

# United States Patent

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[54] **COLOR TELEVISION PICTURE TUBE**

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[51] Int. Cl. .... **H01j 29/46, H01j 29/56**

[58] Field of Search .... **313/85, 85 S, 92 B**

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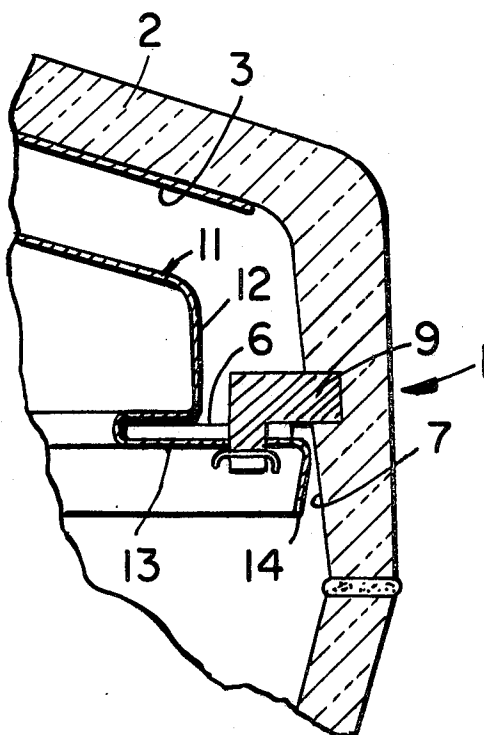
*Attorney*—Sandoe, Hopgood & Calimafde

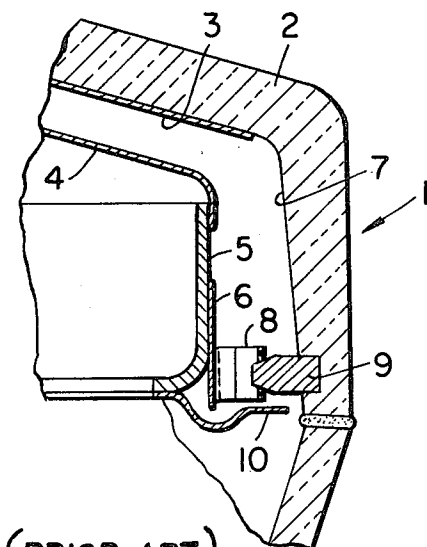
## [57] **ABSTRACT**

A color television picture tube comprises an integrally formed shadow mask unit including electron beam passing apertures, and skirt, and flange portions. The unitary mask construction is secured to a bulb housing via studs, and bimetal is employed for temperature compensation.

The structure obviates welding and welding associated nonuniformity and expense, and also permits accurate registration of the mask structure within the tube.

**4 Claims, 3 Drawing Figures**





(PRIOR ART)  
FIG. 1

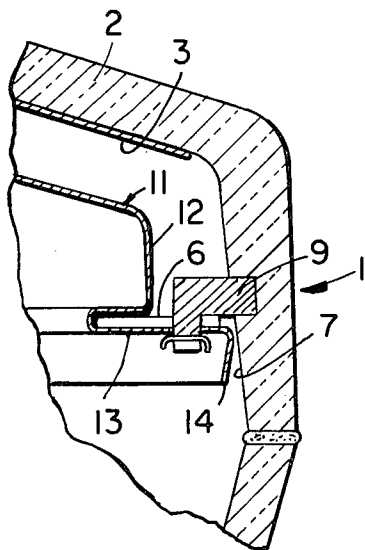


FIG. 2

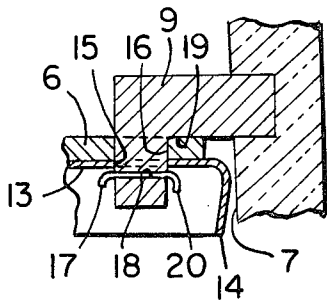


FIG. 3

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## COLOR TELEVISION PICTURE TUBE

This invention relates to a color television picture tube of shadow mask type and, more particularly, to an improved color television picture tube having a shadow mask secured within the glass bulb.

Prior art color television picture tubes comprise a bulb having a front panel which is made of a substantially transparent material, and includes portions for emitting a plurality of colors responsive to electron bombardment. Further, a peripheral side wall portion is fitted along the edge of the front panel. An aperture mask or a shadow mask assembly includes many apertures which pass only the electron beam directed to the color display tube portion; a frame for holding the shadow mask in its requisite shape, and support metal associated with the bulb to support the frame, wherein the shadow mask is welded to the frame.

However, such a picture tube has several drawbacks. For example, the shadow mask structure, assembled by welding individual components together, is made nonuniform during welding and suffers assembly accuracies; the composite structure is heavy; and the welded parts often become loose by reason of vibration or impact. In addition, a complicated assembly process is required to construct every picture tube unit, resulting in high production costs.

In view of the above, it is an object of the present invention to provide a color television picture tube having a light-weight, vibration and impact-resistant shadow mask unit of integral structure, realized without depending upon a conventional assembly process.

Another object of the present invention is to provide a color television picture tube having a shadow mask support provision permitting easy insertion of the shadow mask into position with high accuracy, and rendering efficient temperature compensation possible.

The color television picture tube of the present invention is provided with a shadow mask unit integrally constructed of a piece of metallic plate comprising: a plate-shaped shadow mask portion including plural apertures; a cylindrical skirt portion supporting the mask portion; and a flange portion about one end of the skirt portion and bent inside nearly perpendicular to the surface of the skirt and then bent in a reverse direction, the flange thereafter extending outward beyond the surface of the skirt. The extended part of the flange portion is provided with several mounting holes which engage the ends of L-shaped studs which are sealed into the side wall of the panel skirt. A temperature compensating bimetal is employed in conjunction with these mounting holes and to the studs.

A complete understanding of the present invention, and of the above and other objects, features and advantages thereof, will be gained from a consideration of the following detailed description of an illustrative embodiment thereof, presented hereinbelow in conjunction with the accompanying drawings, in which:

FIG. 1 is a sectional diagram showing a portion of conventional color television picture tube,

FIG. 2 is a sectional diagram showing a portion of color television picture tube embodying the principles of the present invention, and

FIG. 3 is an enlarged sectional diagram showing a part of the color television picture tube of FIG. 2.

Referring now to FIG. 1, there is shown a color television picture tube of the shadow mask type, wherein a phosphor screen 3 is disposed about the inner wall of a front panel 2 of a glass bulb 1. A shadow mask 4, made of a thin plate having many apertures and supported by a frame 5 by welding thereto, is mounted inside the front panel 2. An elastic support 8, welded to the frame 5 by way of a bimetal 6, is used to attach the shadow mask 4 to the panel. In particular, the support 8 engages a stud 9 sealed into a side wall 7 of the glass bulb 1. The purpose of the bimetal 6 is to compensate for the deformation of the shadow mask 4 due to temperature rise and the resultant thermal expansion occurring when electrons hit the mask surface, and thus to prevent deterioration in color purity. An electron shield 10 is welded to the frame 5 to prevent emissions from the phosphor screen 3 when the electron beam hits the inner surface of the side wall of the panel. The electron shield 10 is made of a thin metallic plate disposed so as to hinder electron propagation between the frame 5 and the side wall 7 of the glass bulb 1.

In the color television picture tube arranged as above, the elastic support 8 must have a strong elastic characteristic to prevent the shadow mask from being moved by vibration or impact. Also, the frame 5 must be thick enough to maintain the shape of the shadow mask. Thus the elastic support 8 is required to sustain a fairly heavy weight. In the prior art, therefore, the welded components often cause deformation or separation due to vibration or impact giving rise to degradation in color purity.

In the process wherein the bimetal 6 is welded to the frame 5 and the elastic support 8 welded to the bimetal 6, the distance between the shadow mask 4 and the phosphor screen on the front panel 2 can scarcely be maintained constant because welding is not uniform. To compensate for such nonuniformity in welding, the welded portion of the elastic support 8 must be adjusted for every assembly by using a measuring tool or instrument.

Furthermore, the prior art procedures and construction requires a considerable number of welding processes for assembly, such as welding between the shadow mask 4 and frame 5; between the frame 5 and bimetal 6; between the bimetal 6 and the elastic support 8; and between frame 5 and the electron shield 10. This causes increased costs in the production of color television picture tubes.

Referring now to FIG. 2, there is shown a part of a color television picture tube embodying the principles of the present invention, wherein the shadow mask, frame, elastic supporter, electron shield, and the like, which have heretofore been set into a unit by a welded assembly, are integrally constructed into one unit. The integral unit comprises a piece of metallic plate forming a shadow mask portion 11 having plural apertures; a skirt portion 12 which supports the shadow mask 11; a flange portion 13 which corresponds to the conventional electron shield, the flange being contiguous to one end of the skirt, bent inwardly nearly perpendicular to the surface of the skirt and thereafter bent outwardly; extended outward with respect to the surface of the skirt; and a raised portion 14, which is contiguous to one end of the flange 13, being bent perpendicular to the flange 13. In this structure, the skirt portion 12 may

be embossed for reinforcement purpose. The flange portion 13 is bent inside the skirt 12 to serve as a shield for preventing the occurrence of fog caused by stray secondary electrons produced by electron bombardment at the inner surface of the skirt.

To maintain efficient temperature compensation, one end portion of a bimetal 6 is inserted into the space formed by the reversely bent segments of the flange portion 13 so that the top and bottom sides of the bimetal is brought into full contact with the surface of the bent flange portion 13. Such a composite shadow mask structure can readily be formed by a plurality of reducing processes through the use of a press with a hydraulic die cushion or hydraulic press machine.

FIG. 3 is a partly enlarged diagram showing the structure by which the shadow mask unit is affixed to the glass bulb. A hold 15 is bored in the flange 13, and engages each of a plurality of studs 9 which are sealed into the side wall 7 of the panel. The bimetal 6 is provided for each of the studs 9. A hold 16 is bored in the bimetal 6, which hole 16 is coincident with the hole 15 of the flange 13.

The bimetal 6 is inserted into the space formed by the bent flange portion 13 with its low expansion side in contact with the skirt portion 12. The purpose for such an arrangement of the bimetal is to compensate an aperture position with respect to the electron beam. More specifically, the shadow mask 11, when heated by the electron bombardment, expands in its radial direction due to the thermal constraints and, accordingly, the aperture moves toward the radial direction. Thus the position at which the electron beam will arrive, after passing through the aperture, is deviated outside of the position where the electron beam should reach. However, the bimetal 6 is attached to the flange portion is bent inward on the low expansion side due to the temperature rise and, as a result, the shadow mask unit is pushed forward on the part thereof attached to the bulb, and the aperture moves forward accordingly. In other words, the electron beam, after its passing through the aperture, is compensated to reach the same position as that obtaining before the temperature rise brought about by the electron bombardment.

The studs 9 are L-shaped, one end of each stud being sealed into the side wall 7 of the glass bulb 1. The other end of each stud extends in the direction away from the phosphor screen 3. A hold 18 is provided at a position near the tip of the interior end of the stud 19. The bimetal 6 and flange portion 13 are engaged by the stud 9 by way of holes 15 and 16 and secured together by a pin 17. The reference surface 19 of the stud 9 is positioned so as to determine the distance between the surface of the phosphor screen 3 and the shadow mask 11 as in FIG. 2. Thus the distance between the two is kept

constant in the state where the surface of the bimetal 6 is pressed to the reference surface as in FIG. 3.

The shadow mask unit according to this invention, as has been described above, requires no welding operation. It is therefore impossible for this shadow mask to undergo deformation or separation in a welded part as in the prior art. Thus degradation in color purity due to deformation or separation in a welded portion is entirely eliminated. According to this invention, there is no assembly error due to a welding process and, hence, the shadow mask and the glass panel can be set at an accurate design distance. Further, temperature compensation can be efficiently accomplished. Also, the number of assembly processes can be markedly reduced in comparison with prior art procedures. In addition, the invention makes it possible to omit the use of a conventional frame, elastic support and electron shield, and to thereby realize a considerable reduction in production costs.

While the principles of the invention have been described above in connection with a specific embodiment, it is to be clearly understood that this description is made only by way of example and not limitation as to the scope of the present invention.

What is claimed is:

1. A color television picture tube comprising a bulb having a front panel including portions for producing a plurality of colors responsive to electron bombardment and formed of a substantially transparent material, said bulb including a peripheral side wall portion adjacent to the edge of said front panel, an aperture mask unit having plural apertures for permitting passage of electron beams therethrough corresponding to said front panel portions for producing a plurality of colors, and means for securely supporting said aperture mask unit wherein said aperture mask unit is formed of a plate integrally comprising an aperture plate portion, a cylindrical aperture plate skirt portion, and a flange portion bent inward nearly perpendicular to the surface of said skirt portion and then bent outward extending toward the inner wall of said peripheral side wall portion.

2. A color television picture tube as in claim 1, in which a part of said supporting means is inserted into the space formed between the reversely bent flange portion of said aperture mask unit.

3. A color television picture tube as in claim 2, in which said supporting means comprises an L-shaped stud one end of which is sealed into the inner wall of said peripheral side wall portion, the other end of said stud being engaged with an aperture mask unit support hole bored in the vicinity of the edge portion of said flange portion of said aperture mask unit.

4. A color television picture tube as in claim 2, in which said support means part comprises a piece of bimetal.

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