CATHODE STRUCTURE FOR VACUUM TUBES

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Inventor:
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by Alexander S. Lewis
His Attorney.
The present invention relates to vacuum tubes and more particularly to a cathode structure adapted to be employed in connection with X-ray apparatus.

When vacuum tubes and particularly tubes of the X-ray type are operated at high voltages, electronic discharges sometimes occur from portions of the apparatus other than the cathode electrode, due to existing edges within the tube or to surfaces having relatively small radii of curvature. Such discharges are harmful and are specially noticeable when the electrodes are spaced a short distance apart, such arrangement of electrodes being generally quite advantageous.

To overcome this difficulty, it has been heretofore proposed that within the area of the strong electric field, the portion of the cathode structure, other than the part designed to emit electrons, be made everywhere slightly curved and that the surfaces of slight curvature be smoothed.

During the manufacture of vacuum tubes and especially high vacuum tubes, it is necessary during the pumping operation to bring all metal parts within the tube to as high a temperature as possible. At such a temperature it is usually found that metal points and sharpened edges which have been depressed in the polishing process become straightened out and later in the operation of the vacuum tube send out electronic discharges.

The capacity for emitting electrons varies with different materials and is inferior for all other materials than metal. In accordance with the present invention such parts of the cathode system in vacuum tubes which are not intended to send out any electronic discharge are formed of other materials than metal, or if formed of metal, refractory non-metal coatings are applied to the metal. Coatings particularly well adapted for use under such conditions are oxides, the structures of which are substantially constant at the high temperatures involved in the operation of vacuum tubes and which do not vary under ion or electron bombardment. I have found that chromium oxide is particularly well adapted for this purpose.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, will best be understood from reference to the following specification when considered in connection with the accompanying drawing in which the single figure represents a sectional view partly broken away of an X-ray tube embodying the features of my invention.

Referring to the drawing, I have indicated at 1, an evacuated receptacle having a reentrant stem 2 on which an elongated metallic cylindrical member 3 comprising a portion of the cathode structure is mounted. Member 3 at its outer end is slightly depressed, as indicated at 4, and within the depressed portion a cathode or electron-emitting electrode 5 is mounted. The member 3 closely surrounds the cathode element 5. A pair of leading-in wires 6 and 7 are connected to the member 3 and electrode 5, respectively, so that a potential may be supplied thereto in the normal operation of the tube. A cooperating anode or target 8 is mounted opposite the electrode 5. To prevent electronic emission from any portion of the cathode structure other than the portion 5, the outer surface of the metallic cylinder 3 is provided with a coating 9 of refractory oxide, preferably chromium oxide. Such a coating remains substantially constant under high temperature conditions and electron and ion bombardment and restricts the electron emission to the electrode 5 alone.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An electric discharge device comprising an evacuated receptacle which terminates in a reentrant stem, a cathode and a cooperating anode contained in the receptacle, a support for the cathode comprising a metal tube secured at one end to said stem and supporting the cathode at the other end, said tube being coated with refractory oxide and having its edges rounded whereby electron emission from the tube is precluded.

2. An electric discharge device comprising an evacuated receptacle which terminates in a reentrant stem, a cathode and a cooperating
anode contained in the receptacle, a support for the cathode comprising a metal tube which fits over the reentrant stem and is secured thereto, said cathode being mounted at the other end of the tube remote from the stem, said tube being coated with chromium oxide and having its edges rounded whereby electron emission from the tube is precluded.

In witness whereof, I have hereto set my hand this 30 day of June, 1927.

WALTER HOFMANN.