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CATHODE RAY TUBE WITH IMPROVED SHADOW MASK MOUNTING SPRING ARRANGEMENT

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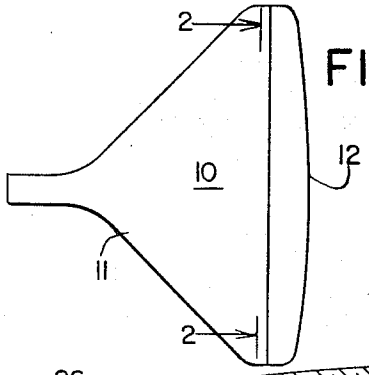


FIG. 1

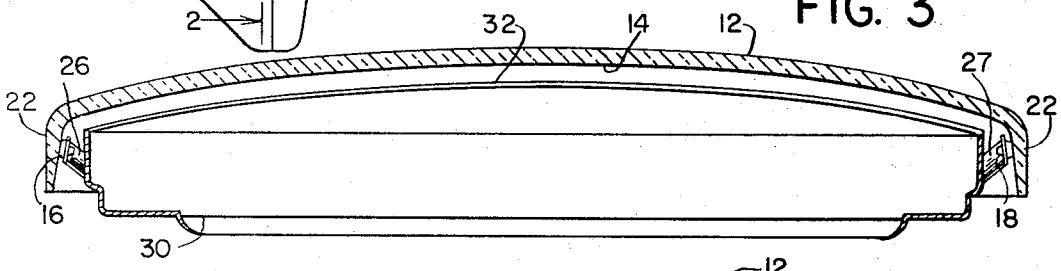


FIG. 3

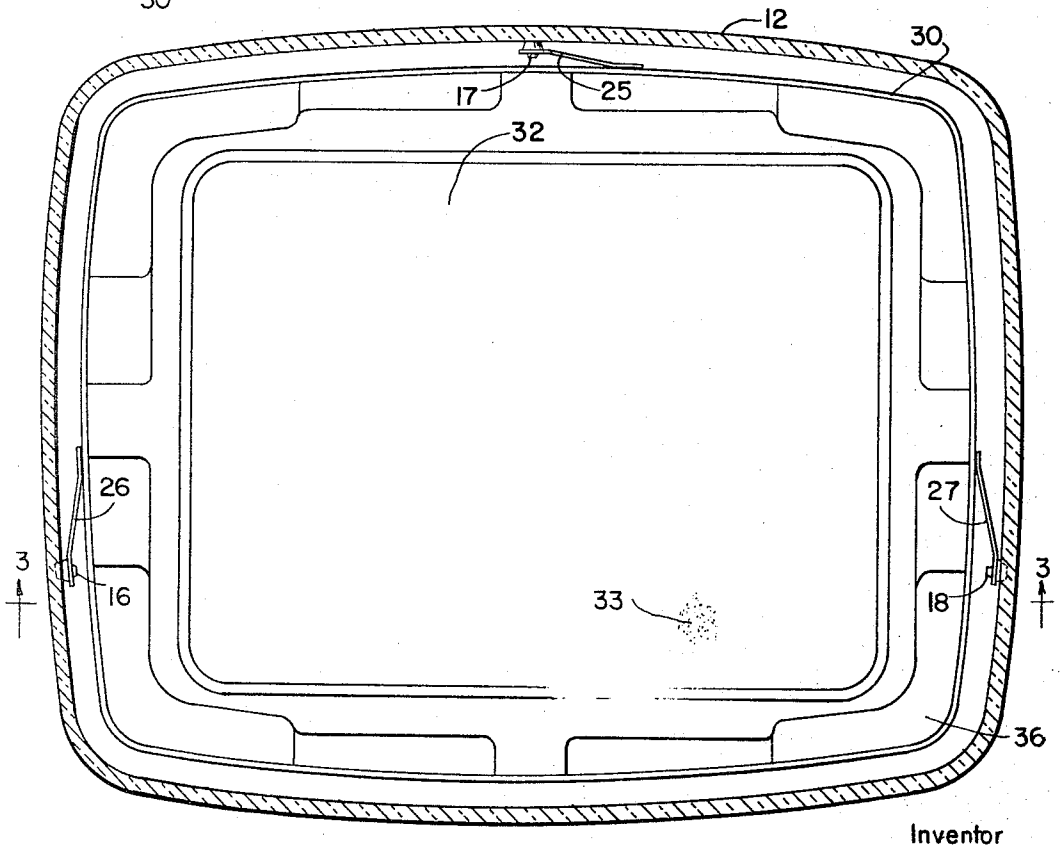


FIG. 2

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CATHODE RAY TUBE WITH IMPROVED SHADOW MASK MOUNTING SPRING ARRANGEMENT

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ABSTRACT OF THE DISCLOSURE

A cathode ray tube of the shadow mask type including a faceplate panel having depending flanges surrounding the image area, a shadow mask positioned in spaced relation from the image area, three flat springs each secured at one end to the shadow mask and defining an apertured free end. The springs are spaced about the periphery of the shadow mask extending generally parallel to the image area, and they are removeably received by studs on the faceplate panel. The free end of one of the springs extends in a direction opposite that of the other two springs about the periphery of the shadow mask. Preferably, the free ends of the two side springs extend downwardly.

This invention relates to color cathode ray tubes and more particularly to tri-color cathode ray tubes of the shadow mask type.

In color cathode ray tubes of the shadow mask type, phosphor dots of color emitting material are arrayed in groups or triads on the target area of the tube and when excited with an impinging electron beam from the corresponding one of the three electron guns in the tube, these dots respectively emit red, green and blue light. A shadow mask having a plurality of apertures therein is positioned immediately behind the target area of the tube and aligned so that each electron beam from the three electron guns will land only on its associated color dot in each triad.

Because of the stringent requirements for positioning of the internal parts of such a tube, including register of the shadow mask and phosphor dots and alignment of the electron gun with respect thereto, it is necessary that the shadow mask be rigidly held in place. Further, the shadow mask mounting structure must be capable of absorbing shock and vibration and to expand and contract as the tube and mask are heated during use. Since the shadow mask is normally used as a pattern for separately laying and processing three different sets of the dot structure of the tube into which it is later permanently sealed, it is necessary that the supporting structure for the shadow mask allow the mask to be removed and replaced easily without causing misalignment. The requirements for accuracy in alignment are even greater when the tube is provided with a wide deflection angle, such as 90° or more, which results in a desirably compact tube.

The color tubes which have been available in commercial quantities in the past are large and cumbersome and provide a round viewing screen. The shadow mask is held in place by flat leaf springs fastened to the shadow mask structure and inserted in studs positioned on the inside walls of the faceplate panel. Because of the circular symmetry of a round tube, the flat leaf springs can be

equally spaced around the periphery of the shadow mask. The use of three such mounting springs defines a plane surface which can be accurately located with respect to other portions of the tube.

In order to have a mounting structure with good strength and stability, the three mounting studs should be spaced so that they define an equilateral triangle, with the center of the triangle positioned as close to the center of the faceplate as possible. When a color cathode ray tube is manufactured in the form of a rectangular tube, circular symmetry no longer exists and it is more difficult to space the supporting structure for the shadow mask so that the proper alignment can be maintained. Solutions to this problem used in prior art tubes have several disadvantages. Placing the mounting studs in the glass faceplate panel closer to the panel center line to accommodate leaf springs oriented in the same direction, as the springs are oriented in a round tube, reduces the strength and stability of the mask mounting structure. Accordingly, in prior art color cathode ray tubes of the shadow mask type, the mounting studs in the faceplate panel have been placed to make the triangle defined by the three mounting studs as large as possible and special springs have been used to connect one corner of the mask to the panel. This requires that one spring be shorter than the other springs, or that it be of special curved construction for mounting on the corner of the shadow mask. Both of these forms of construction are objectionable because mask insertion is difficult and the differences in spring tension caused by the use of different springs can cause misalignment as the shadow mask expands and contracts during heating and cooling.

Other prior art rectangular color tubes use four mounting springs equally spaced along the faceplate. However, the four mounting points will not define a single plane as will three mounting points, so that a higher degree of accuracy is required in placing the mounting studs on the faceplate panels when four mounting points are used, than is required when three mounting points are used. Also, the use of four mounting springs increases the difficulty of removing and replacing the shadow mask, an operation which is required to be performed several times during the process of manufacturing a color tube.

It is an object of this invention to provide an improved and economical mounting structure for a shadow mask for a color cathode ray tube having a rectangular viewing screen.

Another object of this invention is to provide a mounting structure for shadow mask of a color cathode ray tube which will permit the shadow mask to be easily inserted and removed from the faceplate panel and which holds the mask with advantageous stability.

A feature of this invention is the provision of a shadow mask mounting structure for a color cathode ray tube comprising a plurality of flat leaf springs in which one spring is oriented in a direction different from the other springs.

In the drawings:

FIG. 1 is an elevational view of a shadow mask cathode ray tube;

FIG. 2 is a sectional view along line 2—2 of FIG. 1; and

FIG. 3 is a cross-sectional view along line 3—3 of the assembly shown in FIG. 2.

In practicing this invention a rectangular faceplate panel for a color cathode ray tube of the shadow mask

type is provided. Three mounting studs are positioned on the inside surface of the flanges of the faceplate panel. These three studs determine a reference plane for accurately locating the shadow mask with respect to the electron guns and the phosphor surface. The shadow mask is held in position by three flat leaf springs, each fastened at its end to the outside frame of the shadow mask. Each of the springs has an aperture near its free end, which fits over a projection on the mounting stud. The shadow mask is inserted into the faceplate by bending the springs and placing the apertures over the extended portions of the studs. The springs expand to their normal position and hold the shadow mask is place in proper alignment. In order to adapt this mounting structure to the rectangular faceplate panel, one of the three springs is oriented in a different direction than the other two springs. Preferably the free ends of two of the springs extend downwardly from the sides of the shadow mask. This provides a secure mounting structure with the flat leaf springs being long enough to be easily deflected without being deformed and with the mounting stud centers being sufficiently far from the center lines of the faceplate panel to develop a good holding power.

Referring to the figures, the tube **10** includes a funnel portion **11** and a faceplate panel **12** made from glass properly dimensioned for use in the color cathode ray tube. The interior surface of the glass faceplate panel **14** is contoured to be the proper distance from the electron guns and the shadow mask structure. Mounting studs **16**, **17** and **18** are positioned in the accurately dimensioned flanges or side walls **22** of faceplate panel **12**. Studs **16**, **17** and **18** determine a plane which is used to locate the shadow mask structure accurately with respect to the inside surface **14** of faceplate panel **12**.

Shadow mask **32**, having a large number of small apertures **33** located thereon, is mechanically supported by a shadow mask frame structure **30**. Flat leaf springs **25**, **26** and **27** are fastened to the shadow mask frame structure **30** at three areas around its periphery so that the springs are effectively cantilevered parallel to, or nearly parallel to, the face area of the panel **14**.

The three flat leaf springs **25**, **26** and **27** have holes adjacent their free ends to seat upon mounting studs **16**, **17** and **18** to hold the shadow mask frame and shadow mask in proper spaced relationship with the inside front surface of the faceplate panel **14**. The springs act to absorb shock and vibration without displacing the mask from its critically aligned position. The springs also absorb changes in the dimension of the mask and faceplate panel caused by heating and cooling during manufacture and use of the cathode ray tube.

Because of the lack of circular symmetry in the rectangular shadow mask structure, it is not possible to use the same mounting structure as used in round tubes and still provide a sufficiently stable mounting structure for the shadow mask. Therefore, the orientation of one of the flat leaf springs, in this example spring **27**, is reversed from the orientation of the other flat leaf springs. If this were not done it would be necessary to make spring **27** shorter than springs **25** and **26** or place stud **18** closer to the center line of the shadow mask to permit the springs to be oriented in the same direction. Placing stud **18** closer to the faceplate centerline would weaken the mounting structure, while using a short spring would make the mask more difficult to remove and replace. The short spring would also be subject to permanent deformation and misalignment. Mounting leaf spring **27** on corner **36** of frame **30** would weaken the shadow mask structure and would require a special spring. It is thus highly advantageous to have the springs, as shown, with the two side springs **26**, **27** extending with their free ends downwardly.

With the orientation of spring **27** reversed, a design is provided wherein all three springs are the same to minimize cost. The spring leaf can be made long enough to allow sufficient deflection during insertion and removal

without distortion of the spring. The studs can be located as far apart as practical to give maximum stability to the shadow mask. While spring **25** has been shown mounted on the top of the shadow mask frame as oriented in the faceplace panel, it could be located on the bottom of the structure.

I claim:

1. A cathode ray tube of the shadow mask type, including in combination, a rectangular faceplate panel having depending side walls surrounding a face area, a shadow mask structure to be positioned in spaced relation from said face area, at least three flat springs including first and second side springs, each having an end secured to said shadow mask structure and an apertured free end, said springs being spaced about the periphery of said shadow mask structure and extending generally in a direction parallel to said face area, the free end of one of said springs extending in a direction opposite to that of the other two of said springs about the periphery of said shadow mask structure and retaining means carried by said side walls to engage said apertures of said springs for removably retaining said shadow mask structure within said faceplate panel, said retaining means for said first and second side springs being displaced from the horizontal center line of said faceplate.

2. A cathode ray tube of the shadow mask type, including in combination, a rectangular faceplate panel having top, bottom and side flanges surrounding a face area, a shadow mask structure to be positioned in spaced relation from said face area and having top, bottom and side portions to be positioned respectively adjacent said top, bottom and side flanges, at least three springs each having an end secured to said shadow mask structure and an apertured free end, one of said springs being secured to each of said side portions with the free ends thereof extending in opposite directions about the periphery of said shadow mask structure, the other of said springs being secured to another of said portions of said shadow mask structure, and stud means imbedded in said side flanges to engage said apertures of said springs for removably retaining said shadow mask structure within said faceplate panel.

3. A cathode ray tube of the shadow mask type, including in combination, a rectangular faceplate panel having top, bottom and side flanges surrounding a face area, a shadow mask structure to be positioned in spaced relation from said face area and having a top and side portions to be positioned respectively adjacent said top and side flanges, at least three springs each having an end secured to said shadow mask structure and an apertured free end, one of said springs being secured to said top portion, the others of said springs each being secured to one of said side portions with the free ends thereof extending in a direction away from said top portion, and means carried by said side flanges to engage said apertures of said springs for removably retaining said shadow mask structure within said faceplate panel.

4. A cathode ray tube of the shadow mask type, including in combination, a rectangular faceplate panel having a face area bounded by vertically extending side wall flanges and horizontally extending side wall flanges with said face area in an upright position, a shadow mask structure to be positioned in spaced relation from said face area and having first sides to be disposed adjacent said vertically extending side wall flanges and second sides to be disposed adjacent said horizontally extending side wall flanges, a first elongated spring member having an end secured to one of said second sides of said shadow mask structure and having an apertured end extending outwardly from said one side, second and third elongated springs each having ends respectively secured to said first sides of said shadow mask structure and having respective apertured ends extending outwardly from said first side and in a direction away from said

first spring to maximize the peripheral spacing of the apertures in the ends of said springs, and stud means imbedded in said side wall flanges of said faceplate panel so that said apertures of said flat springs engage the same and suspend said shadow mask structure spaced from said face area and in stable relation in a plane determined by said stud means.

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