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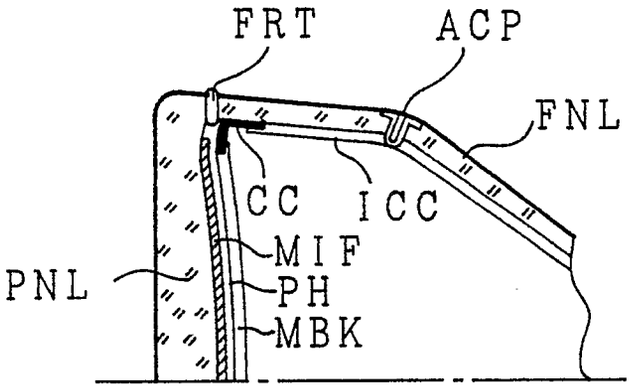
(54) Projection cathode-ray tube.

(57) A projection cathode-ray tube comprises a board-shaped panel (PNL) with no skirt portion whose inner face is convex and has a given curvature. A multilayer interference film (MIF), a phosphor layer (PH), and a metal-backed layer (MBK) are formed in that order on the inner surface of the panel. A peripheral portion of the panel (PNL) is welded to a funnel (FNL) using frit glass (FRT). The panel and the funnel are electrically connected together by means of a conductive film (CC). Therefore, no brightness decreases nor color shade occurs in the panel peripheral portion, and reliable high-voltage conduction is provided between the panel (PNL) and the funnel (FNL).

FIG. 2



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BACKGROUND OF THE INVENTION

Field of the Invention:

This invention relates to a projection cathode-ray tube which has a multilayer interference film, a phosphor layer, and a metal-backed layer formed in that order on the inner surface of a panel bonded to a funnel by frit glass welding, and more particularly, to a projection cathode-ray tube which allows a multilayer interference film to be formed uniformly even in a peripheral portion of a panel, causes no brightness decrease nor color shade in the panel peripheral portion, and has reliable high-voltage conduction between the panel and a funnel.

Description of the Prior Art:

In the field of projection cathode-ray tubes, to make a projected image very bright, the type of projection cathode-ray tube was proposed in which a multilayer interference film is formed on the inner surface of a panel whose inner face is curved with a given curvature toward a neck of the cathode-ray tube to give directivity to a light beam emitted from a phosphor screen to thereby increase the quantity of light being taken in by a projection lens.

For example, as shown in the schematic sectional view of Fig. 1, a multilayer interference film MIF, a phosphor layerPH, and a metal-backed layer MBK made of an aluminum deposition film are formed in that order on the inner surface of a panel PNL with a skirt portion SKT whose inner face is curved with a given curvature toward a neck; the skirt portion SKT of the panel PNL is secured to a funnel FNL using frit glass FRT; and high-voltage conduction is provided between the panel PNL and the funnel FNL by means of a contact spring CSP made of metal. The foregoing and similar types of projection cathode-ray tubes are disclosed in Japanese Patent Laid-Open No. 61-273837, U.S. Patent Nos. 4,633,131 and 4,642,695, Japanese Utility Model Publication No. 63-24615, etc.

In the foregoing type of projection cathode-ray tube, however, since the panel PNL has the skirt portion SKT, evaporation from an evaporation source is shut off by the skirt portion SKT when forming, by vacuum deposition, the multilayer interference film MIF on individual panels PNL arranged in a row in mass production; consequently, the thickness of the interference film MIF deviates from a given level in a peripheral portion, particularly, in a corner portion, of the panel PNL to result in no desired characteristics of the interference film, with the result that brightness decrease or color shade occurs in the peripheral portion of the panel PNL.

Further, the method of providing high-voltage conduction between the panel PNL and the funnel FNL by means of the contact spring CSP deforms mechanically and its strength of contact with a contact portion decreases due to a baking step or the like in manufacture, and the contact portion in contact with the contact spring CSP becomes critical in terms of mechanical strength. In the latter case, particularly, the contact portion of the panel PNL on which the metal-backed layer MBK made of a black lead film or an aluminum deposition film is formed is mechanically destroyed upon contact with the contact spring CSP to damage conduction to thereby degrade reliability.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a projection cathode-ray tube which has an interference film desirably uniform even in a peripheral portion of a panel and causes no brightness decrease nor color shade.

It is another object of the present invention to provide a projection cathode-ray tube of the frit system which has reliable high-voltage conduction between a panel and a funnel.

The foregoing objects can be accomplished by a projection cathode-ray tube whose structure is characterized in that a panel whose inner face is convex and has a given curvature is made in the form of a board with no skirt portion; a multilayer interference film, a phosphor layer, and a metal-backed layer are formed in that order on the inner surface of the panel; the margin of a peripheral portion of the panel is welded to a funnel using frit glass; and high-voltage conduction is provided between the panel and the funnel by mans of a conductive film made of a black lead film or an aluminum deposition film.

With the panel made in the form of a board with no skirt portion, vacuum deposition used in forming the multilayer interference film on the inner surface of the panel is not shut off because of no presence of a skirt portion, whereby a desirably-uniform interference film can be provided even in a peripheral portion of the panel, with the result that the generation of brightness decrease and color shade in the panel peripheral portion that was observed in the prior art can be prevented.

Further, since the panel inner surface can be readily polished because of no presence of a skirt portion, the accuracy of curvature of the panel inner surface can be readily improved.

Therefore, the area of the panel inner face can be effectively utilized.

In this regard, where the panel is made in the form of a board with no skirt portion and its inner

face is made flat with no curvature, the directivity of a light beam incident on a projection lens is lost, thereby causing brightness decrease or color shade in the panel peripheral portion. This however can be overcome by making the characteristic of the interference film different between a central portion and a peripheral portion (for example, by making the thickness of the interference film larger in the peripheral portion than in the central portion).

Further, since high-voltage conduction between the panel and the funnel is provided by applying a conductive film instead of adopting the conventional method of using a contact spring, there is no fear of conduction/connection becoming inferior, whereby the reliability of the projection cathode-ray tube is enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic sectional view of a conventional projection cathode-ray tube;

Fig. 2 is a schematic sectional view of an embodiment of a projection cathode-ray tube according to the present invention;

Fig. 3 is a diagram showing a change in relative brightness of the present projection cathode-ray tube and of the conventional projection cathode-ray tube in relation to the distance from the panel center; and

Fig. 4 is a diagram showing a change in chromaticity of the present projection cathode-ray tube and of the conventional projection cathode-ray tube in relation to the distance from the panel center.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of a projection cathode-ray tube according to the present invention will now be described.

Fig. 2 schematically shows in cross section an embodiment of a projection cathode-ray tube according to the present invention. In this drawing, a multilayer interference film MIF made of laminated titanium oxide (TiO_2) and silicon oxide (SiO_2), a phosphor layer PH made of a mixture of phosphor P53 and P1, and a metal-backed layer MBK made of an aluminum film are formed in that order on the inner surface of a panel PNL with no skirt portion whose inner face is convex and has a radius of curvature of about 350mm. A peripheral portion of the panel PNL and an end face of a funnel FNL are secured together using frit glass FRT. Conduction between the phosphor layer PH applied to the panel PNL and an internal conductive film ICC applied to the funnel FNL is provided by means of a conductive black lead film CC. As will be appreciated, since the margin of the peripheral portion of the panel PNL is used in securing the panel to an end portion of the funnel FNL, it is necessary during the deposition of the multilayer interference film MIF to prevent the peripheral margin from deposition by the use of an adequate jig.

Figs. 3 and 4 show the normal brightness and chromaticity of the inner face of the phosphor screen panel of the thus composed projection cathode-ray tube (7-type) according to the present invention, measured varying the distance from the center of the phosphor screen panel, together with those of the conventional projection cathode-ray tube.

As is clear from these drawings, although the conventional sample tube exhibits the brightness and chromaticity decreasing steely in the peripheral portion, the present sample tube exhibits them decreasing gently up to the peripheral portion, thus is improved remarkably.

Further, the present projection cathode-ray tube using the black lead film for conduction and the conventional projection cathode-ray tube using the contact spring for conduction were subjected to high-voltage conduction testing. Although the latter caused about 10% of imperfect high-voltage conduction, the former caused no imperfect high-voltage conduction. Further, they were subjected to withstand voltage testing. Although the latter became imperfect in terms of withstand voltage at 70KV, the former was well perfect in terms of withstand voltage even at 80 to 90KV.

As described above, the defects of the prior art have been overcome by the present invention which in the projection cathode-ray tube makes the panel (whose inner face is convex and has a given curvature) in the form of a board with no skirt portion; welds the peripheral margin of the panel to the end portion of the funnel using frit glass; and electrically connects the panels and the funnel using the conductive film. That is, there is provided the projection cathode-ray tube which has the multilayer interference film desirably uniform even in the panel peripheral portion, causes no brightness decrease nor color shade in the panel peripheral portion, and is very high in reliability in terms of high-voltage conduction.

Claims

1. A projection cathode-ray tube of the type in which the inner face of a panel (PNL) is convex and has a given curvature; and a multilayer interference film (MIF), a phosphor layer (PH), and a metal-backed layer (MBK) are formed in that order on the inner surface of the panel (PNL), character-

ized in that the panel (PNL) is made in the form of a board with no skirt portion.

2. The cathode-ray tube of claim 1, wherein a peripheral portion of the panel (PNL) and a funnel (FNL) are welded together using frit glass (FRT).

3. A projection cathode-ray tube of the type in which a panel portion (PNL) and a funnel portion (FNL) are bonded together by frit glass (FRT) welding, characterized in that a conductive film (CC) is formed between the panel portion (PNL) and the funnel portion (FNL).

4. The cathode-ray tube of claim 3, wherein the conductive film (CC) is formed between a phosphor layer (PH) applied to the panel portion (PNL) and an internal conductive film (ICC) applied to the funnel portion (FNL).

5. The cathode-ray tube of claim 3, wherein the conductive film (CC) is made from black lead.

6. The cathode-ray tube of claim 3, wherein the conductive film (CC) is an aluminum deposition film.

FIG. 1

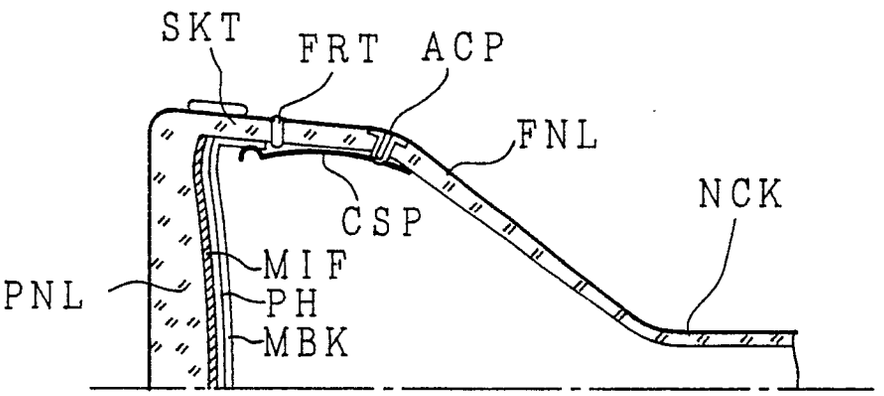

SKT
FRT
ACP
FNL
NCK
CSP
MIF
PH
MBK
PNL

FIG. 2

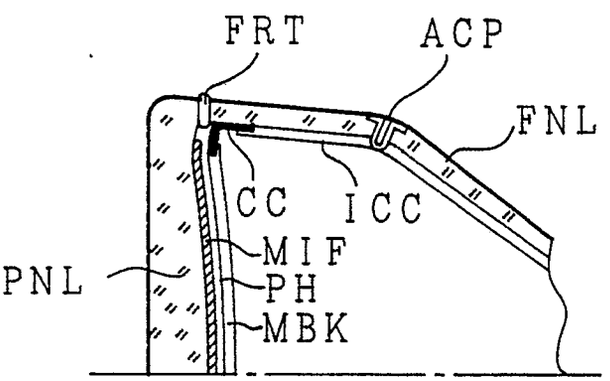

FRT
ACP
FNL
CC
ICC
MIF
PH
MBK
PNL

FIG. 3

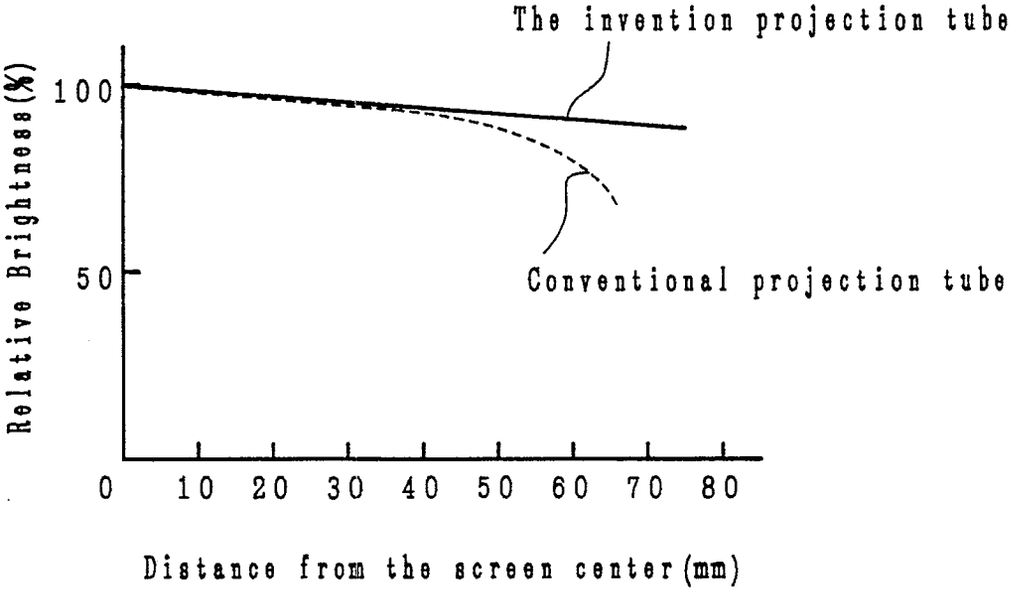
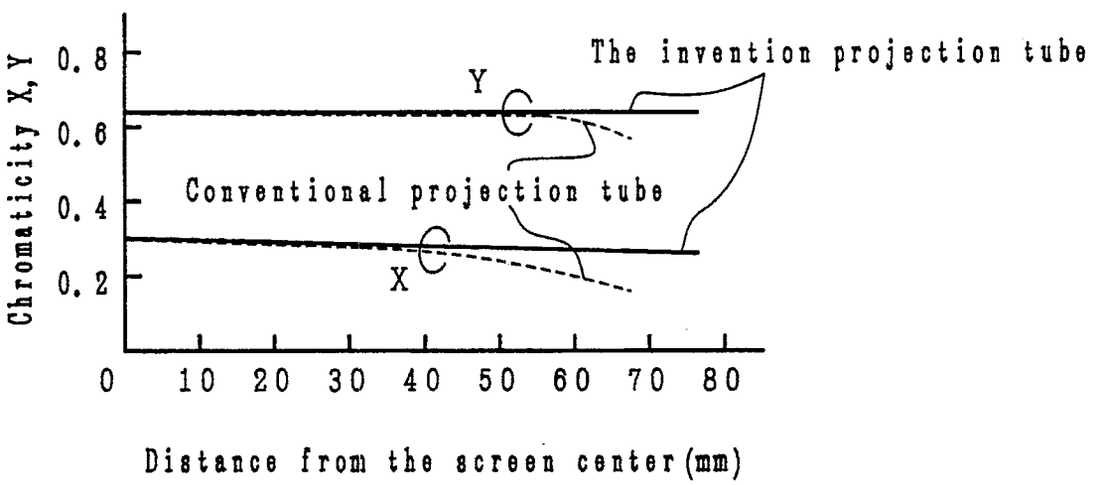

The invention projection tube
Conventional projection tube
Relative Brightness(%)
100
50
0
10
20
30
40
50
60
70
80
Distance from the screen center(mm)

FIG. 4


The invention projection tube
Y
Conventional projection tube
X
Chromaticity X, Y
0.8
0.6
0.4
0.2
0
10
20
30
40
50
60
70
80
Distance from the screen center(mm)