrease in pressure, when allowance is made for the ionization pressure[3] is exactly caused by the ozone formed as is shown in figure 2. Towards the re-

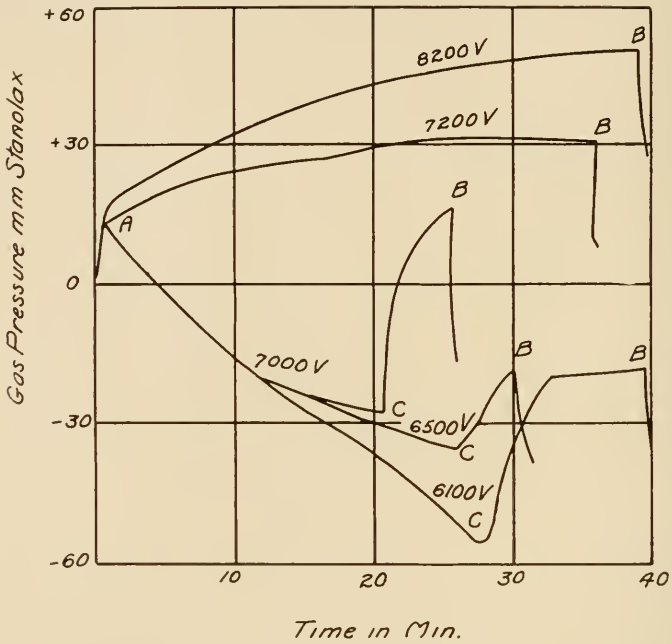

Fig. 2. A series of runs over varying length of discharge time was made at about 6100 volts.

versal point there is an accumulation of oxides of nitrogen which prevent the further formation of much ozone. This part checks McEachron's results.

Discussion. In the corona discharge ozone is the chief product formed at first, provided the intensity of the discharge and the temperature are not too great. A little nitrogen is oxidized, which gradually accumulates with time, and not only reduces the ozone concentration, but prevents further ozone formation. There are two possibilities, one is catalytic decomposition of the ozone molecules in the gas space by oxides of nitrogen; another is the adsorption of the oxides of nitrogen, (these may possibly be very heavy molecules), on the walls

[3] Kunz. Phys. Rev. 8, 285 (1916); 10, 483 (1917); 19, 165, 244, 390 (1922).

of the tube where the ozone may be catalytically decomposed. In addition the accumulation of oxides of nitrogen on the walls will change the nature of the surface and therefore the nature of the discharge is apt to be altered. The discharge tends to be concentrated into a few brushes in which the more intense activation allows less and less ozone to exist. Finally, when the whole wall is all covered a further change in the discharge occurs. The adsorbed molecules are more or less driven off and decomposed, explaining the pressure increase. There is, doubtless, a very complicated state of affairs. This hypothesis gives an explanation of the observed facts. It is now being further tested experimentally.