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METHOD OF MANUFACTURING COLOR SELECTING APPARATUS

FOR CATHODE RAY TUBE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of manufacturing a color selecting apparatus for a cathode ray tube preferred to assemble a color selecting apparatus having a frame and a color selecting electrode welded together.

2. Description of the Related Art

In a cathode ray tube, a color selecting electrode on which vertically-continuous striped thin metal slits (aperture grille) are formed is set to a frame and color display is performed by the color selecting electrode. In this cathode ray tube, three electron beams emitted from an electron gun G are deflected to scan the whole of a phosphor screen and each electron beam is interrupted by a color selecting electrode and reaches the phosphor screen only when passing through the slits of the color selecting electrode, and it is applied to the phosphor of its corresponding color.

As shown in Fig.1, the color selecting apparatus has a structure in which a color selecting

electrode 5 is set to a frame 1 set in a cathode ray tube 20.

As shown in Fig. 2, the color selecting apparatus 10 in a cathode ray tube 20 has a structure in which the color selecting electrode 5 with the striped thin metal slits is set to frame members 1a and 1b of the frame 1 obtained by welding and joining frame members 1a, 1b, 1c, and 1d each other so that they are rectangular, and a thin wire (damping wire) 9 is set to the color selecting apparatus 10 between frame members 1c and 1d perpendicularly intersecting the striped thin metal slits to prevent the vibration of the striped thin metal slits.

Moreover, the color selecting electrode 5 with a vertically-continuous striped slits has a marginal portion 5a to be removed in the manufacturing step at its margin.

Figures 3A to 3E are views showing a procedure for assembling the color selecting apparatus 10.

As shown in Fig. 3A, the frame 1 is held between the holder 6 with a curvature close to that of the frame members 1a and 1b while applying a compressive force F to the frame members 1a and 1b, the color selecting electrode 5 is mounted on a holder 6.

Then, as shown in Fig. 3B, the color selecting electrode 5 is pulled at a force f by holding it by a pressing jig 7 so that the color selecting electrode 5 which is mounted on the holder 6 does not loosen. Under

the above state, the frame 1 is pressed against the color selecting electrode and thereafter, as shown in Fig. 3C, the color selecting electrode 5 is welded to the frame members 1a and 1b by pressurizing it with a discoid welding electrode 8 and rotating the discoid welding electrode 8 along with the frame members 1a and 1b.

Then, as shown in Fig. 3D, the holder 6 and the pressing jig 7 are removed and the compressive force F applied to the frame members 1a and 1b are released. Then, as shown in Fig. 3E, assembling of the color selecting apparatus 10 is completed by removing the marginal portion 5a of the color selecting electrode 5 jutting out of the frame 1.

Moreover, as shown in Fig. 2, a damping wire 9 is mounted to the color selecting apparatus 10 so as to perpendicularly intersect the striped thin metal slits 4 in order to prevent vibrations of the striped thin metal slits 4.

Figure 4 is a view showing the state of the color selecting electrode 5 at the start of welding between the color selecting electrode 5 and the frame 1 described in Fig. 3C.

As shown in Fig. 4, the color selecting electrode 5 placed on a predetermined position on the frame members 1a and 1b is welded with the frame members 1a and

1b while rotating the discoid welding electrode 8 to which a depressive force W is applied. In this case, if a welding start position is set to any position of the marginal portion 5a on the color selecting electrode 5, the discoid welding electrode 8 may turn up an end of the color selecting electrode 5 nearby the welding start position. Therefore, as shown in the circle A drawn by a dotted line, bumps are formed on the color selecting electrode 5 nearby the welding start position. The bumps on the color selecting electrode 5 produce twists and creases on the striped thin metal slits 4.

When these twists and creases are produced, the damping wire 9 does not completely contact the striped thin metal slits 4 nearby an end of the striped thin metal slits 4 in the stripe direction as shown in Fig. 6. Unless the striped thin metal slits 4 properly contacts the damping wire 9, a problem occurs that the vibration of the striped thin metal slits 4 (aperture grille vibration) cannot be prevented. Because the relative positional relation between the aperture grille and a phosphor screen is changed due to the aperture grille vibration, a problem such as a color shift occurs.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a

method of manufacturing a cathode ray tube preferred to prevent a color selecting electrode from twisting or shifting when welding and securing a color selecting electrode to the surface of a frame, capable of greatly decreasing vibrations of the color selecting electrode, and hardly causing a color shift.

According to the present invention, there is provided a method of manufacturing a color selecting apparatus for a cathode ray tube in which a color selecting electrode having striped thin metal slits are welded on a frame, comprising the steps of: forming a plurality of the striped thin metal slits on the color selecting electrode, providing the color selecting electrode on the frame, and welding the color selecting electrode and the frame, a starting position of the welding being a predetermined distance from an end of the color selecting electrode.

Preferably, the starting position on the surface of the frame is within 2mm from the end of the color selecting electrode.

Preferably, the forming step includes a step for forming a welding outout in the color selecting electrode where the striped thin metal slits is not formed.

Preferably, the color selecting electrode is positioned to the frame so that an end of the frame is placed in said welding outout of the color selecting

electrode, and the welding is started from a predetermined position in the welding cutout of the color selecting electrode.

Preferably, the welding is carried out by a discoid welding electrode.

Preferably, the discoid welding electrode is pressed on the color selecting electrode placed on the frame, and rotated to move on the surface of the color selecting electrode.

Preferably, the circumference of the discoid welding electrode is contacted with the surface of the frame at a position within predetermined distance from an edge of the welding cutout in starting the welding, and rotated to move on the surface of the color selecting electrode.

According to the present invention, there is provided a method of manufacturing a color selecting apparatus for a cathode ray tube further comprising a step of mounting a damping wire on the striped thin metal slits at a predetermined tension so as to perpendicularly intersect the striped thin metal slits, after the welding of the color selecting electrode and the frame.

According to the present invention, there is provided a method of manufacturing a color selecting apparatus for a cathode ray tube further comprising a step of removing an outer periphery of the color selecting electrode after the

welding of the color selecting electrode and the frame.

Preferably, the welding cutout is formed on an end part parallel with the striped thin metal slits, and removed by the removing of the outer periphery of the color selecting electrode.

Preferably, the providing step includes a step for tensing the color selecting electrode at a predetermined force in the direction of the striped thin metal slits.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clearer from the following description given with reference to the attached drawings, in which:

Fig. 1 is a perspective view of a cathode ray tube having a color selecting apparatus;

Fig. 2 is a perspective view showing a color selecting apparatus;

Figs. 3A to 3E are views showing a procedure for assembling a color selecting apparatus;

Fig. 4 is a schematic view showing the shape of the marginal portion of a color selecting apparatus at start of welding;

Fig. 5 is a schematic view showing a state in which a damping wire does not completely contact striped thin metal

slits; and

Figs. 6A and 6B are views for explaining a method of manufacturing a color selecting apparatus for a cathode ray tube of the present invention, in which Fig. 6A is an illustration viewed from the upside of a color selecting apparatus and Fig. 6B is an illustration viewed from the lateral side of a frame.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be explained with reference to the attached drawings.

Figure 6A and 6B are illustrations for explaining a method of manufacturing a color selecting electrode for a cathode ray tube of the present invention, in which Fig. 6A is an illustration viewed from the upside of an color selecting electrode 5 and Fig. 6B is an illustration viewed from the lateral side of a frame member 1a.

As shown in Fig. 6A, striped thin metal slits 4 are formed on the color selecting electrode 5 and the color selecting electrode 5 has a marginal portion 5a on its margin. A predetermined region of the marginal portion 5a is joined with a portion 1am to be welded of the frame member 1a by means of welding.

A welding cutout 5b is formed on a marginal portion of color selecting electrode 5 parallel with the striped

thin metal slits 4.

The welding cutoff 5b is formed by cutting out the marginal portion 5a of the color selecting electrode 5 correspondent to an end of the frame member 1a and 1b. An edge P1 becomes an end of the color selecting electrode after the removing of the marginal portion 5a.

Figure 6A is a view showing a welding outout only a part correspondent to the frame member 1a, other part correspondent to the frame member 1b is also formed in the same shape and both of the parts are formed continuously in each other.

The above color selecting electrode is mounted on the holder 6, as shown in Fig.3Aa, under the state applying a compressive force F to the frame members 1a and 1b of the frame 1.

Then the color selecting electrode 5 is provided to the frame 1 so that an edge face of the frame member 1a is brought to a predetermined position within a region of the welding outout formed on the outer marginal portion 5a of the color selecting electrode. As described in Fig. 3B, the marginal portion 5a is held by the pressing jig 7 and pulled at a tension f so that the color selecting electrode 5 does not loosen. The tension f has a value when a tensile stress of 30 to 70 kgf/mm² works on the striped thin metal slits 4. The above tension is applied to prevent the

position of an electron-beam passing hole from changing due to thermal expansion during operation.

Under the above state, as shown in Fig.6B, the frame member 1a is pressed by the circumference of the discoid welding electrode 8 at a position within the welding cutout 5b, and rotated in the direction of an arrow along with the frame members 1a and 1b.

The marginal portion 5a of the color selecting electrode 5 is welded to the surface 1am to be welded of the frame member 1a when the discoid welding electrode 8 rotates in the arrow direction and advances. The case of the frame member 1b is, as not shown, the same.

Symbol P2 in Figs. 6A and 6B denotes a tangent position when the outer periphery 8a of the discoid welding electrode 8 contacts the surface of the frame member 1a at the rotation start position of the discoid welding electrode 8.

In the present invention, the rotational start position is set so that the distance L between a rotational start position P2 and an end face of the welding cutout 5b is within predetermined distance.

Accordingly, as described below, the aperture grille vibration occurrence rate of assembled color selecting electrode can be greatly decreased.

The holder 6 and the pressing jig 7 are removed and

the compressive force F applied to the frame members 1a and 1b are released. Then, as shown in Fig. 3E, assembling of the color selecting apparatus 10 is completed by removing the marginal portion 5a of the color selecting electrode 5 jutting out of the frame 1. Accordingly, the welding outout 5b is also removed by the removing of the marginal portion 5a.

Next, as shown in Fig. 2, a damping wire 9 is mounted to the color selecting apparatus 10 so as to perpendicularly intersect the striped thin metal slits 4 in order to prevent vibrations of the striped thin metal slits 4.

The color selecting apparatus of this embodiment is assembled by the above steps.

The following shows how the striped thin metal slits vibration (AG vibration) occurs by changing the distance L between the tangent position P2 and the end position P1 from 0 to 10 mm when the outer periphery 8a of the discoid welding electrode 8 contacts the surface of the frame member 1a at the rotation start position of the discoid welding electrode 8.

[Table 1]

	Embodiment 1	Embodiment 2	Embodiment 3	Comparative example 1	Comparative example 2
L	0mm	2mm	5mm	7mm	10mm
AG vibration occurrence rate	0%	0.5%	3%	20%	70%

AG vibration occurrence state depending on welding
start position

The embodiment 1 in Table 1 shows a case in which the distance L is 0 mm, that is, a case in which welding is started from the end position P1. In this case, the AG vibration does not occur at all.

The embodiment 2 shows a case in which the distance L is 2 mm. In this case, the AG vibration occurrence rate is approx. 0.5% and therefore, the AG vibration slightly occurs.

The embodiment 1 shows a case in which the distance L is 5 mm. In this case, the AG vibration occurrence rate is approx. 3% and therefore, the AG vibration slightly increases.

Then, the comparative example 1 shows a case in which the distance L is 7 mm. In this case, the AG vibration occurrence rate comes to approx. 20% and therefore, it

greatly increases.

The comparative example 1 shows a case in which the distance L is 10 mm. In this case, the AG vibration occurrence rate comes to approx. 70% and therefore, it further greatly increases.

From the above results, it is found that the AG vibration occurrence rate greatly decreases when the distance L between the tangent position P2 and the end position P1 is kept in a range of 5 mm or less where the outer periphery 8a of the discoid welding electrode 8 contacts the surface of the frame member 1a at the rotation start position of the discoid welding electrode 8.

Moreover, it is found that the AG vibration occurrence rate extremely increases when the distance L exceeds 5 mm.

Therefore, the discoid welding electrode 8 hardly turns up a portion nearby the end position P1 of the color selecting electrode 5 when the distance L is kept in a range of 0 to 5 mm. Therefore, no bumps are produced at a portion nearby the end position P1 of the color selecting electrode 5 or a portion nearby a welding start position or the striped thin metal slits 4 is not twisted or creased.

Therefore, as shown in Fig. 3, the damping wire 9 with a diameter of 10 to 30 μ m which is set so as to perpendicularly intersect the striped thin metal slits 4 in

order to prevent the striped thin metal slits 4 from vibrating completely contacts the striped thin metal slits 4. Therefore, even if vibrations occur in the striped thin metal slits 4, they are immediately damped. As a result, because the relative positional relation between the striped thin metal slits 4 and a phosphor screen is hardly changed, it is possible to greatly reduce the AG vibration occurrence rate and manufacture a cathode ray tube having no problem on a color shift or the like.

Moreover, in the case of this embodiment, the welding outout 5b cut out into a predetermined shape shown in Fig.6A is formed on the marginal portion 5a of the color selecting electrode 5. Therefore, it is easily possible to keep the distance L in a range of 0 to 5 mm.

Furthermore, this embodiment is described about a case of welding the marginal portion 5a of the color selecting electrode 5 to the frame member 1a. However, the same is true for the frame member 1b.

As described above, a method of manufacturing a color selecting apparatus for a cathode ray tube of the present invention makes it possible to prevent a color selecting electrode from twisting or creasing at a welding start position by setting the rotation start position of a discoid welding electrode to a predetermined position from an end of the color selecting electrode when welding the color

selecting electrode to a frame, and thereby obtain a cathode ray tube hardly causing the color selecting electrode to vibrate and having no problem on a color shift or the like.



CLAIMS

1. A method of manufacturing a color selecting apparatus for a cathode ray tube in which a color selecting electrode having striped thin metal slits are welded on a frame, comprising the steps of:

forming a plurality of the striped thin metal slits on the color selecting electrode,

providing the color selecting electrode on the frame, and

welding the color selecting electrode and the frame, a starting position of the welding being a predetermined distance from an end of the color selecting electrode.

2. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, wherein the starting position on the surface of the frame is within 2mm from the end of the color selecting electrode.

3. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, wherein the forming step includes a step for forming a welding cutout in the color selecting electrode where the striped thin metal slits is not formed.

4. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 3, wherein the color selecting electrode is positioned to the



frame so that an end of the frame is placed in said welding cutout of the color selecting electrode, and the welding is started from a predetermined position in the welding cutout of the color selecting electrode.

5. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, wherein the welding is carried out by using a discoid welding electrode.

6. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 5, wherein the discoid welding electrode is pressed on the color selecting electrode placed on the frame, and rotated to move on the surface of the color selecting electrode.

7. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 5, wherein the circumference of the discoid welding electrode is contacted with the surface of the frame at a position within predetermined distance from an edge of the welding cutout in starting the welding, and rotated to move on the surface of the color selecting electrode.

8. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, further comprising a step of mounting a damping wire on the striped thin metal slits at a predetermined tension so as to perpendicularly intersect the damping wire to the



striped thin metal slits, after the welding of the color selecting electrode and the frame.

9. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, wherein further comprising a step of removing an outer periphery of the color selecting electrode after the welding of the color selecting electrode and the frame.

10. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 9, wherein the welding outout is formed on an end part parallel with the striped thin metal slits, and removed by the removing of the outer periphery of the color selecting electrode.

11. A method of manufacturing a color selecting apparatus for a cathode ray tube as set forth in claim 1, wherein the providing step includes a step for tensing the color selecting electrode at a predetermined force in the direction of the striped thin metal slits.