United States Patent

Nakamura et al.

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[54] SHADOW MASK SUPPORT MEANS FOR A COLOR TELEVISION IMAGE TUBE

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[30] **Foreign Application Priority Data**

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Mar. 19, 1969 Japan.....44/21833

[52] **U.S. Cl.**.....**313/85 S**, 313/292
[51] **Int. Cl.**.....**H01j 29/06**, H01j 29/02, H01j 31/20
[58] **Field of Search**.....313/92 B, 85 S

[56] **References Cited**

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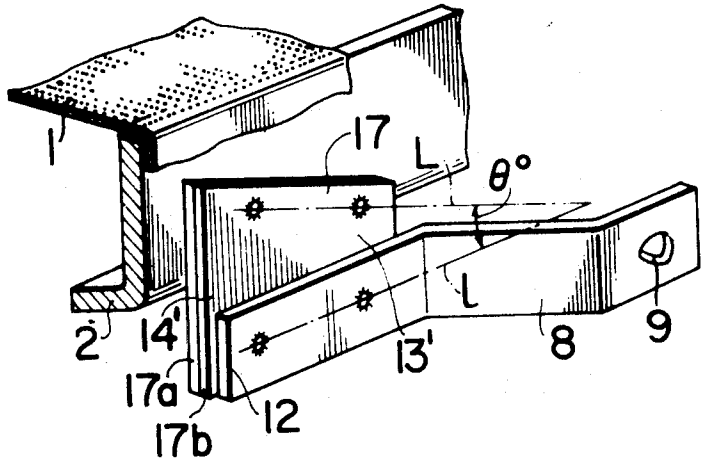
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[57] **ABSTRACT**

In a shadow mask support means comprising a bi-metal piece having one end secured to a shadow mask frame with the other end left free, and a leaf spring secured at one end to said free end of the bi-metal piece and extending therefrom toward a pin provided on a side wall of a face panel, the improvement residing in that a metallic plate portion disposed between said frame and said spring is so arranged that it is displaced due to thermal deflection of the bi-metal at the end adjacent to said pin by an amount smaller than the displacement at the opposite end.

2 Claims, 7 Drawing Figures



Patented May 2, 1972 3,660,708

2 Sheets-Sheet 1

FIG. 1 PRIOR ART

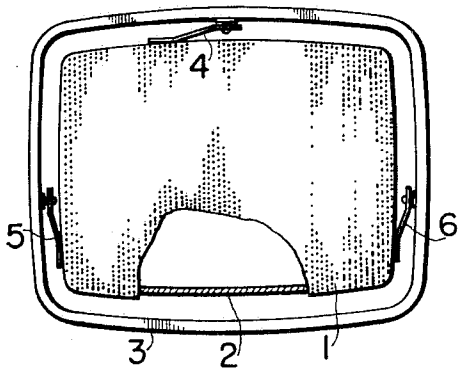


FIG. 2
PRIOR ART

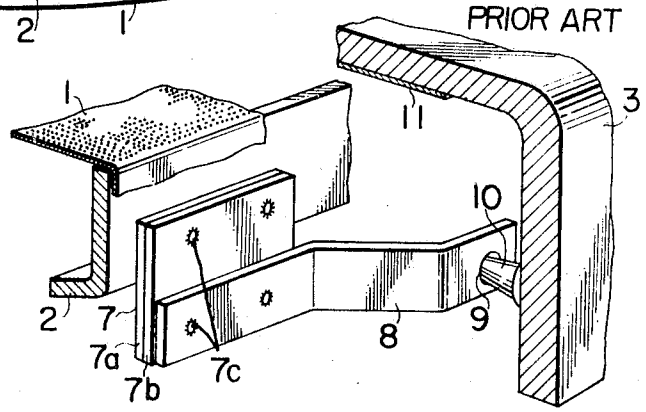
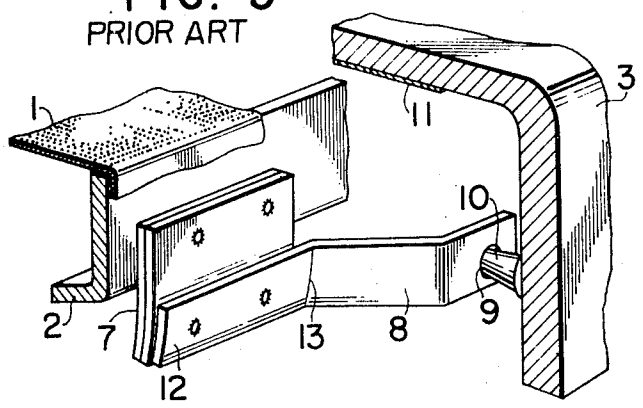


FIG. 3
PRIOR ART



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FIG. 5

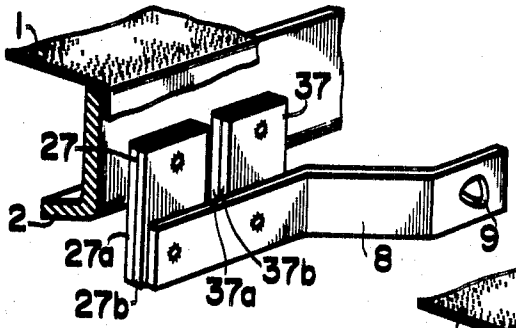


FIG. 4

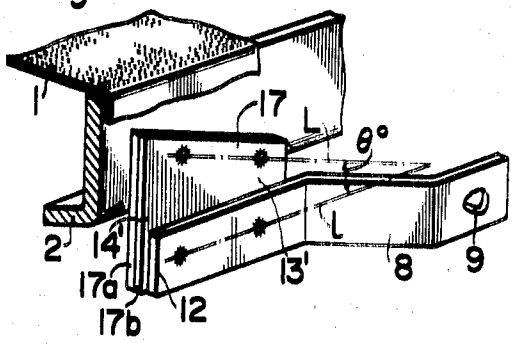


FIG. 6

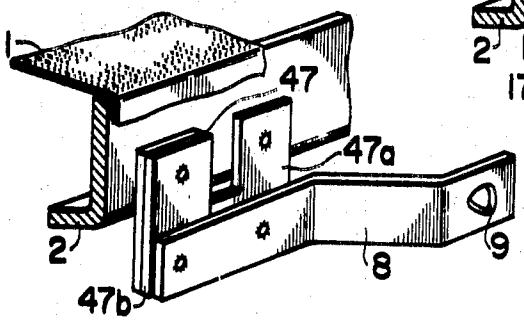
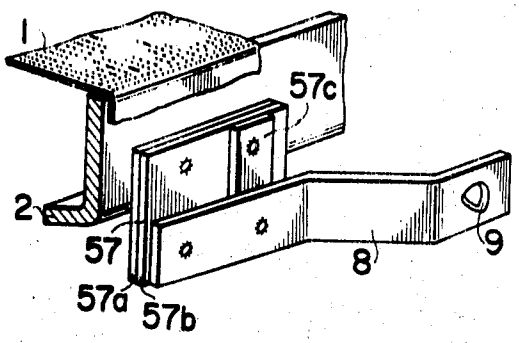


FIG. 7



SHADOW MASK SUPPORT MEANS FOR A COLOR TELEVISION IMAGE TUBE

The present invention relates to a mechanism for supporting the shadow mask of a color television picture tube at three or four places in its frame on a face panel.

In a picture tube provided with a shadow mask, the shadow mask is normally supported resiliently on a face panel through mask supporters at three or four places on the mask frame itself. For said mask supporter, a metallic leaf spring is generally used. This spring is welded at one of its ends to the outer face of the frame side wall, the other end of said spring being engaged by a pin provided on the inner surface of the side wall of the face panel through a hole formed on said other end of the leaf spring.

However, in such a mask support mechanism, when thermal expansion occurs in the shadow mask during operation of the picture tube, the electron beam path is deviated with the result that the color purity characteristics of the picture tube are substantially degraded.

In order to overcome this disadvantage, it has hitherto been proposed to provide a bi-metal piece in a shadow mask supporter so that the shadow mask is slightly displaced toward the screen in accordance with the thermal expansion of the shadow mask.

However, in this arrangement, when the bi-metal piece is deflected, the spring is subjected to a local twist which undesirably prevents the shadow mask from being uniformly displaced throughout its surface.

Therefore, an object of the present invention is to reduce the amount of the twist which appears when the bi-metal is deflected.

It is a further object of the present invention to reduce the relative sliding movement between the spring and said pin at the points of engagement thereof.

It is a still further object of the present invention to arrange the shadow mask so that it can be displaced smoothly and uniformly throughout its surface along the axis of the tube when it is thermally expanded or contracted.

The present invention will now be described with reference to preferred embodiments shown by way of example in the accompanying drawings, in which;

FIG. 1 is a plan view illustrating a conventional mask support mechanism for a color television picture tube;

FIG. 2 is a perspective view showing a mask supporter which may be used in the conventional mask support mechanism;

FIG. 3 is a fragmentary perspective view showing the operation of the mask supporter shown in FIG. 2; and

FIGS. 4 through 7 show perspective views of various mask supporters, each of which may be used in a mask support mechanism made in accordance with the present invention.

In a conventional mask support mechanism shown in FIG. 1, a shadow mask 1 is mounted within a face panel 3 by means of three mask supporter 4, 5 and 6 disposed in a space between a frame 2 of the shadow mask and the face panel 3. All of the mask supporters 4, 5 and 6 are substantially identical in shape; however, these three mask supporters do not act on the shadow mask 1 symmetrically about the center line of the surface of the shadow mask 1.

Further, in a known structure which is shown in FIG. 2 and in which a mask supporter is provided with a bi-metal piece, the bi-metal piece 7 is rectangular in shape and welded at one end to the outer surface of the side wall of the frame 2. The other end or free end of the bi-metal piece 7 is welded to one end of a leaf spring 8, the other end of the spring 8 being in turn connected by means of a hole 9 provided therein to a pin 10 projecting from a side wall of the panel 3. The bi-metal piece 7 is so arranged that the metallic layer 7*a* of a lower coefficient of thermal expansion is disposed adjacent to the frame 2 and the metallic layer 7*b* of a higher coefficient of thermal expansion is disposed adjacent to the panel 3, whereby the bi-metal piece 7 is deflected towards the tube axis in response to an increase in temperature. In the drawing, the reference numeral 11 shows a fluorescent screen and 7*c* the welding spots.

According to the above described mechanism, when thermal exansion takes place in the shadow mask 1, for example, during the manufacture or the operation of the picture tube, the apertures in the shadow mask 1 are displaced along the plane of the mask surface from the center thereof towards its periphery. However, in this instance, the bi-metal piece 7 in each of the mask supporters is deflected at its lower portion as shown in FIG. 3. This deflection serves to give the spring 8 a tendency to shift its outer end which is outwardly extended or the end in which the hole 9 is provided downwardly as seen in the drawing with respect to the shadow mask 1. Since the hole 9 is in engagement with the pin 10, the shadow mask 1 is in effect displaced towards the screen 11 so that the path of the electron beam is substantially free from deviation, despite the fact that the apertures are displaced as described above. In other words, the apertures of the shadow mask 1 are shifted along a predetermined electron beam path.

However, in this known structure, since the bi-metal piece 7 serves to deflect the spring 8 uniformly throughout the welded edge 12 thereof and since there exists a substantial frictional resistance between the hole 9 of the spring 8 and the pin 9, the spring 8 is subjected, when the bi-metal piece 7 is deflected, to a local twist at the portion between the point 13 and the hole 9. Since a few, for example three, of such mask supporters are disposed asymmetrically as shown in FIG. 1, it is difficult to uniformly maintain the displacement of the shadow mask 1 for compensating the thermal expansion thereof throughout its surface, and there often appears a non-uniform displacement of the shadow mask causing an uneven compensation effect. Particularly, a mask supporter disposed on the upper periphery of a rectangular panel will cause a displacement of the shadow mask which is asymmetrical about its vertical center line.

Further, in this known structure, the spring 8 or the frame 2 will be possibly subjected to a permanent deformation during the high temperature treatment which may be performed during the manufacture of the picture tube.

The present invention has been accomplished to eliminate the above described disadvantages of the known arrangement and aims to provide an arrangement in which a metallic plate portion disposed between the frame 2 and the spring 8 is thermally displaced by means of a bi-metal at the side adjacent to the pin 10 by an amount smaller than that at the opposite side.

The present invention will now be described in more detail with reference to the accompanying drawings. Referring to FIG. 4, a bi-metal piece is designated by a reference numeral 17. As will be seen in the drawing, the bi-metal piece 17 is welded to the frame 2 along a welding line L of which extension intersects, at an angle θ degree, the extension of a welding line l at points on which line the bi-metal piece 17 is welded to the spring 8. The angle θ may be selected to have any desired value within a range from 5° to 40°, however, an angle of about 15° is preferred. The bi-metal piece 17 is trapezoidal in shape and has a metallic layer 17*a* of a lower coefficient of thermal expansion facing toward the frame 2 and another metallic layer 17*b* of a higher coefficient of thermal expansion facing towards the side wall of the panel 3.

Three or four of such mask supporters may be used. In the former case, the supporters may be disposed as shown in FIG. 1 and, in the latter case, they may be disposed one at each of the sides.

According to the mask supporter shown in FIG. 4, the portion of the bi-metal located between the frame 2 and the spring 8 is in effect thermally displaced at the side 13' adjacent to the pin 10 by a smaller amount than at the opposite side 14' whereby the spring 8 is twisted uniformly in the same direction throughout its length. Further, in the support mechanism using such mask supporters, one of the mask supporters is free from irregular influence of the other supporters, so that the frame 2 and the shadow mask 1 can be smoothly displaced along the tube axis in accordance with the deflec-

tion of the bi-metal piece **17**, and the deflection of the shadow mask **1** is uniform throughout the mask surface. Further, in accordance with the above-described arrangement, the problem of permanent deformation as well as the trouble of the detachment of welded spots, which may be encountered in the conventional structure, can be safely eliminated.

A further embodiment of the present invention is shown in FIG. **5**. In this embodiment, two bi-metal pieces **27** and **37** are employed in parallel for one mask supporter, the thermal deflection of the bi-metal piece **37** adjacent to the pin being determined to be smaller as compared with that of the other bi-metal piece **27**. This is done by determining the combination of the materials for the lower thermal expansion metal layer **27***a* and the higher thermal expansion metal layer **27***b* to be different from that of the materials for the lower thermal expansion metal layer **37***a* and the higher thermal expansion metal layer **37***b* so that the deflections of the bi-metal pieces **27** and **37** are different from each other. Alternatively, the thickness or shapes of the layers may be varied to accomplish the same purpose. Further, the bi-metal piece **37** located at the side adjacent to the pin **10** may be replaced by a metal plate having a single layer.

In the embodiment of the present invention shown in FIG. **6**, a U-shaped metal plate **47***a* of a lower thermal expansion coefficient is combined with a metal plate **47***b* of a higher thermal expansion coefficient attached thereto at its leg remote from the pin, the other leg of the plate **47***a* being left as a single layer metal plate.

Further, in the embodiment shown in FIG. **7**, a substantially rectangular bi-metal piece **57** having a metal plate **57***a* of a lower thermal expansion coefficient and a second metal plate **57***b* of a higher thermal expansion coefficient is further combined with a small metal piece **57***c* welded to the outer side surface of the metal plate **57***b* at the side nearer to the pin so that the amount of deflection of the bi-metal is mechanically reduced at this side.

It is to be noted that a shadow mask mechanism should not necessarily be provided with the mask supporter of the present invention in all of the locations where mask supporters are used, but only one of the tube supporter of the present invention may be used at the upper side of the face panel and two or three mask supporters having conventional bi-metal arrangements may be used in the other places.

What is claimed is:

1. A shadow mask support mechanism for a color television picture tube including a plurality of mask supporters for supporting a shadow mask spread out on a frame opposite a face panel, at least one of said mask supporters comprising a bimetallic element having metal layers of different thermal coefficients of expansion for the deformation of said bimetallic element upon its heating for the purpose of displacing said shadow mask in the direction of the television screen, said bimetallic element being positioned in the direction of the length of said tube and secured at its one end to said shadow mask frame and at the other free end to one end of a leaf spring, the other end of said leaf spring extending in the direction of and engaging a pin secured on the side wall of said face panel, wherein said bimetallic element is disposed such that its free end on the side thereof closer to said pin thermally deforms less than on the side thereof disposed away from said pin, said bimetallic element being welded to said frame along a line intersecting a line along which said bimetallic element is welded to said spring, the angle of intersection of said welding lines being between approximately 5° and 40°.

2. A shadow mask support mechanism in accordance with claim **1**, in which said angle of intersection is substantially 15°.

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