United States Patent

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[54] MEANS FOR CONTROLLING ELECTROSTATIC CHARGE ON THE REAR WINDOW OF A CATHODE RAY TUBE
3 Claims, 7 Drawing Figs.

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[51] Int. Cl. H01j 29/34, H01i 29/89
[50] Field of Search ..... 313/64, 91, 92, 83(Sp digest); 178/7.83, 7.84, 7.87

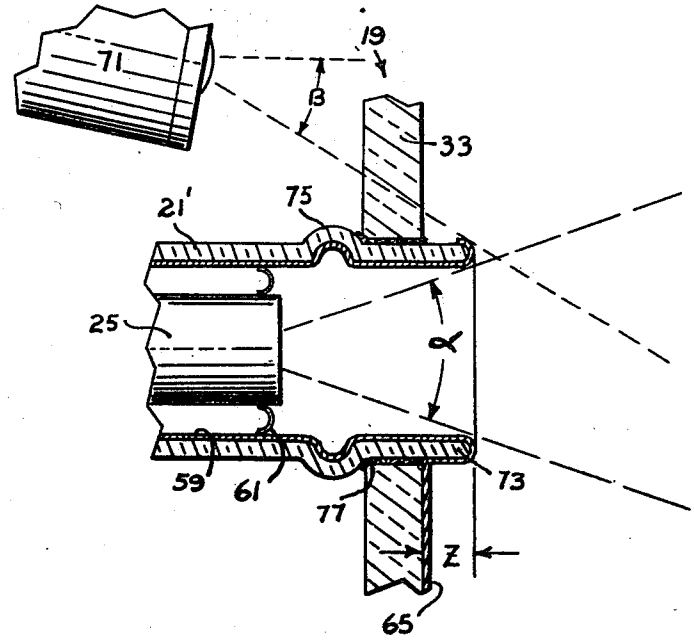
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ABSTRACT: Means for controlling the electrostatic charge on the rear window of a cathode ray tube wherein a substantially annular-shaped optical access rear window is oriented in the tube envelope in substantially symmetrical relationship to the longitudinal axis thereof. The window which provides a substantially annular viewing area for observing the electron impinged side of the screen has electrical conductive means symmetrically associated therewith to control the electrostatic charge thereon.



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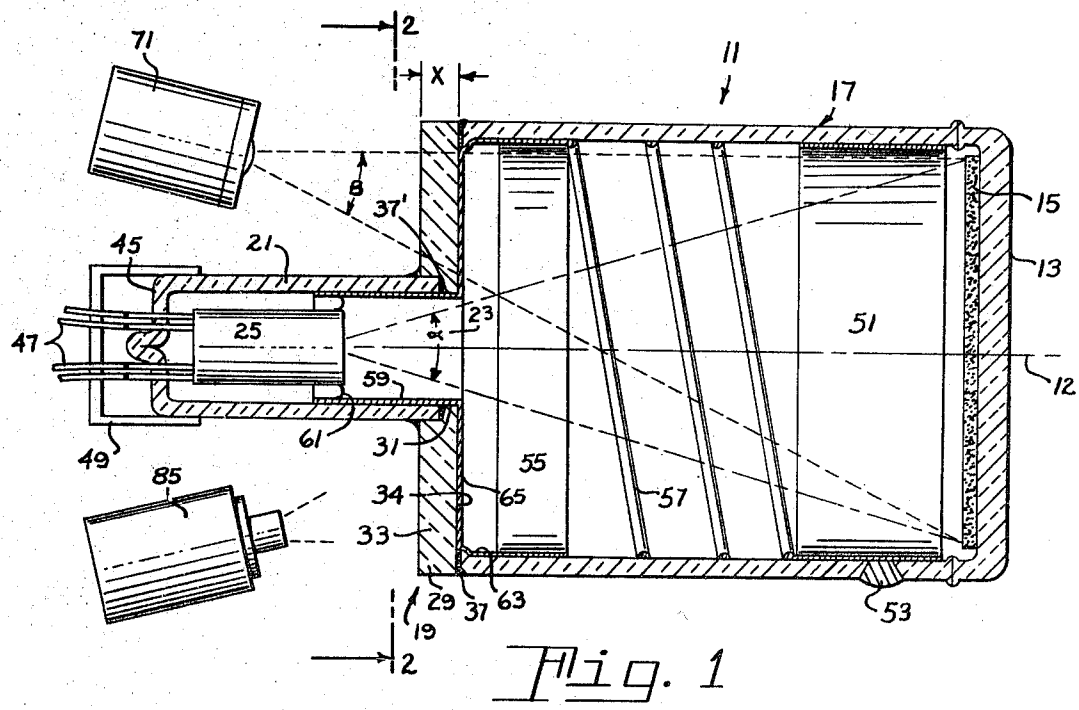


Fig. 1

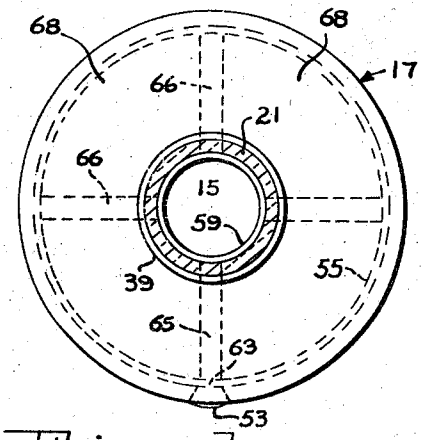


Fig. 2

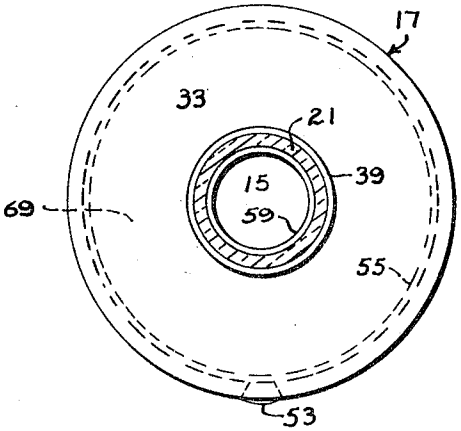


Fig. 4

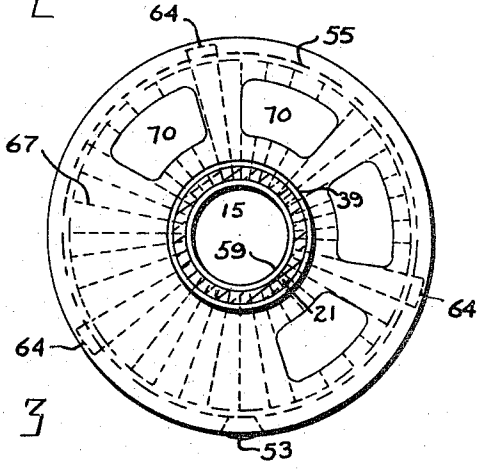


Fig. 3

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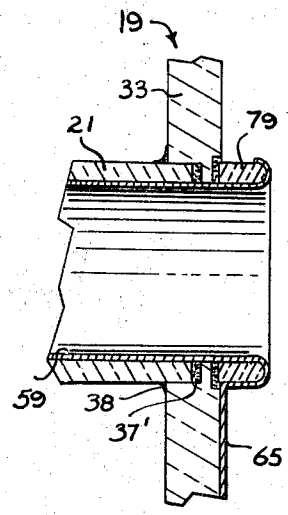


Fig. 6

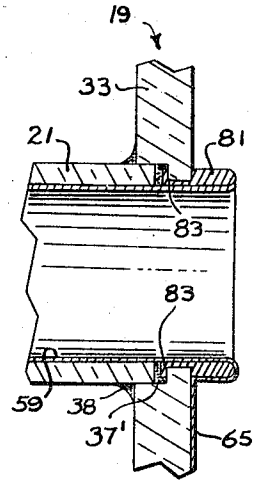


Fig. 7

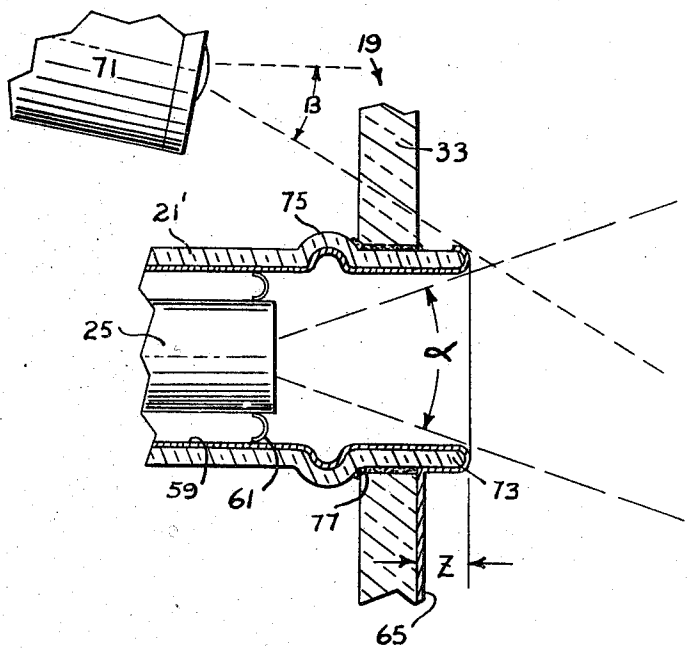


Fig. 5

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MEANS FOR CONTROLLING ELECTROSTATIC CHARGE ON THE REAR WINDOW OF A CATHODE RAY TUBE

CROSS REFERENCES TO RELATED APPLICATIONS

This application contains matter disclosed but not claimed in two related applications filed concurrently herewith and assigned to the assignee of the present invention. These related applications are: Ser. No. 785,646 "Cathode Ray Tube Having An Annular Shaped Rear Window," and Ser. No. 785,647 "Method and Apparatus For Fabricating A Cathode Ray Tube Having An Annular Shaped Rear Window."

BACKGROUND OF THE INVENTION

The invention relates to cathode ray tubes and more particularly to an improved rear window type of cathode ray tube having means therein for controlling the electrostatic charge on the rear window thereof. In certain types of information display systems, rear window cathode ray tubes are employed to facilitate full presentation and observation of the display. Such tubes not only provide the conventional frontal viewing area but also have one or more portal provisions oriented in the funnel portion of the tube envelope to permit viewing of the rear surface of the screen. Through this type of funnel oriented viewing port, it is possible to observe, photograph, or project a superimposed image on the information displayed on the screen without interfering with the frontal observation thereof. While a large number of conventional rear window tubes are restricted to one or two observation ports, there is an improved type of rear window tube which incorporates an annular-shaped rear window in the envelope in substantially symmetrical relationship to the longitudinal axis of the tube. While this annular window affords extensive and advantageous utilization, there are sometimes occasions when an electrostatic charge builds up thereon to adversely affect the electron beam or beams passing through the centrally oriented aperture therein.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to reduce the aforementioned difficulties and to provide means for controlling the electrostatic charge on the annular window of the improved rear window type of cathode ray tube having extensive provisions for rear view utilization.

The foregoing object is achieved in one aspect of the invention by the provision of means for controlling the electro static charge on the annular-shaped window of an improved rear window cathode ray tube having an envelope comprising a bulb portion perimetrically sealed to a rear window annular plate and a tubular neck section joined to the substantially centrally oriented aperture in the annular window. The electrostatic charge which may be present on the annular plate is controlled by a plurality of spaced-apart radially oriented electrically conductive stripes which are applied to the interior surface of the window to provide connective means with the neck coating to dissipate the charge from the window area. Thus, there is provided a tube having an annular-shaped rear window that is substantially free of electrostatic charge and which permits simultaneous back of the screen projection, photographing and observation of the information displayed on the cathodoluminescent screen of the tube.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of the rear window cathode ray tube of the invention;

FIGS. 2, 3 and 4 are views taken taken along the line 2–2 of FIG. 1 illustrating the expansive area of the annular rear window portal and several embodiments of the electrical conductive means associated therewith; and

FIGS. 5, 6 and 7 are enlarged sectional views of substantially the annular plate and neck section seal region showing several shield embodiments protruding into the bulb portion.

DESCRIPTION OF THE PREFERRED EMBODIMENT

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

With reference to FIG. 1 there is shown a rear window cathode ray tube 11 having a face panel portion 13 upon which is interiorly disposed a cathodoluminescent screen 15. Integral with the face panel portion is the funnel or bulb portion 17 to which is sealed a substantially transparent annular plate 19 of optical quality. A tubular neck section 21 is sealed to the centrally oriented aperture 23 of the annular plate to complete the envelope structure. At least one electron source 25 is mounted in the tubular neck in a manner to beam electrons to the screen to form a cathodoluminescent image therein. The light transmissive plate 19 forms an annular-shaped optical window which provides extensive visual access to the rear of the screen.

A round tube is shown and described such as, for example, one having an external envelope diameter within the range of 5 to 6 inches. It is not intended that the size or shape be limiting. In addition, the term "annular" as used herein is intended to include any shape of substantially continuous optical viewing window oriented to surround the axial oriented tubular neck portion of the tube.

In greater detail, the tube 11 has a longitudinal axis 12 extending therethrough from the face to the base portions thereof. The componental parts of the envelope structure have compatible thermal expansion coefficients to insure hermetic jointures therebetween.

The substantially planar face panel portion 13 is of a non-browning-type glass hermetically sealed with the compatibly formed bulb portion 17.

A cathodoluminescent screen 15 of suitable phosphor material is disposed on the interior surface of the face panel 13 by conventional means as, for example, by the settling technique.

A substantially transparent annular plate 19, such as G-12 optical quality glass has outer and inner peripheries or boundaries 29 and 31 respectively, defining annular region 33 therebetween which constitutes an annular-shaped planar viewing window that is spacedly related in a substantially symmetrical manner about the longitudinal axis of the tube. The inner periphery 31 defines a substantially centrally oriented opening or aperture 32, while the outer periphery 29 of the annular plate is formed to substantially perimetrically match the compatible bulb portion to which it is hermetically sealed by glass solder or frit 37 which has a melting temperature much lower than the softening temperatures of the respective glass portions joined together.

A substantially tubular neck section 21 is formed to be seated and sealed in the centrally oriented aperture 23 in the annular plate by utilizing a continuous band therebetween of glass frit 37′ similar to that used in making the aforementioned bulb-to-plate seal.

One or more electron gun(s) is/are positioned within the neck section of the tube in a manner to beam electrons to the screen. As shown, an undetailed source of electrons 25 denotes the presence of one or several guns. In this instance, both focusing and deflection are accomplished by electrostatic means which eliminates the need for externally oriented yoke means.

A stem portion 45, which supports the source of electrons 25, is hermetically sealed to the terminal end of the neck section 21. Electrical connective means 47 extend from the stem through the base 49 to provide external connections for the tube.

The interior surface of the bulb portion 17 has two separated bands of conductive material, such as aquadag, applied thereto. The first of these bands 51 is oriented adjacent the screen area and makes electrical contact with the high voltage anode button 53 located in the bulb or funnel portion

17. The second conductive band 55, of similar material, is disposed on the bulb wall near the optical window 33. Electrically joining the two bands is a conventional accelerating spiral 57 of resistive material.

A neck conductive band 59 is applied to the upper part of the tubular neck section 21. Electrical connection between this band and the electron source 25 is effected by the usual type of connective means 61.

Operation of the tube is dependent upon an electrical connection between the neck conductive band 59 and the second conductive band 55 on the bulb. This is expeditiously effected by applying one or more conductive paths 63 to the inner bulb surface to extend from the second band thereon to the annular optical plate 19, whereupon at least one radial conductive stripe 65, such as aquadag or tin oxide, is applied to the surface 34 to complete an electrical path between the neck and bulb conductive coatings.

There is an electrostatic charge effect that may at times build up on the interior surface of the annular plate during operation of the tube. This electrostatic charge is the result of spurious electron impingement and secondary emission. The presence of this charge on the annular window area deleteriously affects the axially related stream of electrons beamed through the centrally oriented aperture in the plate.

In referring to the FIGS., it has been found that several constructional embodiments can be utilized to minimize electrostatic charge buildup and prevent the undesirable effects thereof. With particular reference to FIG. 2, a plurality of spaced-apart radially oriented conductive stripes 66 making common connections with the bulb and neck conductive bands may be used to uniformly dissipate and conduct away the electrostatic charge from the annular window area. This array of conductive sectors provides a plurality of annular viewing areas 68 therebetween. While four conductive stripes or sectors are shown, such number is not to be considered as limiting.

FIG. 3 illustrates another charge reducing embodiment in the form of an annular gridlike metallic conductive medium 67 comprised of a fine wire construction which is oriented relative to the interior surface of the window. The term "gridlike" is intended to include a radial array of wires, web, mesh or foraminous material. Such material may introduce a degree of opacity or reduced transmission to the window area. Since the plane of orientation of this material is spacedly remote from the screen, it is out of focus with the image in or on the screen 15 and presents a degree of optical interference which, in some instances, may not be objectional. If desired, cutout areas 70 can be made in the gridlike material to provide multiple window areas. Each gridlike structure has multiple tabs 64 or projections, several of which are shown extending peripherally therefrom to facilitate affixation to the respective seal areas. The material, from which the gridlike structures are fabricated, has a thermal expansion coefficient similar to that of the glass of the annular window, such, for example Ni-Cr-Fe alloy.

In FIG. 4, the annular window 33 is shown as having a substantially light transmissive conductive medium or coating 69, such as tin oxide, uniformly applied to the interior surface of the window. This material also exhibits a degree of opacity, but as with the gridlike construction, it also is out of focus with the screen image and presents a degree of uniform optical interference. This type of reduced optical transmission may be acceptable in certain instances where extensive viewing provisions are desired.

FIGS. 5, 6 and 7 illustrate additional embodiments for controlling the electrostatic charge effects on the annular window. These embodiments are in the form of ring-shaped shielding means oriented to protrude within the bulb portion of the envelope. These ring-shaped protrusions shield the electron beams from the influence of the charge which may be present in the plate. The maximum height Z of the respective shield means should be such as to not interfere with the angle of deflection α of the electron beam or the angle of width β of the optics of the photographic device 71.

In FIG. 5, the shield member 73 is an extension of the neck portion 21'. The neck section is formed to have a bulging peripheral rib 75 of a diameter slightly larger than that of the centrally oriented aperture 23 to thereby provide a seat for the annular plate 19. A continuous annular layer of frit 77 disposed between the plate and the neck section provides a hermetic jointure. The conductive coating of the neck band 59 is continued to cover at least the inner surface of the shield member.

FIG. 6 illustrates a separate ring-shaped glass or ceramic shield member 79 which is seated in and frit-sealed to the annular plate 19. The neck band conductive coating 59 is likewise extended to at least cover the inner surface of this shield member.

FIG. 7 represents still another shield embodiment in the shape of a metallic ring 81 having a plurality of lugs 83 extending to the seal region and there embedded in the frit 37'. The material, such as Ni-Cr-Fe alloy, has a thermal expansion coefficient that is compatible with the glass of the enveloper. The conductive coating of the neck band is extended to at least make contact with the metallic ring.

Thus, the rear window cathode ray tube 11 provides an extensive provision for rear view utilization and incorporates means for controlling the electrostatic charge that may be present on the annular window area thereof. As shown in FIG. 1, the annular window adequately and simultaneously accommodates photographic means 71 and projection means 85 in addition to visual observation.

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 scope of the invention as defined by the appended claims.

I claim:

1. A rear view cathode ray tube having a longitudinal axis, said tube comprising: a cathodoluminescent screen; at least one electron source positioned within said tube relative to said screen to beam electrons thereto; a glass envelope having panel, bulb and neck portions integrally formed to provide an enclosure for said screen and said electron source, said envelope having a substantially annular-shaped optical access window oriented between said bulb and neck portions in substantially symmetrical relationship about said longitudinal axis and in relation to said screen to provide a substantially annular viewing area for observing the electron impinged side of said screen; and means for controlling the electrostatic charge effects on said annular shaped window, said means being in the form of a ring-shaped shield member oriented to protrude within said bulb portion as substantially an extension of said neck portion to provide substantially symmetrical electrical conduction relative to said annular viewing area to prevent said charge effects from interfering with the performance of said tube.

2. The tube according to claim 1 wherein said shield member is of glass having an electrically conductive coating disposed thereon.

3. The tube according to claim 1 wherein said shield member is a gridlike electrically conductive metallic structure having thermal characteristics compatible for jointure with said envelope.