United States Patent [19]

Ishizuka

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[45] **July 1, 1975**

[54] **COLOUR PICTURE TUBES**

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[73] Assignee: **Hitachi, Ltd.,** Japan

[22] Filed: **Aug. 1, 1968**

[21] Appl. No.: **756,338**

Related U.S. Application Data

[63] Continuation of Ser. No. 591,331, Nov. 1, 1966, which is a continuation-in-part of Ser. No. 514,577, Dec. 17, 1965, abandoned.

[30] **Foreign Application Priority Data**

Dec. 21, 1964 Japan 39-2364
Jan. 14, 1966 Japan 41-98316

[52] **U.S. Cl.** **313/414;** 313/449
[51] **Int. Cl.** **H01j 29/02;** H01j 29/56
[58] **Field of Search** ..... 313/85, 89 S, 70 C, 82, 313/82 BF, 313, 356, 83, 92 B; 315/8

[56] **References Cited**

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Primary Examiner—Robert Segal
Attorney, Agent, or Firm—Craig & Antonelli

[57] **ABSTRACT**

A color picture tube for a color television set is provided which comprises three electron guns embraced in a tube neck portion of a picture tube. Each of the electron guns includes a plurality of focusing grid electrodes supported with an interstice therebetween to form an electric focusing lens. Electro-conductive shielding plate means surround at least that portion of each interstice which is opposite the tube neck portion in such a way that substantially the whole of the three electron guns are surrounded collectively as a group and overlaps the opposing end portions of the focusing grid electrodes. The electro-conductive shielding plate means is electrically isolated from the tube neck portion and has applied thereto the same potential as that of one of the focusing grid electrodes. As a result of this construction the electro-conductive shielding plate means effectively electrostatically shields the opposing end portions of the focusing grid electrodes and the interstice therebetween from the tube neck portion of the picture tube so that undesired electric charges are not allowed to accumulate on such tube neck portion of the picture tube.

7 Claims, 6 Drawing Figures

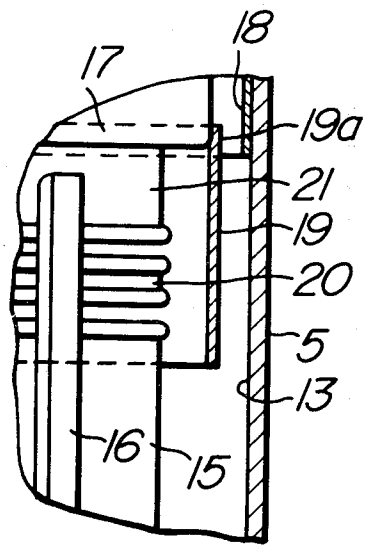


FIG. 1

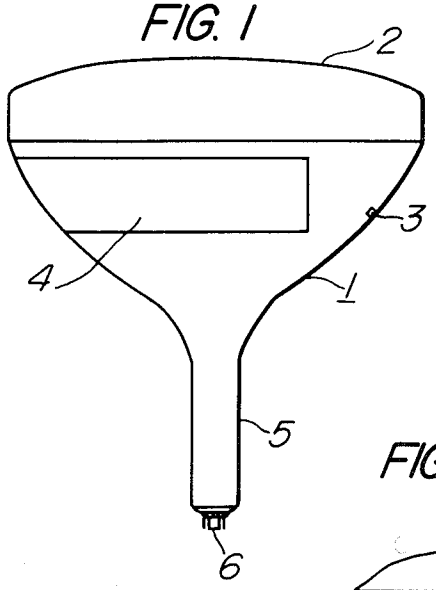


FIG. 2

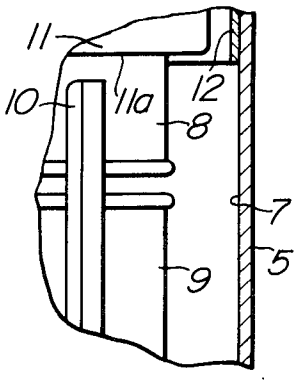


FIG. 4

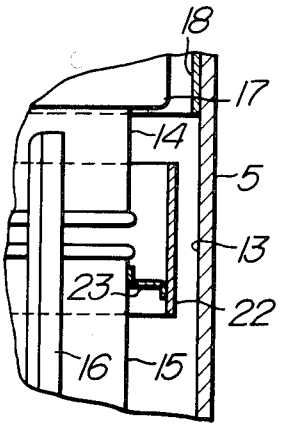


FIG. 3

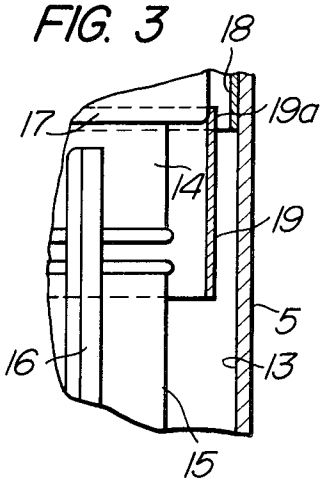


FIG. 5

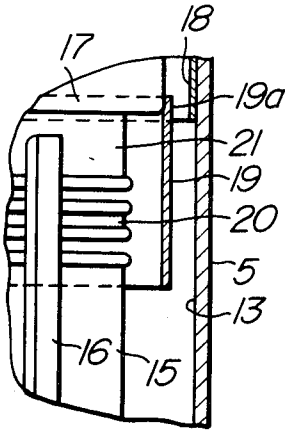
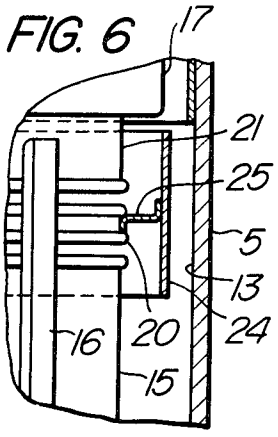


FIG. 6



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COLOUR PICTURE TUBES

This application is a continuation application of U.S. Application Ser. No. 591,331, filed Nov. 1, 1966, which was a continuation-in-part application of my U.S. Application Ser. No. 514,577, filed Dec. 17, 1965, now abandoned.

The present invention relates to colour picture tubes and more specifically to a colour picture tube structure of three electron gun type using a shadow mask.

The object of the present invention is to provide a new and improved colour picture tube of three electron gun type using a shadow mask, which is characterized in that each of the electron guns is provided with shield means that collectively and substantially surround all three electron guns as a group for eletrostatically shielding the focusing grids of the electron gun from the adjacent inner wall of the neck tube portion of the picture tube.

Other objects, advantages and particularities of the present invention will become apparent by reading the following descriptions in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view showing an external aspect of a generic colour picture tube;

FIG. 2 is a sectional view, in an enlarged scale, showing the essential parts of the neck tube portion of the conventional type electron gun employed in the colour picture tube of FIG. 1; and

FIGS. 3 through 6 are sectional views, also in an enlarged scale, of the essential parts of the neck tube portion in accordance with the present invention respectively.

Referring now to FIG. 1, reference numeral 1 represents a glass envelope of a colour picture tube; numeral 2 represents a face plate of the envelope 1; numeral 3 represents an anode button; numeral 4 represents an electro-conductive coating formed on the external surface of the envelope 1; numeral 5 represents a glass neck tube and numeral 6 represents a base mounted in the glass neck. Referring then to FIG. 2, reference numeral 7 represents an inner wall surface of the neck tube 5; and numerals 8 and 9 represent a No. 4 grid and a No. 3 grid of an electron gun, respectively, which form a bi-potential type electron focusing lens for focusing an electron beam formed by a cathode and No. 1 and No. 2 grid electrodes (not shown). The No. 4 grid 8 and the No. 3 grid 9 are secured to a glass rod 10 and are insulated from each other. Numeral 11 represents a pole piece cage secured to the No. 4 grid 8. Numeral 11*a* represents the joint portion joining the pole piece cage to the No. 4 grid 8. The pole piece cage 11 is brought into contact with an internal electro-conductive coating 12 by a spring means (not shown) mounted at the head portion of the pole piece cage 11, and is further connected to an anode button 3 which is shown in FIG. 1.

In conventional colour picture tubes shown in FIG. 2, the lower edge 12 of the internal electro-conductive coating formed on the inner wall surface 7 of the neck tube 5, in general, extends no further than the vicinity of the joint portion 11*a* between the No. 4 grid 8 and the pole piece cage 11. In view of the fact, however, that normally the No. 4 grid 8 is subjected to a high voltage of the order of 15,000 volts to 25,000 volts, and the No. 3 grid 9 is subjected up to a voltage of the order of 2,000 volts to 4,000 volts, a potential difference between the No. 4 grid 8 and the No. 3 grid 9 will be on

the order of about 20,000 volts, and electric charge is accumulated on the inner wall surface 7 of the neck tube portion 5 of the pixture tube which faces the interstice between the No. 4 grid 8 and the No. 3 grid 9 by virtue of the field emission from the No. 3 grid 9 and other causes. This accumulated electric charge exerts an influence upon the electric field between the No. 4 grid 8 and the No. 3 grid 9 resulting in alteration of the path of electrons which causes colour disparity. In addition, since the accumulation of electric charge varies with the lapse of time, the colour disparity varies also as time passes.

The present invention contemplates providing a new colour picture tube having an improved structure which can eliminate such shortcomings as have been disclosed above.

FIG. 3 shows an embodiment of the colour picture tube of the present invention, wherein reference numeral 13 represents an inner wall surface of a neck tube 5 of a picture tube; numerals 14 and 15 represent a No. 4 grid and a No. 3 grid, respectively, which constitute a bi-potential type electron focusing lens for focusing electron beam formed by a cathode and No. 1 and No. 2 grid electrodes (not shown). The No. 4 grid 14 and the No. 3 grid 15 are fixed to a glass rod 16 and are insulated from each other. Numeral 17 represents a pole piece cage fixed to said No. 4 grid 14. Numeral 18 represents an inner electro-conductive coating. Numeral 19 represents an electro-conductive shielding electrode surrounding the No. 4 grid 14 and an upper portion of the No. 3 grid 15. The upper portion 19*a* of the shielding electrode is fixed to the pole piece cage 17 so that it collectively and substantially surrounds all three electron guns as a group and is kept at No. 4 grid potential. The No. 4 grid 14 is connected to the internal electro-conductive coating 18 by a spring means (not shown) mounted at the head portion of the pole piece cage 17, and the internal electro-conductive coating 18 per se is connected to an anode button (not shown).

As is clear from the foregoing statement, in accordance with the present invention, not only the No. 4 grid 14 but also an upper portion of the No. 3 grid 15 are electrostatically shielded by the shielding electrode 19 from the neck tube portion closely adjacent to the interstice between No. 4 and No. 3 grids to prevent the neck tube portion from the accumulation of electric charge on the inner surface thereof, and therefore colour disparity due to accumulation of electric charge as has been encountered by the conventional colour picture tubes can be avoided.

In this embodiment, the shield electrode may be electrically conductively connected to the No. 3 grid instead of being connected to the No. 4 grid as shown in FIG. 4 in which the same numerals as those of FIG. 3 show the same parts and 22 is a shield electrode, 23 is a support member that supports the shield electrode and also serves as an electric connection to the No. 3 grid 15 performed by, for example, spot welding.

Now another embodiment of the present invention will be described by referring to FIG. 5 showing a sectional view of the essential part of the embodiment, wherein 13 is an inner wall surface of the neck tube portion 5 of a picture tube embracing three electron guns. Each of the electron guns includes a cathode and No. 1 and No. 2 grids (not shown) and a uni-potential type electron focusing lens which is composed of No. 3, No. 4 and No. 5 grids indicated by numeral 15, 20

and 21 respectively. These grids 15, 20 and 21 are secured to a glass rod 16, and the No. 3 grid 15 and the No. 5 grid 21 are connected with each other to become the same potential, and the No. 4 grid 20 is applied with a different potential from that of the No. 3 and No. 5 grids 15 and 21.

17 is a pole piece cage secured to the No. 5 grid 21, and 18 is an internal electro-conductive coating which is extended to the anode button of the picture tube (not shown), thereby connecting the pole piece cage 17 to the anode through a spring means (not shown).

In this embodiment, a cylindrical shield electrode 19 of electric conductor is specifically provided in the space between the focusing grid electrodes 15, 20 and 21, on one hand and the neck tube portion of the picture tube on the other to sufficiently surround the entire outer periphery of the No. 4 and No. 5 grid electrodes and at least the upper edge portion of the No. 3 grid electrode which opposes to the edge portion of the No. 4 grid.

The shield electrode 19 is so effectively inserted in the space between the grid electrodes 15, 20 and 21 and the inner wall surface 13 of the neck tube portion 5 of the picture tube that it provides a sufficient electrostatic shielding between the grid electrodes and the neck tube portion whereby resulting in causing no electric charge accumulation on the inner surface 13 of the neck tube portion 5.

According to the present invention, the shield electrode should be electrically connected with either one of the focusing grid electrodes. For instance, in case of the uni-potential type electron focusing lens, the shield electrode may be connected to the No. 4 grid electrode instead of being connected to the pole piece cage in such a manner as to entirely surround the No. 3 and No. 4 grid electrodes and at least the lower edge portion of No. 5 grid electrode, as shown in FIG. 6, in which the same numerals as those of FIG. 5 show the same parts, 24 is a shield electrode and 25 is a support member for supporting the shield electrode on the No. 4 grid 20 and for also providing an electric connection therebetween which is performed by, for example, spot welding.

In the present invention, the shield electrode is to be so positioned that any interstice between the focusing grid electrodes, i.e., in case of a bi-potential type electron focusing lens the No. 3 and No. 4 grid electrodes or in case of a uni-potential type electron focusing lens the No. 3, No. 4 and No. 5 grid electrodes, is provided to be shorter than the shortest spacing from the focusing grid electrodes to the shield electrode.

If, instead of the construction as shown in FIGS. 3 through 6 using shield electrodes 19, 22 and 24, the inner electro-conductive film 12 were extended to the portion corresponding to the shield electrodes, such construction would not be satisfactory. This is due to the fact that in case of employing graphite as an electro-conductive film wall coating, it has been experienced that flash over is apt to occur. In case of employing metallic film and the like as such a coating, a spring means for supporting the electrodes tends to peel the metallic film off during inserting the electrodes into the neck portion of the tube. Consequently, use of such coating films is not suitable for the purpose of providing shielding in a manner similar to the present invention.

What is claimed is:

1. A color picture tube comprising an envelope having a neck portion, three electron guns embraced in said neck portion of said picture tube for generating respective electron beams, each of said electron guns including a plurality of focusing grid electrodes supported with an interstice therebetween to form an electric focusing lens for a respective one of said electron beams, electro-conductive shielding plate means surrounding each interstice of said electric focusing lens and overlapping the opposing end portions of said focusing grid electrodes, means for supporting said electro-conductive shielding plate means so as to collectively and substantially surround all three electron guns as a group and be disposed out of direct contact with said tube neck portion, said electroconductive shielding plate means uniformly having the same potential as that of one of said focusing grid electrodes thereby effectively electrostatically shielding said opposing end portions of said focusing grid electrodes and said interstice therebetween from said tube neck portion of said picture tube.

2. A color picture tube according to claim 1, in which the interstice between said focusing grid electrodes is shorter than the spacing between said electro-conductive shielding plate means and said focusing grid electrodes.

3. A color picture tube according to claim 1, in which said focusing grid electrodes are composed of two grid electrodes each having a different potential applied thereto from the other thereby forming a bi-potential type electric focusing lens.

4. A color picture tube according to claim 1, in which said focusing grid electrodes are composed of three grid electrodes, two of which have the same potential applied thereto and the other of which has a different potential from that of the first two applied thereto thereby forming a uni-potential type electric focusing lens.

5. A color picture tube comprising three electron guns embraced in a tube neck portion of said picture tube having an electrically insulating surface, each of said electron guns including a plurality of focusing grid electrodes supported separately with an interstice therebetween to form an electric focusing lens; and electro-conductive shielding plate means surrounding the interstices between the grid electrodes that face the electrically insulating surface of the tube neck portion, said electro-conductive shielding plate means collectively and substantially surrounding all three electron guns as a group and being spaced insulated from the tube neck portion and having the same potential as that of one of the focusing grid electrodes thereby effectively electrostatically shielding the electric focusing lens from the tube neck portion of said picture tube.

6. A color picture tube according to claim 1, wherein said electro-conductive shielding plate means is provided as a conductive electrode completely surrounding all three electron guns as a group and being in electrical contact only with one said focusing grid electrode.

7. A color picture tube according to claim 6, wherein said conductive electrode is connected to one of said focusing grid electrodes by at least one bracket forming the sole means of support of said conductive electrode.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,892,992 Dated July 1, 1975

Inventor(s) Tomio Ishizuka

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page as it reads now:

[30] Foreign Application Priority Data

December 21, 1964 Japan.....39-2364
January 14, 1966 Japan.....41-98316

Title page as it should read:

[30] Foreign Application Priority Data

December 21, 1964 Japan.....39-98316
January 14, 1966 Japan.....41-2364

Title page as it reads now:

[75] Inventor: Tomic Ishizuka

Title page as it should read:

[75] Inventor: Tomio Ishizuka

Signed and Sealed this

eighteenth Day of *November 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks