COMPARATIVE EFFICIENCY OF WEHNELT CATHODES IN RESIDUAL AIR AND HYDROGEN

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ABSTRACT

A Wehnelt cathode, heated to a cherry red, was used in a discharge tube of approximately .03 mm. of mercury pressure. The active material on the cathode was produced by heating Bank of England sealing wax. A 500-volt direct-current generator maintained a steady potential difference across the tube.

First with dry air as the contained gas, the discharge current was measured every fifteen minutes for three hours. Beginning with a value of 2.5×10^{-6} amperes, the current decreased at a nearly steady rate to 1.4×10^{-6} amperes.

At the end of this three hour period the atmosphere was quickly changed to hydrogen at about the same pressure. The current then suddenly increased almost two thousand times. In a few minutes the discharge decreased to 4×10^{-6} amperes. Three minutes later an "explosion" took place at which the current rapidly increased and in seven minutes time reached a value of 31.2×10^{-6} amperes. Then as quickly the current decreased to nearly its value before the "explosion." Hereafter the decrease was at the same rate it had been in air.

The above data were taken from a typical curve and were verified by other readings. The conclusions from the investigation are:

(1) Considering the normal decrease in the discharge, the Wehnelt cathode is about three times as efficient in hydrogen as in air.

(2) Explosions are likely to occur soon after the apparent steady condition is reached and not later.

(3) The rate of decrease of the current is not dependent on the pressure within the limits of ordinary vacuua, i. e., between .1 and .001 mm. of mercury.

(4) The tremendous increase in current upon the introduction of hydrogen continues for only a short time and is independent of the pressure.

(5) A small change in the heating current causes a large change in the thermonic current.

(6) Mechanical vibrations increase the discharge.

These observations agree with the results of other experimenters.

The author wishes to express his appreciation to Professor C. T. Knipp for the suggestion of the problem and for assistance in carrying out the details.