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CATHODE INSULATOR

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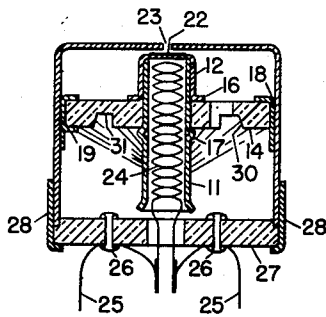


Fig. 1

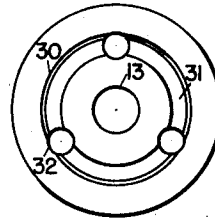


Fig. 2

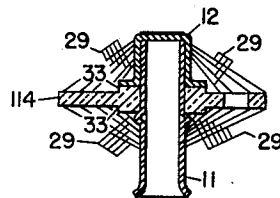


Fig. 3

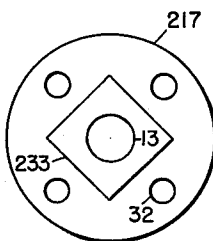


Fig. 4

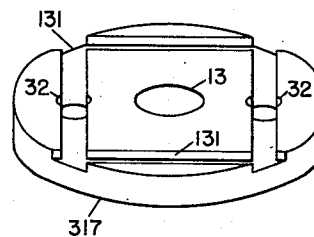


Fig. 5

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CATHODE INSULATOR

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6 Claims. (Cl. 313—250)

1

This invention relates to electron discharge devices and more particularly to the cathode mounting insulator therein.

In electron discharge devices such as cathode ray tubes, it is undesirable to have an internal low resistance leakage path between the cathode and the control grid. The cathode of cathode ray tubes is usually shaped like a cylinder, capped at one end and mounted axially in a ceramic disk which in turn is mounted coaxially in a thimble shaped control grid. While the cathode ray tube is in normal use, the undesirable leakage path between the cathode and grid frequently forms on the surface of this disk insulator by the evaporation of metal from the outer walls of the cathode cylinder. As more and more metal is deposited on the disk, a conductive film is built up which forms an electrical connection between the cathode and grid and ruins the tube.

It is one object of this invention to provide an improved cathode ray tube by providing an insulating disk on which a continuous film between the grid and cathode cannot form.

Another object is to provide a cathode support insulator which, without the assistance of other, complicated structures, will prevent the formation of the continuous conductive film between grid and cathode.

Other objects and advantages will in part be obvious and in part appear hereinafter.

The invention is accordingly embodied in a cathode structure for an electron emission device in which that portion thereof which evaporates metal which tends to deposit on insulation intervening between the cathode and control grid is modified to provide a shadow zone surrounding the cathode structure so that metal evaporating from surfaces in the cathode structure and passing in straight lines to the insulator will not see the shadow zone. Briefly the invention is based on the observation that evaporating metal will travel in relatively straight lines to the nearest relatively cool surface to condense and, accordingly, by incorporating in the insulator of a cathode structure a shadow zone the formation of a continuous conductive metal film on the insulator is avoided. The invention thus is embodied in a cathode insulator and cathode structure for an electron emission device having the features of construction, combination of elements and arrangement of parts hereinafter to be described.

Figure 1 shows a cross section of the cathode grid assembly of a cathode ray tube utilizing this invention.

Figure 2 shows one side of the cathode insulating disk in Figure 1.

2

Figures 3, 4 and 5 show different embodiments of this invention.

In Figure 1 the cathode, comprising a cylindrical sleeve 11 having a cap 12 welded or otherwise secured thereto, is held securely in the central aperture 13 (Figure 2) of an insulating disk 14 by means of a skirt 16 on the cap 12 abutting against one side of the disk 14 and a ridge 17 on the other side of the disk. The periphery of the disk 14 is held in a ring 18 of the type disclosed in my co-pending application, Serial No. 161,793 by means of a plurality of fingers 19 at intervals around the ring 18, which in turn is welded to the cylindrical sides of the thimble-shaped grid.

The electron-emissive material 22 is located on the top of the cap 12 adjacent the grid aperture 23. A heater 24 is held within the cathode sleeve 11 by a pair of supports 25 which in turn are attached by means of a pair of eyelets 26 to a disk 27, which is secured to the grid by a plurality of fingers 28.

In normal operation, electrical current supplied to the heater 24 heats the cap 12 thereby heating the material 22 sufficiently to cause the emission of electrons therefrom. These electrons are utilized in the well known way to form a cathode ray beam. In heating the cap 12, the heater 24 also heats the sleeve 11 sufficiently so that over a period of time some of the metal forming the sleeve 11 will be evaporated, and, will condense on the disk 14, the cooler portion of the zone. In order to provide a break in this metal layer, an annular trough 31, which is also shown in Figure 2, is cut or molded in the disk 14 during the manufacturing process. The disk 14 must be heat resistant and rigid and is therefore preferably, but not necessarily, made of a ceramic material with one or more breather holes 32 therethrough to assist in evacuating the tube. It is necessary that the side of the trough nearest the cathode be sufficiently perpendicular to the surface of disk 14 so that none of the evaporated metal will "see" that surface to impinge thereon. Thus a break or shadow in the metal deposition is assured. In order that the ceramic disk 14 may be easily withdrawn from the die in the molding process by which these insulators are usually made, the outer wall 30 of the trough 31 is preferably sloped slightly.

Figure 3 shows the cathode mounted in a different type of insulating disk 114. Instead of having a trough, the disk 114 has raised portions 33 which may be on both sides in order to provide a leakage-proof surface on the top as well as the bottom of the disk.

Figures 4 and 5 illustrate two other modifications. In Figure 4 the raised portions 233 are

square shaped and may be formed, for instance, by milling the surface of the disk 217 in four places around the center. In Figure 5 the slots 131 are milled into the surface of the disk 317.

It will be obvious to those skilled in the art that modifications may be made in this invention without departing from the spirit thereof.

What is claimed is:

1. In a cathode ray tube comprising a tubular electron emitting hot cathode and a tubular cold grid electrode coaxial with and surrounding said cathode, an insulating disk having a surface substantially perpendicular to the axis of said tubular electrodes, said disk having a central aperture in which said cathode is secured, the outer periphery of said disk being secured to said tubular portion of said grid, a trough in said disk surrounding said central aperture and intermediate said central aperture and said periphery, the wall of said trough nearer to said central aperture being substantially parallel to the axis of said cathode cylindrical portion and facing said grid.

2. In a cathode ray tube having a cylindrical cathode and thimble-shaped grid coaxial with and surrounding said cathode, an insulating disk having a central aperture in which said cylindrical cathode coaxially positioned at a point intermediate the ends thereof, the outer periphery of said insulating disk being secured to the inner wall of said thimble-shaped grid, said disk having a trough in the surface thereof intermediate said cathode and said grid, said trough having a wall substantially parallel to the axis of said cathode said wall facing said grid.

3. The device of claim 2 in which said trough comprises a plurality of straight sections.

4. In a cathode ray tube having a cylindrical cathode and a thimble-shaped grid coaxial with

and surrounding said cathode, an insulating disc having a central aperture in which said cylindrical cathode is coaxially positioned at a point intermediate the ends thereof, the outer periphery of said insulating disc being secured to the inner wall of said thimble-shaped grid, said disc having a trough in the surface thereof between said cathode and said grid.

5. In an electron discharge device, a cathode-grid assembly comprising an insulating disc having an aperture therein, a cathode positioned in said aperture and secured to said disc, a grid mounted concentrically with said cathode with the outer periphery of said insulating disc being secured to the inner wall of said grid, said disc having a trough in the surface thereof between said cathode and said grid.

6. In an electron discharge device, a cathode-grid assembly comprising an insulating disc having an aperture therein, a tubular cathode positioned in said aperture and secured to said disc, a tubular grid mounted concentrically with said cathode with the outer periphery of said insulating disc being secured to the inner wall of said grid, said disc having a trough in the surface thereof between said cathode and grid.

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