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SUPPORTING STRUCTURE

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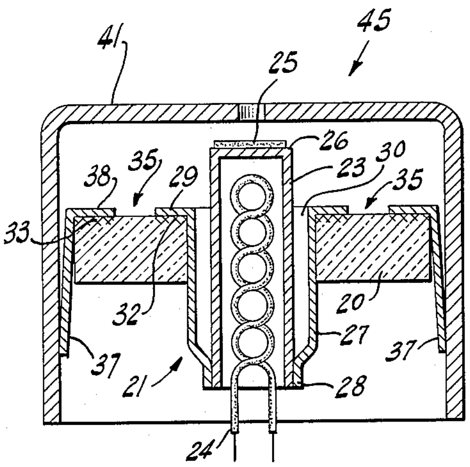

Fig. 1
Prior Art

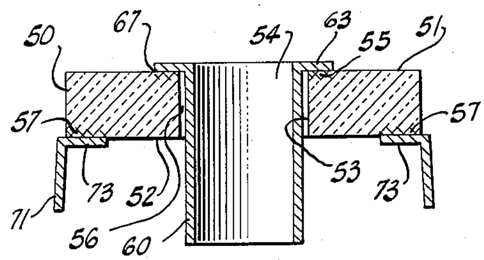

Fig. 2

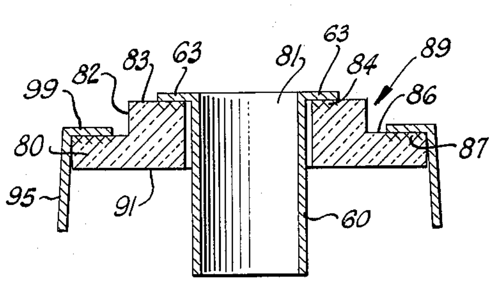

Fig. 3

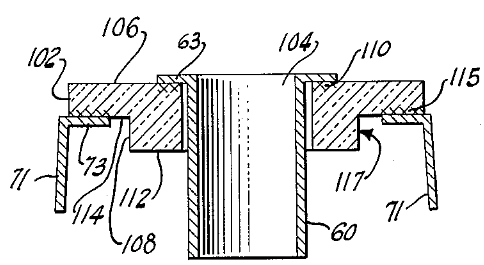

Fig. 4

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SUPPORTING STRUCTURE

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This invention relates to electrode supporting means in electron discharge devices and more particularly to means for insulatively spacing and supporting the components of a cathode assembly within a companion electrode structure for use in a cathode ray tube.

It has been conventional practice in the manufacture of cathode ray tubes to employ cathodes utilizing heat responsive electron emissive material as the source of beam energy. In devices of this nature the cathode usually comprises a cylindrical metal sleeve capped on one end with electron emissive material. There is disposed within the cathode cylinder a heater or resistance filament. A ceramic insulating disc, having an axial aperture therein, is normally used to position and support the cathode within a cup-shaped grid electrode having an apertured bottom.

It is operationally essential to have the cathode positioned in a manner that the emissive material thereon is properly oriented and spaced relative to the grid electrode aperture. It is also highly important that the cathode be mounted in its supporting structure to be spaced from the grid by an adequate amount of insulation in the form of insulative material thickness or area or both. Metallic vaporization emanating as sublimation from the heated cathode deposits on the surrounding areas, including the insulating area, and thusly promotes the formation of electrical leakage paths thereacross. Therefore, it is paramount that the cathode structure be properly disposed in its support wafer relative to the adjacent grid electrode to assure an adequate electrical insulative area or barrier therebetween.

In one supporting method, the cathode cylinder is disposed in the disc aperture and fixed therein by means of swages or ferrules which contact the ceramic disc completely around the cathode cylinder. The disc being fixedly oriented within a circular metal retainer which is, in turn, positioned within the grid structure and affixed thereto. This method affords considerable insulation between the cathode structure and the grid but the swaging has a disadvantage in that it is difficult to achieve necessary and consistent tightness of the cathode in the insulator without fracturing the ceramic insulator. This factor of tightness assumes greater importance in color cathode ray tube applications where it is imperative to have the cathode rigidly anchored in the insulator. Any looseness of the cathode varies the critical operational cathode to grid spacing thereby generating deterimental spurious signals that are visibly manifest during tube operation.

By another supporting method conventionally utilized in color cathode ray tubes, the cathode cylinder is spacedly telescoped within a larger cylindrical cathode eyelet with the bottom end of the cathode being suitably joined to the bottom end of the eyelet. The cathode eyelet cylinder is then oriented within the axial aperture and mounted therein by peripheral seating means integral to the top or terminal end of the eyelet.

A retainer for positioning the disc within the adjacent grid electrode, having a circumferentially oriented seating surface to accommodate the disc, is likewise joined to the surface of the disc adjacent the eyelet seat but spaced therefrom.

The eyelet and the retainer are insulated from one another by the width of the circular intervening area of disc surface separating the adjacent edge of each. To provide adequate rigidity of the cathode eyelet with the disc, and the disc within the retainer, certain limitations of bearing or seating surface widths must be maintained along with adequate insulative spacing therebetween. In addition, in certain color tube applications it is desirous to miniaturize or further decrease the diametrical size of the disc. As the disc size is decreased, surface grooves are sometimes used to increase the surface or insulation area and produce insulative shadowing between the edges of the eyelet and the retainer, but obviously there is a limit to the useful extent of this innovation as the diametrical size of the disc decreases.

Accordingly, it is an object of the invention to reduce the aforementioned disadvantages by providing an improved cathode structure supporting member having superior insulative qualities.

A further object is to improve the insulation barrier between the cathode structure and the adjacent electrode.

Another object of the invention is to provide a miniature cathode-support structure adapted to rigid cathode mounting and having insulative spacings in leakage prone areas.

The foregoing objects are achieved in one aspect of the invention by the provision of a disc-like insulating support adapted to accommodate a cathode-containing eyelet and a support retainer each of which is separately and spacedly affixed thereto on different surfaces or surface levels thereof.

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following disclosure and appended claims in connection with the accompanying drawings in which:

FIGURE 1 is a sectional view illustrating a cathode-grid assembly comprising a heater, a cathode, a cathode eyelet, and an insulating support adapted for mounting within a grid structure as utilized in the prior art; and

FIGURES 2 through 4 are cross-sectional views showing various modifications of the cathode support structures embodying the invention.

In referring to FIGURE 1 there is shown a representation of the aforementioned prior art wherein a ceramic supporting disc 20 having a cathode structure 21 rigidly affixed therein is attachced to a support retainer 37 which is positionally mounted within an apertured grid electrode 41. An insulated heater 24 suitably disposed within cathode 23 functionally completes the assembly. In greater detail, cylindrical cathode 23 having electron emissive material 25 disposed on the capped end 26 thereof is spacedly telescoped within the cylindrical cathode eyelet 27 and joined thereto at one end by a welding jointure 28. The eyelet is adapted for insertion within the axial aperture 30 of ceramic disc 20. Integral to the open terminal end of the eyelet 27 is an outstanding seating ledge 29 formed to facilitate a braze jointure with disc 20 on the metallized surface area 32 surrounding the aperture 30.

Supporting disc 20 has a second circular metallized area 33 on substantially the peripheral area of the aforementioned disc surface.

A metal support retainer 37, dimensioned for sliding placement within grid electrode 41 and adapted to receive disc 20 is formed with a substantially instanding seating ledge 38 adapted for bonding to the peripheral metallized area 33 on ceramic disc 20. Thus a rigid cathode-grid assembly 45 is constructed wherein electrical insulation between the cathode structure 21 and the grid electrode 41 is effected by the ceramic surface spacing 35. It is clearly evident that as the diametrical size of the cathode-grid assembly 45 decreases, as is the case in the development of color cathode ray tube art, a condition is reached wherein inadequate insulative spacing 35 exists between the edges of eyelet seating means 29 and retainer ledge 38. Thus, practice of the aforedescribed prior art limits successful miniaturization of the cathode-grid assembly 45.

Now advertising to the structures of the invention as exemplified in FIGURES 2 through 4, it is evident that much greater miniaturization of the cathode-grid assembly is feasible. For clarity and simplicity only the cross-sectional manifestations of the ceramic support, the cathode eyelet and the support retainer are illustrated.

In FIGURE 2 there is shown a substantially planar ceramic supporting disc 50 having a first surface 51 and an oppositely disposed second surface 52 and an internal wall 53 defining an axial aperture 54 therethrough. The first surface 51 has a circular metallized area 55 adjacent the axial aperture 53 and the second surface 52 has a similar but circumferentially larger metallized area 57 adjacent the periphery of the disc 50. These metallizations 55 and 57 of the ceramic areas are accomplished by methods conventional to the art, as for example, by disposing molybdenum-manganese or nickel-titanium powder on the discrete areas of the disc and heating the ceramic to a temperature suitable for sintering.

A cathode eyelet 60 of nickel or stainless steel material and similar to the previously described eyelet 27, is aligned within the axial aperture 54 so as to be removed from internal wall 53 providing a space 56 therebetween. The terminally formed outstanding seating edge 63 on the eyelet is conventionally welded or brazed to effect a circumferential bond 67 with the circular metallized area 55 on the first surface 51 of the ceramic supporting disc 50

The term circumferential bonding, as used in this specification, may be defined as a continuous bond or a plurality of spaced spot-bonds effective equi-circumferential support.

An insulator retainer 71 formed of a metal such as stainless steel or nickel is utilized for supporting and positioning the ceramic insulating disc 50. This metal retainer terminally formed to have an instanding seating ledge 73 which mates with the peripheral metallized area 57 on the second surface 52 of ceramic 50 and is likewise circumferentially bonded thereto by welding or brazing.

The insulative advantages realized in this type of ceramic support are clearly evident as the construction affords maximum insulation area between the cathode eyelet and the grid.

Another embodiment is shown in FIGURE 3 wherein a disc-like ceramic support insulator 80, having an axial aperture 81, therein has a stepped first surface 82 comprising at least a rasied first circular level 83 and a lower circular second level 86. The second surface 91 of the ceramic is substantially planar. The first level 83 has a circular metallized area 84 disposed adjacent the aperture 81 and the second or lower level 86 has a similar but circularly larger metallized area 87 disposed adjacent the periphery of the ceramic disc 80.

The cathode eyelet 60 is spacedly positioned within the aperture as described in the previous embodiment and the seating edge 63 suitably bonded to metallized area 84.

A metal insulator retainer 95 is terminally formed to have an instanding seating ledge 99 and has an internal dimension at least equal to the diameter of the insulator 80 to permit placement of the insulator therein; ledge 99 being circumferentially bonded to metallized area 87 on the second level 86.

In this embodiment, the stepped construction of the first surface 82 affords an insulative area 89 between the peripheral boundary of the raised first level 83 and this inner boundary of the lower second level 86. This insulative area 89 is oriented so as to be shadowed from sublimation by the first raised level 83.

In an alternate embodiment as illustrated in FIGURE 4, there is shown a disc-like support insulator 102, having an axial aperture 104 therein, a planar first surface 106 and a stepped second surface 108. The first surface has a circular metallized area 110 adjacent the aperture 104. The eyelet 60, as aforedescribed, is positioned within the aperture and the seating edge 63 bonded to metallized area 110.

The second surface 108 has thereon a first circular level 112 proximal to aperture 104 and a recessed second level 114 distal to the aperture occupying the peripheral area of the second surface. This second level 114 has metallizing 115 disposed thereon and is circumferentially bonded by welding or brazing to ledge 73 of retainer 71.

The stepped construction of the second surface 108 of the support insulator 102 shown in FIGURE 4 affords not only the insulative area of the first level 112 but also that of insulative area 117 which by orientation is shadowed by the first level. Thus, the recessing of the second level 114 augments the insulative properties of the second surface.

It is evident from the several embodiments shown that the invention provides a miniature ceramic cathode supporting structure that has both superior insulative properties and rugged construction.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention as defined by the appended claims.

What is claimed is:

1. In a thermionic electron discharge device, integral means for supporting the cathode within a miniature cylindrical grid electrode having a given internal diameter comprising:

a circular support insulator having an upper first surface and an oppositely disposed lower second surface with said insulator thickness defining the distance therebetween, each of said surfaces having at least one planar level with at least a portion of said insulator thickness constituting the distance therebetween, said insulator having an internal wall defining an axial aperture therethrough, said insulator being of a diameter smaller than the internal diameter of said electrode;

a substantially cylindrical eyelet encompassing said cathode and connected therewith, said eyelet being disposed within said axial aperture and spaced from the internal wall of said insulator, said eyelet having a terminally formed outstanding peripheral seat secured to said first surface of said insulator to effect spaced alignment of said eyelet within said aperture; and

an insulator retainer internally dimensioned to at least equal the diameter of said support insulator and adapted to slide within said grid electrode for affixation thereto, said retainer having a terminally formed instanding ledge secured to said insulator on a planar level below the one accommodating said eyelet.

2. In a thermionic electron discharge device, integral means for supporting a cathode within a miniature cylindrical grid electrode having a given internal diameter comprising:

a substantially disc-like support insulator formed of first and second oppositely disposed surfaces having said insulator thickness constituting the vertical distance therebetween, said insulator having an internal wall defining an axial aperture therethrough, said first surface having at least a raised first circular level proximal to said aperture and a lower circular second level distal thereto with a portion of said insulator thickness defining a substantially vertical insulative area therebetween to effect at least a partial shadowing of said second level by said first level to inhibit sublimation leakage thereacross, said first level having a circular area adjacent said aperture and said second level being substantially planar and having a circular area adjacent the periphery thereof said support insulator being of a diameter smaller than the internal diameter of said electrode;

a substantially cylindrical eyelet encompassing said cathode and connected therewith, said eyelet being disposed within said axial aperture and spaced from said internal wall thereof, said eyelet having a terminally formed outstanding seating ledge affixed to only said first surface of said support insulator on said first level thereof on the area proximal to said aperture to effect spaced alignment of said eyelet within said aperture; and

an insulator retainer externally dimensioned to slide within said electrode for affixation thereto, said retainer having an internal dimension at least equal to the diameter of said insulator to permit insulator placement therein, said retainer being terminally formed with an instanding seating ledge secured to said support insulator on the peripheral metallized area on only the lower second level of said first surface.

3. In a cathode ray tube, integral means for supporting a cathode within a miniature cylindrical first grid electrode having a given internal diameter comprising:

a substantially disc-like ceramic support insulator formed of first and second oppositely disposed surfaces having said insulator thickness constituting the vertical distance therebetween, said insulator having an internal wall defining an axial aperture therethrough, said first surface having a stepped topography defining at least a raised first circular level having an inner boundary proximal to said aperture and a peripheral boundary removed therefrom and a lower circular second level having an inner boundary distal to said aperture and a peripheral boundary removed therefrom, said second level inner boundary having a circumference at least equal to that of the peripheral boundary of said first level being separated therefrom by a portion of said insulator thickness defining a substantially vertical insulative area therebetween to effect at least a partial shadowing of said second level by said first level to inhibit sublimation thereacross, said first level having a circular area adjacent said aperture and said second level having a circular area adjacent the peripheral boundary thereof, said support insulator being of a diameter smaller than the internal diameter of said electrode;

a substantially cylindrical eyelet encompassing said cathode and connected at one end therewith being disposed within said axial aperture and spaced from said internal wall thereof, said eyelet having a terminally formed outstanding seating ledge circumferentially secured to only said first surface of said support insulator on said first level thereof on the area proximal to said aperture to effect spaced alignment of said eyelet within said aperture; and

an insulator retainer externally dimensioned to slide within said electrode for affixation thereto, said retainer having an internal dimension at least equal to the diameter of said insulator to permit insulator placement therein, said retainer being terminally formed with an instanding seating ledge circumferentially secured to said support insulator on the peripheral area on only the lower second level of said first surface.

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