

[54] **COLOR PICTURE TUBE SHADOW MASK OF LOW CARBON SOFT STEEL**

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[58] Field of Search **313/85 S, 92 B**

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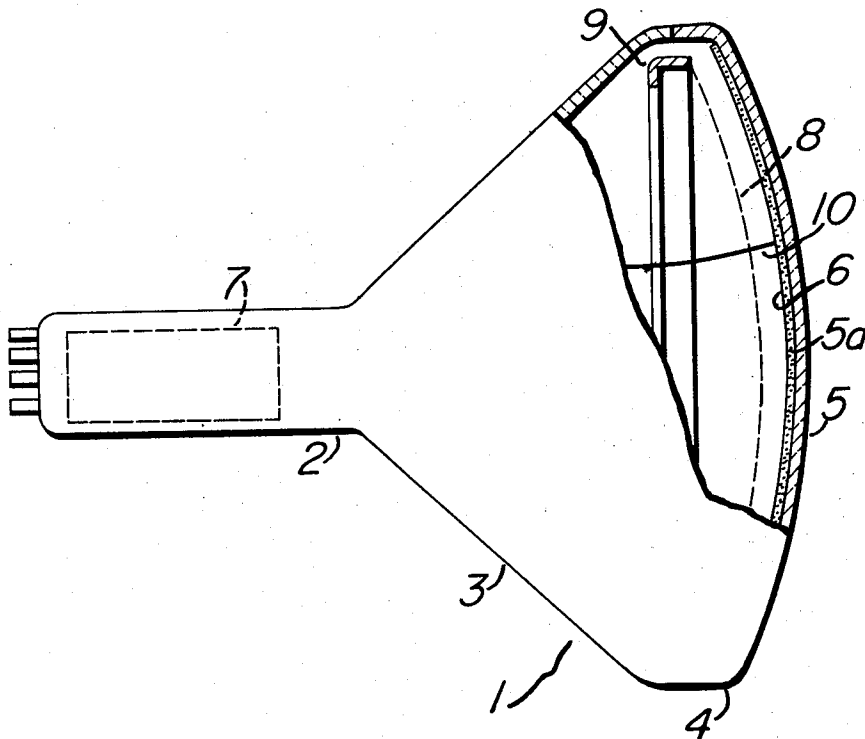
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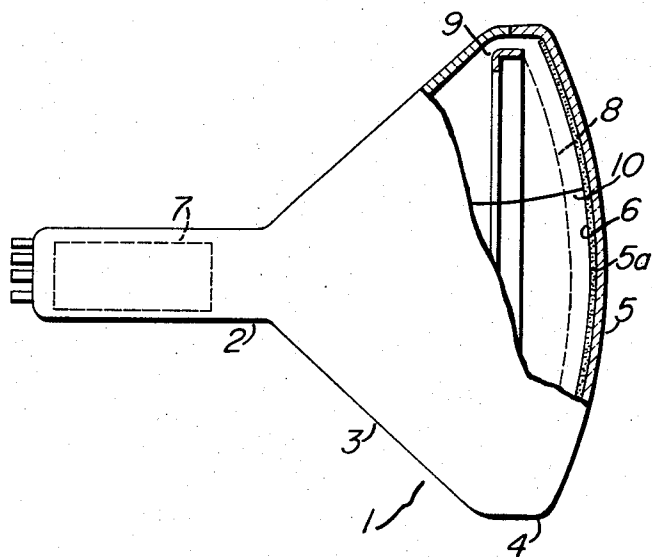
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[57] **ABSTRACT**

A color picture tube in which a color selective electrode is disposed in close proximity to a phosphor screen and is provided with a plurality of openings through which electron beams emanating from electron guns pass to impinge against the phosphor dots. The color selective electrode is made of a plate of soft steel containing 0.002 to 0.012 percent by weight of carbon for minimizing the formation of undesirable projections on the side wall surface of the openings.

2 Claims, 1 Drawing Figure





COLOR PICTURE TUBE SHADOW MASK OF LOW CARBON SOFT STEEL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a color picture tube and more particularly to a color selective electrode thereof.

2. Description of the Prior Art

A color picture tube, for example, a shadow mask type color picture tube has such a construction that a color selective electrode or shadow mask is disposed between electron guns and a phosphor screen and the position of electron beam passing openings of the shadow mask relative to the phosphor dots on the phosphor screen and to the electron guns is suitably selected so as to obtain a desired color picture.

However, the shadow mask employed in conventional color picture tubes has been defective in that many projections exist on substantially the entire surface of the shadow mask including the side wall surface of the openings and the electron beams impinge against these projections thereby giving rise to one of the sources of objectionable halation in the color picture tube. These projections consist principally of iron carbide (Fe_3C) and are considered to be produced due to aggregation and growth of the crystals of iron carbide. Therefore, the formation of the undesirable projections must be prevented by suppressing the aggregation and growth of the iron carbide crystals. However, it has been extremely difficult to prevent the growth of iron carbide crystals.

In an effort to obviate the above drawback, means have been employed heretofore according to which blanks of soft steel for forming the shadow mask therefrom are annealed over tens of hours, for example, 40 hours at a temperature of the order of the order of 650°C for the purpose of tempering and the satisfactorily tempered blanks are then subjected to microscopic structural analysis for the exclusive and careful selection of the materials in which the carbide is finely and uniformly distributed. However, the conventional means above described has involved various problems which hinder the mass production in that not only the annealing over such an extended period of time and the exclusive and careful selection of suitable blanks by microscopic structural analysis result in a very troublesome process, but also in an undesirable increase in the manufacturing cost and an undesirable reduction in the operating efficiency results.

Recently, a color picture tube of a so-called black matrix type has been proposed. This color picture tube has such a structure that the diameter of phosphor dots is smaller than that of electron beams impinging thereagainst and the space between the phosphor dots is covered with a light absorbing material such as graphite. In the manufacture of this black matrix type color picture tube, it is common practice to employ a shadow mask of a so-called post etched type which is called by this name due to the fact that post etching is applied thereto for enlarging the diameter of openings of the shadow mask after exposure to form the phosphor screen. In this case too, projections are frequently formed on the side wall surface of the openings of the shadow mask having been subjected to the post etching even when the shadow mask is made of a carefully selected material annealed over an extended period of time and is free from any projections during the step of

exposure to form the phosphor screen. Thus, a vital defect has been unavoidable with the conventional process as far as it resorts to the post etching and the prevention of objectionable halation in the color picture tube has been nearly impossible.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a color picture tube having a unique color selective electrode for minimizing the formation of undesirable projections on the side wall surfaces of electron beam passing openings.

Another object of the present invention is to provide a color picture tube in which one of the sources of objectionable halation is removed and which ensures improved color purity.

A further object of the present invention is to provide a color picture tube which is suitable for mass production due to the simplification of the manufacturing process.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE is a partly cut-away side elevation of a color picture tube embodying the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described with reference to the drawing. While the following description refers, by way of example, to a shadow mask type color picture tube in which a color selective electrode is in the form of a shadow mask which is provided with a plurality of openings for passing electron beams therethrough, it will be understood that the present invention is also applicable to a Chromatron (Trade Mark) type color picture tube which is provided with a color selective electrode commonly called a grid having a plurality of slits for passing electron beams therethrough.

Referring to the drawing, an envelope 1 consists of a neck portion 2, a funnel portion 3 and a panel portion 4. A phosphor screen 6 consisting of an assembly of phosphor dots (not shown) is formed on the inner surface 5a of the front wall 5 of the panel portion 4. Electron guns 7 emanating an electron beam 10 for each of the primary colors are disposed within the neck portion 2 of the envelope 1. A shadow mask 8 is disposed in close proximity to the phosphor screen 6 between the phosphor screen 6 and the electron guns 7 and is fixed within the panel portion 4 of the envelope 1 by being supported by means such as a mask support 9.

The present invention is intended to limit the carbon content of the material of the shadow mask 8 for the purpose of minimizing the formation of undesirable projections produced by the aggregation and growth of iron carbide crystals. According to the present invention, the shadow mask 8 is made of a plate of soft steel which contains carbon in an amount of from 0.002 to 0.012 percent by weight, preferably from 0.002 to 0.006 percent by weight.

A carbon content of more than about 0.02 percent by weight is undesirable in that projections tend to appear on the side wall surface of the openings. An extremely low carbon content is also undesirable in that the shadow mask made of such a low carbon steel does not possess a sufficient mechanical strength. Thus, a car-

bon content of at least 0.002 percent by weight is absolutely necessary. Experimental results have proved that a carbon content of 0.002 to 0.006 percent by weight is most desirable. It has been found, however, that the carbon content may be increased to about 0.012 percent by weight without appreciably producing projections.

When the shadow mask is made of a plate of soft steel containing carbon in an amount of about 0.002 to 0.012 percent by weight, the mechanical strength of the shadow mask may be reduced depending on the temperature, duration and other conditions of treatment, resulting in deformation of the shadow mask. However, this undesirable deformation can be sufficiently eliminated by securely fixing the shadow mask by means such as a mask support or increasing the number of levelling by a roller leveller during the manufacture of the shadow mask.

It will be understood from the foregoing description that the color picture tube according to the present invention is provided with a shadow mask which is made of a plate of soft steel containing carbon in an amount of from 0.002 to 0.012 percent by weight, preferably from 0.002 to 0.006 percent by weight. In the color picture tube, the shadow mask is substantially free from undesirable projections formed on the side wall surface

of the openings thereof thereby minimizing objectionable halation. The shadow mask is suitable for mass production due to the fact that annealing over an extended period of time and microscopic structural analysis for the exclusive and careful selection of suitable ones are unnecessary. Thus, troublesome steps are not required for the production of the shadow mask which can therefore be manufactured at low cost.

We claim:

1. A color picture tube comprising an envelope consisting of a neck portion, a funnel portion and a panel portion, electron guns disposed within said neck portion, a phosphor screen formed on the inner surface of the front wall of said panel portion opposite to said electron guns, and a color selective electrode disposed in close proximity to said phosphor screen and having a plurality of openings for passing the electron beams emanating from said electron guns therethrough, said color selective electrode being made of a plate of soft steel containing carbon, the carbon content being 0.002 to 0.012 percent by weight.

2. A color picture tube as defined in claim 1 wherein the carbon content of the soft steel from which the color selective electrode is made is 0.002 to 0.006 percent by weight.

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