Dec. 13, 1955 J. T. MARK ET AL 2,727,172

ELECTRODE SUPPORT FOR CATHODE-RAY COLOR TUBE

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Fig. 1.

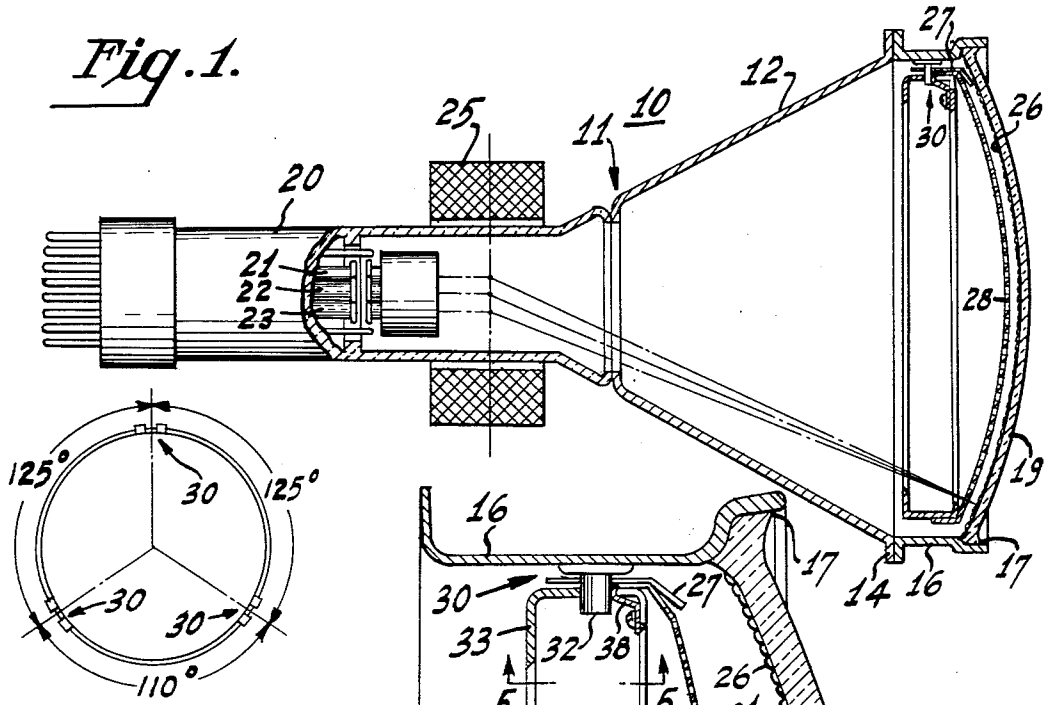


Fig. 2.

Fig. 3.

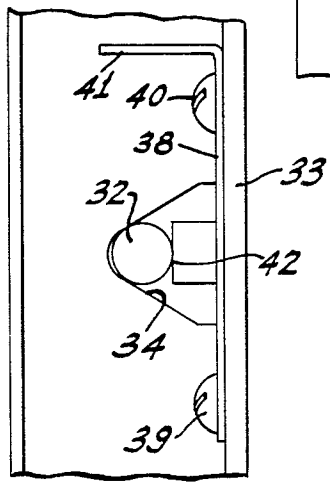


Fig. 5.

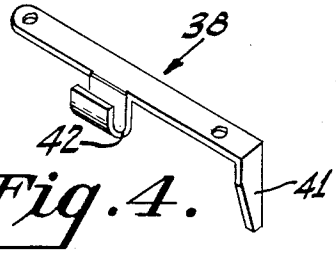


Fig. 4.

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ELECTRODE SUPPORT FOR CATHODE-RAY COLOR TUBE

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4 Claims. (Cl. 313—85)

This invention relates to improvements in cathode-ray tubes and particularly to means for supporting an apertured electrode in tri-color cathode-ray tubes.

In the manufacture of tri-color cathode-ray tubes of the type comprising a phosphor screen and an apertured electrode through which beam electrons pass in their transit to the phosphor screen there arises several problems in supporting the apertured electrode. One of these problems occurs due to the fact that the foundation plate for the phosphor screen varies in size from tube to tube so that the apertured electrode cannot be placed into an envelope at a predetermined position, but the location of the apertured electrode must be adjusted with respect to the foundation plate of the phosphor screen in each individual tube.

A further problem occurring in the support structure for tri-color cathode-ray tubes is that the apertured electrode is normally made from a thin piece of metal. Therefore, stresses and strains on the apertured electrode that occur during the processing of the tube, as well as during the operation of the tube, are likely to cause bending or deforming of the apertured electrode which results in color dilution during tube operation.

Furthermore, in the manufacture of tri-color kinescopes the phosphor screen is usually fixed to the screen support member by being exposed to light through the apertured electrode. When this method of processing the phosphor screen is utilized the apertured electrode must be inserted into, and removed from, the predetermined position with respect to the foundation plate once for each of the three colors in the screen. Due to this insertion and removal into and out of the predetermined position, it is necessary that any support means for the apertured electrode be readily detachable, and also be of the type which is accurately positioned when reassembled. Thus, the apertured electrode support means must be capable of being assembled and disassembled with the apertured electrode in substantially exactly the same position and with the apertured electrode self-orienting in this position.

It is therefore an object of this invention to provide a new and improved support means for an apertured electrode in a cathode-ray tube.

It is another object of this invention to provide a novel support structure for use in a tri-color kinescope.

These and other objects have been accomplished in accordance with this invention by providing a novel supporting means in a tri-color cathode-ray tube including an evacuated envelope in one end of which there is provided at least one beam source of electrons. In the other end of the envelope there is provided a tri-color phosphor screen. Spaced adjacent to the phosphor screen there is provided an apertured electrode, or mask, which is supported within the envelope by a plurality of the novel support means. The novel support means are radially disposed about the axis of the envelope and each includes a stud receiving V-notch and a stud. Each of the stud receiving V-notches receives one of the studs. Due

to the V-shape of the notches, the apertured electrode is automatically disposed in substantially exactly the same position each time it is supported and the position of support is self-orienting. Each of the studs is maintained in slidable position in its respective V-notch by a rounded edge of a holding clamp. The force applied by the holding clamp, which holds the stud in the V-notch, applies this force in the neutral axis or onto the center of gravity of the stud and hence no torque is applied to the apertured electrode assembly.

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself will best be understood by reference to the following description when read in connection with the accompanying single sheet of drawings wherein:

Fig. 1 is a longitudinal sectional view of a tri-color kinescope constructed in accordance with this invention;

Fig. 2 is a schematic view of the location of the support member of the tube shown in Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view of the support structure shown in Fig. 1;

Fig. 4 is a perspective view of the holding clamp used in the invention; and,

Fig. 5 is a side view taken along line 5—5 of Fig. 3.

Although the invention is applicable to other types of tubes wherein a self-orienting quick detachable means is utilized to support an electrode, it will be explained with reference to a color kinescope and particularly to an apertured electrode, in a color kinescope, through which beam electrons travel in their transit to a phosphor screen.

Referring now to the drawings in detail, there is shown a sectional view of a color kinescope tube **10** comprising an evacuated envelope **11** including a main chamber in the form of a conical frustum **12**. The large end of the frustum **12** includes a lip **14** which is sealed to a cap member **16**. The cap **16** includes a lip **17** which is sealed to a transparent face plate **19**. The small end of the frustum **12** terminates in a neck portion **20** which is made of glass. The seal between the frustum **12** and a flange on the cap **16** may be any of the conventional metal-to-metal seals, while the seal between cap **16** and face plate **19**, as well as the seal between frustum **12** and neck **20**, may be any of the conventional glass-to-metal seals. Enclosed within the neck portion **20** of envelope **11** there is provided a battery of three electron guns **21**, **22** and **23** which may be arranged 120° apart, and substantially parallel to the long axis to the tube **10**. Surrounding the neck portion **20** is a conventional deflection yoke **25** which produces a plane of deflection designated by line P—P for the three electron beams. As shown the envelope **11** is composed primarily of metal. However, it should be understood that the envelope **11** could be made of glass. Also, the envelope **11** could be substantially rectangular in cross-section. Furthermore, this invention is applicable to color kinescopes utilizing only one electron gun.

In the cap **16** there is provided a screen **26** which includes red, blue and green phosphor dots which are arranged in a hexagonal mosaic pattern on the inner, or target surface, of the glass face plate **19** to form the color screen. In the instant case the glass face plate **19** is in the form of a circular section of a spherical shell. Supported adjacent to the screen **26** is an apertured electrode, or mask, **28** which may be formed of a thin metal or other conducting material, such as a copper-nickel alloy of 95% copper and the balance nickel.

When, as in the instant case, the screen **26** is laid down on a curved face plate **19** of the envelope **11**, the mask **28** is appropriately curved so as to be approximately concentric with the curved inner, or target surface, of face

plate 19. As is well-known, apertures 31 in the mask 28 are arranged in the same hexagonal pattern as the phosphor dots which are laid down on the face plate 19. In the present case the red, blue and green scanning beams pass through the plane of deflection P—P with the beam centers equally spaced apart and from the tube axis and converge through the apertures 31.

The mask 28 is affixed to a frame 33, such as by welding. The frame 33 is supported within the envelope 11 by three support means 30 one of which is shown more clearly in Figs. 3 and 5. The support means 30 are spaced around the axis of the envelope 11 so as to be removed from the useful area of the screen 26, i. e. out of the line of view, when utilizing the conventional four to three aspect ratio for the television picture. As shown in Fig. 2 the spacing of the support means 30 may be 110° apart in the lower portion of the enevolpe with the third support means 30 supported at the top of the envelope, or 125° from each of the other two support means 30.

Each of the support means 30 comprises a substantially round stud, or pin, 32 which may be welded, or affixed by other well-known means, to the inner surface of the cap 16 at the three spaced apart locations. Each of the pins 32 is accurately positioned within the cap 16 in a predetermined spaced relationship with respect to the face plate 19. As shown more clearly in Fig. 5 each of the pins 32 is round and fits into a V-notch, or track, 34 in the frame 33 to which the mask 28 has been affixed. Due to the locations and shape of the V-notches 34, the frame 33 is supported in only one position. Since the V-notches 34 can be slipped over the studs 32, the mask frame 33, and therefore the mask 28, is self-orienting into this one position.

In each of the support means 30 there is provided a holding clamp 38 which is attached to an inner surface, or flange, of frame 33 by screws 39 and 40. Of course other well-known means of attaching the clamp 38 may be utilized. When in position, a rounded surface 42 of clamp 38 presses each of the pins 32 into a V-notch 34 to hold the pins 32 in the previously mentioned one position. It should be noted that the rounded portion 42 of the clamp 38 secures the pins 32 in place but does not hamper the sliding of the frame 33 with respect to the pins 32. Since the frame 33 expands and contracts, when the mask 28 is heated by electron bombardment, this is a necessary feature of a useful support means. In other words the frame 33 must be capable of uniform expansion in order to prevent color dilution when the mask 28 is heated by electron bombardment.

As shown more clearly in Fig. 4 the clamp 38 is a torque or twist spring fabricated from a flat spring strip. Extending centrally from the clamp 38 is a flange having the rounded end 42. The clamp 38 is inserted in the normal or uncompressed position and is compressed by fastening, by means of screws 39 and 40, at its ends. Other means (not shown) such as eyelets, rivets, welds, and snap clip fastners may be used for securing the clamp 38.

When the photographic method of applying the tri-color phosphor particles to the face plate 19 is utilized the clamp 38 must be inserted four times, i. e. once for each of the three colors and the final assembly. The hold down clamp need be fastened down only at one end during the first three insertions of the mask and is preferably fastened by screw 39, which functions as a hinge, and the clamp 38 is swung or pivoted into and out of position by means of flange 41 on the clamp 38. As is obvious in the final assembly both screws 39 and 40 should be inserted to permanently hold the clamp 38, and therefore the frame 33 and mask 28, in a slidable engagement in the predetermined position within the envelope 11.

Adjacent to each of the support means 30 is provided a pair of mask guards 27 for the purpose of preventing damage to the mask 28 during the insertion and removal of the frame 33 onto pins 32. As can be seen there has been provided a support means which is readily disassembled for the processing of the screen and which is self-orienting since each of the V-notches 34 are radially disposed around the axis of tube 10. Thus, there is only one position of mask 28 where each of the pins 32 is positioned in the track of one of the V-notches 34.

What is claimed is:

1. A tri-color cathode-ray tube comprising an envelope having a face plate, a phosphor screen on the inner surface of said face plate, a mask disposed adjacent to said screen, three rounded studs affixed to said envelope adjacent to said face plate and at spaced apart intervals around the axis of said tube, a frame affixed to said mask and supported on said studs by quick detachable self-orienting means, said means including a flange on said frame, V-notches in said frame at said spaced apart intervals, three holding clamps movably attached to said frame one at each of said intervals, each of said holding clamps including a portion interposed directly between and in contact with said flange and one of said studs whereby said studs are positively retained in said V-notches when said clamps are attached, and hinge means adjacent one of the ends of each of said clamps for attaching each of said clamps to said frame.

2. A cathode-ray tube as in claim 1 further comprising a handle adjacent one end of each of said clamps for pivoting each of said clamps into and out of the retaining position.

3. A cathode-ray tube as in claim 1 further comprising a plurality of pairs of apertured electrode guards, one of said pairs of guards being supported by means of said frame adjacent to each of said studs.

4. A tri-color cathode-ray tube comprising an evacuated envelope having a curved face plate on one end thereof, a tri-color fluorescent screen on the inner surface of said face plate, a frame having a C-shaped cross-section, an apertured mask secured to the outer periphery of said frame, means to support said mask and frame in a predetermined position with respect to said screen, said means being self-orienting into said position and quickly detachable into and out of said position, said means comprising, three pins secured to an inner surface of said envelope at spaced apart intervals around the axis of said envelope, said pins extending from said envelope toward the center axis of said tube and each pin being substantially round in cross-section, three V-notches in said frame each arranged at one of said intervals, three holding clamps removably attached to an inner surface of one leg of said C-shaped frame each for holding one of said pins in one of said V-notches, each of said clamps being a flat metal strip having a centrally located flange, said flange having a curved end, said curved end being snugly in contact with one of said pins when said clamp is secured, and means adjacent to each end of each of said clamps for pivotally securing each of said clamps to said inner surface of said leg of said frame whereby said rounded end of each of said clamps presses against one of said pins to retain said one of said pins in one of said V-notches.

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