

CATHODE RAY TUBE

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BACKGROUND OF THE INVENTION

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1. Field of the Invention

The present invention relates to a cathode ray tube which prevents halation when it is used with over-scanning.

2. Description of the Related Art

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In a color cathode ray tube, as shown in Fig. 1, a phosphor screen 4 is formed on an inner surface of a faceplate 3 of a tube envelope 2. A color selecting electrode system 10 called an aperture grill or a shadow mask is disposed facing the phosphor screen 4. An electron beam E emitted from an electron gun 5 disposed in a neck 2a of the tube envelope 2 is deflected by a deflection yoke 6 to scan the phosphor screen 4.

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In a cathode ray tube used for a TV monitor in broadcasting station etc., as shown in Fig. 2, which is a schematic view showing a color selecting mechanism in the cathode ray tube from above, sometimes the cathode ray tube is used with over-scanning where the electron beam E is made to scan the outside of a normal effective region defined by the endmost slit of the

color selecting electrode system 10 in the figure.

When the cathode ray tube is used with such over-scanning, the over-scanned electron beam is reflected irregularly at a frame 11 of a color selecting

5 electrode system. When the irregularly reflected electrons reach the phosphor screen 4, frame halation is caused. For this reason, in the TV monitors for broadcasting stations etc., a long and thin beam shielding plate 12 made of metal is disposed between
10 the frame 11 and a deflection center DC of the electron beam attached to an internal beam shielding plate 13 so as not to allow the electron beam to strike the frame 11. This beam shielding plate 12 is made of iron or stainless steel usually having a thickness of about 0.2
15 mm, absorbs electrons when a high voltage is applied, or reflects the electrons to the electron gun side and therefore shields the frame 11 from the electron beam and prevents halation due to the irregular reflection.

Depending, however, on the application of
20 the TV monitor for a broadcasting station, there are cases where it will be used in a dark room in a low current state. When it is used by such a method of use, slight generation of halation is observed. Suppression of this halation has been desired.

An object of the present invention is to provide a cathode ray tube which is used with over-scanning and in addition with which the generation of halation can be prevented even when it is used in a dark room or the like.

The present invention provides a cathode ray tube comprising:

- a color selecting electrode system having a frame,
- a beam shielding plate disposed between the frame of the color selecting electrode system and a deflection center of the electron beam so as to prevent the electron beam from striking the frame when the electron beam overscans,

- the beam shielding plate being sandwiched between an internal magnetic shield and a temperature compensation plate attached to the frame,

- said beam shielding plate having an inner peripheral end surface approximately parallel to, or swept back from, the path which the electron beam takes at the maximum normal scan deflection angle.

Preferably, said beam shielding plate has a portion inclined relative to the frame of the colour selecting electrode so that the said inner peripheral end surface thereof is substantially parallel to the said path of the electron beam.

The beam shielding plate may be tapered to define the said inner peripheral end surface thereof.

Alternatively, said beam shielding plate has a portion inclined relative to the frame of the colour selecting electrode and the plate is tapered to define the said inner peripheral end surface thereof so as to be swept back from the said path.

The present invention was made based on the discovery that the halation at the time of over-scanning is caused by the fact that the beam shielding plate has a certain thickness and therefore the front end surface thereof faces the direction of emission of the electron beam at a slant, the electron beam is irregularly reflected at this front end surface, and the reflected electrons strike the phosphor screen side.

Namely, the cathode ray tube of the present invention has the beam shielding plate ingeniously shaped so that the front end surface of the beam shielding plate becomes substantially parallel to the path of the electron beam or is swept back from the path of the electron beam whereby the electron beam is prevented from being emitted onto the front end surface of the beam shielding plate, the reflection of the electron beam at the front end surface is prevented, and the halation can be prevented.

Formation of the front end surface of the beam shielding plate in this way can be achieved by bending the front end portion of the beam shielding plate to the color selecting electrode system side so that the front end surface becomes substantially parallel to the path of the electron beam or by making the front end surface of the shielding plate taper.

For a better understanding of the present invention, reference will now be made by way of example to the accompanying drawings in which:

Fig. 1 is a sectional view of the general configuration of a cathode ray tube;

Fig. 2 is a plan view of a color section mechanism of the cathode of the cathode ray tube;

Fig. 3 shows part of the tube encircled in Figure 2, being a view explaining generation of halation by a conventional beam reflection plate;

Fig. 4 is a plan view of a color selection mechanism in a cathode ray tube of an embodiment of the present invention;

Fig. 5 shows part of the tube encircled in Figure 4, being a view of a front end part of an example

of a beam reflection plate according to the present invention;

Fig. 6 is a view of another example of the beam reflection plate according to the present invention; and

5 Fig. 7 is a view of still another example of the beam reflection plate according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

10 Below, an explanation will be made of an embodiment of the present invention. Figure 4 is a plate view of a color selecting mechanism in a cathode ray tube of the present invention seen from above. The cathode ray tube of the present invention is similar to
15 the usual cathode ray tube as shown in Fig. 1 except for a beam shielding plate 1, so the same reference numerals in Fig. 4 are given to the same structural parts in Fig. 1.

In Fig. 4, a frame 11 is attached to a color
20 selecting electrode system 10 called a shadow mask or an aperture grill. An internal magnetic shield (IMS) 13 is attached to this frame via a standard temperature compensation plate (STC plate) 14. To the frame 11, a spring 15 for attaching the color selecting mechanism
25 to the phosphor screen 4 shown in Fig. 1 is attached via

a spring holder 16. Further, a long, thin rectangular beam shielding plate 1 is disposed in the vertical direction of the cathode ray tube while being sandwiched between an internal magnetic shield 13 and the standard temperature compensation plate 14. The front end side of that beam shielding plate 1 projects to a center axis C side of the color selecting electrode system 10 and prevents the electron beam E from hitting the frame 11 disposed in the vertical direction.

The path E of the electron beam shown in Fig. 4 reaches the endmost slit ES of the color selecting electrode system (end of the phosphor screen, that is, corresponding to the end of the effective screen) from the deflection center DC. Usually, the cathode ray tube is used at the side inside from this (referred to as under-scanning), but in a TV monitor for a broadcasting station etc., the electron beam is made to scan at the side outside from this (referred to as over-scanning). When the electron beam is made to swing more than a deflection angle a half angle of a normal full scan α of the path E of the electron beam shown in Fig. 4, the electron beam hits the beam shielding plate 1, to which a high voltage is applied, located at the front surface side of the frame (deflection center side). The electron

beam is reflected there to directions other than the phosphor screen 4 shown in Fig.1 or is absorbed. Due to this, the electron beam strikes the frame 11 and halation due to irregular reflection to the phosphor screen is prevented.

The beam shielding plate 12, as shown in Fig. 3, is positioned in a state with the plate oriented in a direction perpendicular to the center axis C. In this state, since the plate has a certain thickness, when the front end surface 12a thereof is oriented in the direction of emission of the electron beam and the electron beam strikes this front end surface 1a, the electron beam is reflected to the phosphor screen 4. This has become a cause of the halation.

In the embodiment of the present invention, this beam shielding plate 1 is ingeniously shaped. An enlarged view of the front end side thereof is shown in Fig. 5. This beam shielding plate 1 is formed by bending the front end portion to the color selecting electrode system side and making the front end surface 1a thereof become substantially parallel to the path E of the electron beam. Due to this, the electron beam no longer strikes this front end surface 1a, and the electrons striking the beam shielding plate 1 are reflected to the deflection center side or absorbed by the beam

shielding plate 1. Therefore the electrons are not reflected to the phosphor screen 4. For this reason, even in a case where the cathode ray tube is used in a dark room in a low current state, halation is not caused.

5 The bending angle θ of the beam shielding plate 1 shown in Fig. 5 is preferably made substantially the same as the deflection angle α when the path E of the electron beam strikes the edge of the beam shielding plate 1 so as to make the front end surface 1a
10 substantially parallel to the path of the electron beam, but can be changed within a range of about 5° . If the bending angle is smaller than this, the front end surface 1a will be oriented in the direction of
 emission of the electron beam, the electron beam will
15 strike the front end surface 1a, and electrons will be reflected to the phosphor screen 4 and cause halation. On
 the other hand, if the bending angle is larger than this, there will be a possibility that the electrons
 reflected at the bending surface 1b will reach the
20 phosphor screen 4. Further, the bending position is preferably made a portion near the edge as much as
 possible from the viewpoint of the ease of positioning of the front end surface.

 A cathode ray tube of the present invention
25 having a beam shielding plate given a shape as shown in

Fig. 5 and the cathode ray tube having the beam shielding plate 12 as shown in Fig. 3 before the improvement were used for performing an experiment comparing the margin of safety until halation appears on the screen 4 in the case of different amounts of over-scanning (amount of deflection from the edge of the effective screen of the panel to the non-effective screen side).

In the conventional cathode ray tube shown in Fig. 2, the halation was caused at about 3 to 4 mm (a state where the reflection occurs at the front end surface of the beam shielding plate), but in the cathode ray tube of the embodiment of the present invention, the halation was caused first at about 15 mm (a state where the electron beam strikes the internal magnetic shield). A monitor for a broadcasting station is usually used with 105 to 107 percent over-scanning. In for example a 20 inch model, there is about 10 mm over-scanning on one side, but in the cathode ray tube of the embodiment of the present invention, it was confirmed that a sufficient allowance could be secured.

Further, a beam shielding plate 1A shown in Fig. 6 is a flat plate similar to the conventional beam shielding plate, but is configured so that the front end surface is swept back from the electron beam by

shaping the front end surface as a taper so that the electron beam will not strike the surface. This taper angle can be appropriately selected by considering the orientation of the beam reflection plate etc. As to the method of forming the front end surface into a taper,
5 it is possible to form it by the well known etching process.

Further, in a beam reflection plate 1B shown in Fig. 7, since the front end portion is bent and, a
10 taper is provided at the front end surface, even in a case where the bending angle is slightly deviated from α shown in Fig. 5 or mounting error occurs in the beam shielding plate, since the tolerance is increased by the taper of the front end surface, the electron beam
15 can be reliably prevented from striking the front end surface.

In the cathode ray tube of the present invention, by ingeniously shaping the beam shielding plate, the generation of halation at the time of over-scanning can
20 be reliably prevented.

CLAIMS

1. A cathode ray tube comprising:

a color selecting electrode system having a frame, a beam shielding plate disposed between the frame of the color selecting electrode system and a deflection center of the electron beam so as to prevent the electron beam from striking the frame when the electron beam overscans,

the beam shielding plate being sandwiched between an internal magnetic shield and a temperature compensation plate attached to the frame,

said beam shielding plate having an inner peripheral end surface approximately parallel to, or swept back from, the path which the electron beam takes at the maximum normal scan deflection angle.

2. A cathode ray tube as set forth in claim 1 wherein said beam shielding plate has a portion inclined relative to the frame of the color selecting electrode so that the said inner peripheral end surface thereof is substantially parallel to the said path of the electron beam.

3. A cathode ray tube as set forth in claim 1 wherein said beam shielding plate is tapered to define the said inner peripheral end surface thereof.

4. A cathode ray tube as set forth in claim 1 wherein said beam shielding plate has a portion inclined relative to the frame of the color selecting electrode and the plate is tapered to define the said inner peripheral end surface thereof so as to be swept back from the said path.