United States Patent

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[54] **COLOR TELEVISION PICTURE TUBE WITH METALLIC FILM COATING ON FUNNEL PORTION**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **313/64,** 174/50.54, 313/85, 313/239, 313/283, 313/291
[51] **Int. Cl.** **H01j 29/46**
[50] **Field of Search** ..... 313/85, 92 B, 69, 283, 291; 174/50.54

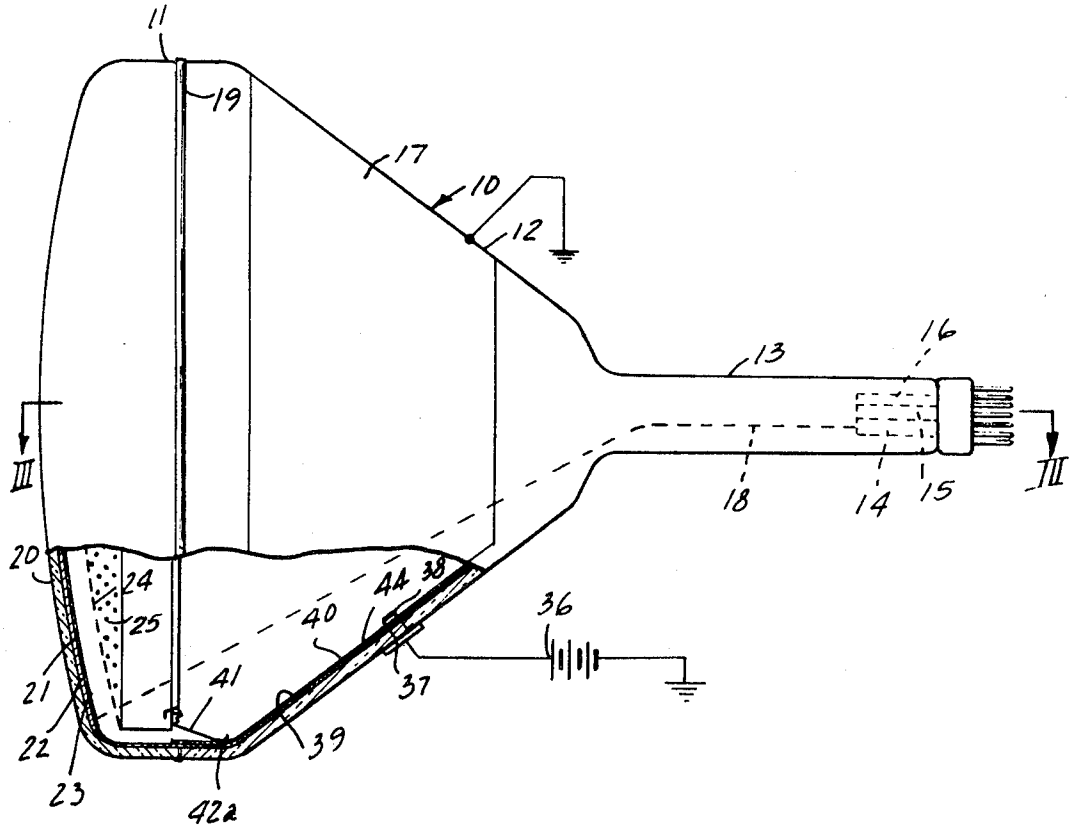
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ABSTRACT: A cathode-ray tube for a color television receiver having an evacuated glass envelope which includes a faceplate panel, a funnel portion and a neck portion. The faceplate panel has a plurality of different color light-emitting phosphors thereon. A control electrode is positioned immediately adjacent the faceplate panel to assist in the excitation of the phosphor elements by appropriate electron beams. The control electrode takes the form of a shadow mask, and the phosphor elements are triads of blue, red and green light emitting phosphor dots. The shadow mask is supported at the inside of the faceplate panel by three springs which are mounted on bimetal "hinges" for adjustably positioning the shadow mask as temperature within the tube envelope changes. For instance, increases in temperature within the envelope tend to spread the openings in the shadow mask, and this is compensated by the effect of the bimetallic hinges which move the shadow mask in the direction of the faceplate panel. The tube envelope is coated with a vacuum-deposited aluminum layer which serves to prevent the buildup of high-voltage charges on the wall of the tube. Strips of a conductive colloidal graphite solution may be applied between certain critical points of electrical contact inside the tube envelope.



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Fig. 1

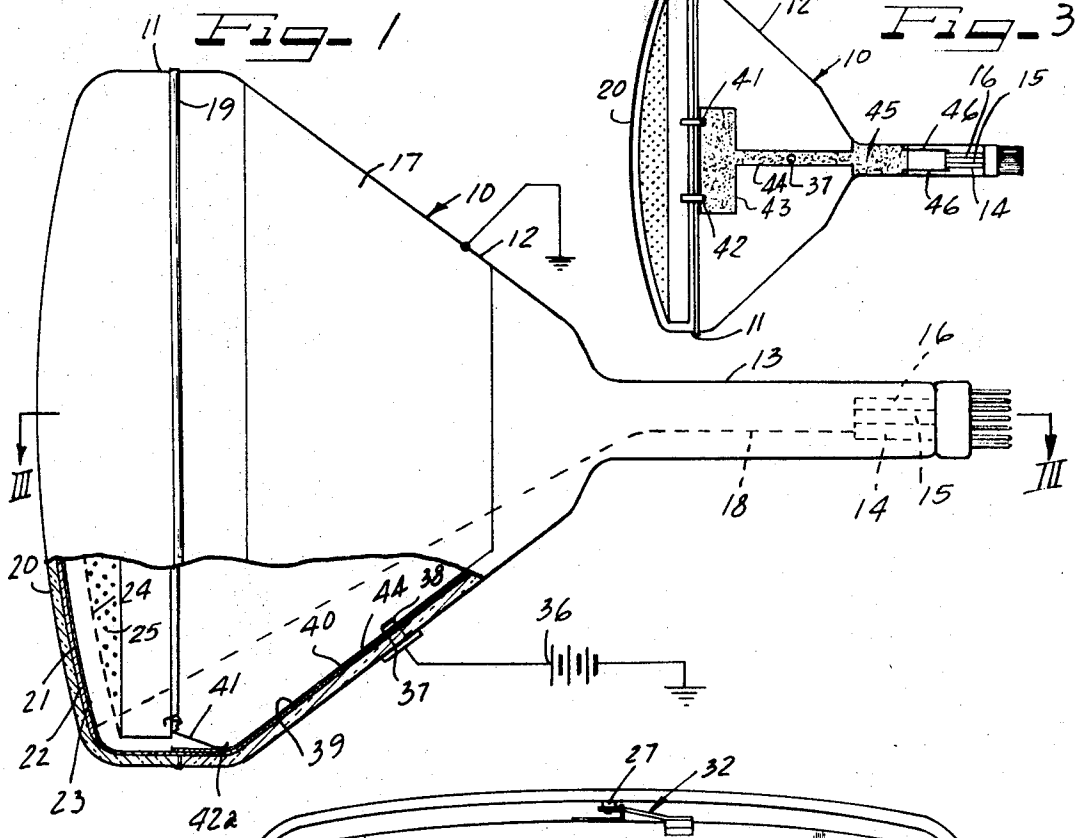
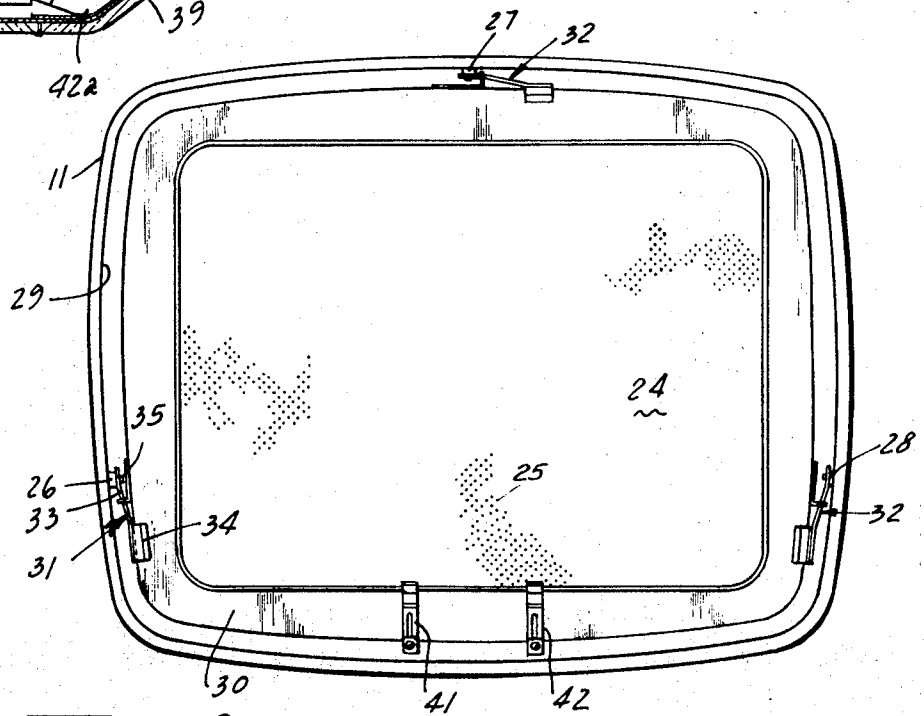


Fig. 3

Fig. 2



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COLOR TELEVISION PICTURE TUBE WITH METALLIC FILM COATING ON FUNNEL PORTION

BACKGROUND OF THE INVENTION

1. Description of the Prior Art

Monochrome picture tubes utilize aluminum-coated glass envelopes. These tubes merely have a single phosphor coating on the faceplate, however, and do not require a shadow mask. As a result, high temperature within the envelope doesn't have an undesirable effect on the registration of the beam on the phosphor screen. However, in conventional tricolor picture tubes, the phosphor screen consists of a plurality of triads of different color light-emitting phosphor dots. A shadow mask is positioned immediately adjacent to the phosphor screen with openings in the mask corresponding to the locations of each of the color dot triads. The openings in the shadow mask cause the beams of the picture tube to register on the proper ones of the color dots to reproduce the required color information, and it is critical that the shadow mask be correctly orientated to direct the proper beam onto the proper phosphor dot.

However, increasing temperatures within the envelope tend to cause expansion of the thin shadow mask which has the effect of spreading apart the openings in the mask and producing misregistration. Accordingly, color television picture tubes have not been coated with a metallic film, but rather have been coated with a conductive black colloidal graphite solution. The metallic film has the effect of increasing the temperature within the tube, whereas the colloidal graphite allows heat to be dissipated by transmission through the walls of the tube.

2. Field of the Invention

The field of art to which this invention pertains is color television cathode tubes and in particular to means for coating the inside surface of the tube to prevent local charge buildup and to provide a high-voltage conducting path within the envelope.

SUMMARY OF THE INVENTION

It is an important feature of the present invention to provide an improved picture tube for a color television receiver.

It is another feature of the present invention to provide an improved conductive coating for the inside wall of a color television picture tube.

It is an object of the present invention to provide a picture tube for a color television receiver which is substantially entirely coated by a vacuum-deposited metallic film.

It is an additional object of the present invention to provide a picture tube for a color television receiver which includes a combination of a heat-responsive mounting means for a shadow mask and a metallic film coating on the inside surface of the funnel portion of the picture tube.

It is another object of the present invention to provide a picture tube for a color television receiver having an aluminum film deposited on the inside surface of the funnel portion of the tube.

It is a further object of the present invention to provide a picture tube for a color television receiver which has an aluminum coating substantially on the entire inner surface of the tube envelope and which has localized coated portions of a colloidal graphite solution.

These and other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawing, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevational view of a picture tube for a color television receiver having a portion thereof cut away to show the location of the shadow mask and the positioning of the various layers on the inner and outer surfaces of the tube.

FIG. 2 is an elevational view of the inside of the faceplate portion of the tube showing the positioning of the shadow mask frame therein and illustrating the thermally responsive spring mounting of the shadow mask frame to the wall of the faceplate panel and further illustrating the position of the electrical spring contacts which extend from the shadow mask frame to the inside surface of the picture tube envelope.

FIG. 3 is a sectional view of the tube shown in FIG. 1 and taken along the lines III—III thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While vacuum-deposited metallic films have been and still are used on the funnel portions of black and white picture tubes, such an arrangement has not been possible with color television tubes due to the effects of heat buildup within the tube. It has been recognized that excessive heat within the envelope of a color television tube creates undesirable effects on registration. Accordingly, color television receivers presently use a black graphite coating on the inside surface of the tube envelope to absorb heat from the inside of the tube. Metallic coatings have continued to be used in color television receivers in the area of the faceplate panel, and in particular aluminum coatings are practically universally used on the inside surface of the phosphor layer. The electron beams readily penetrate the thin aluminum coating to energize the various phosphors.

However, the colloidal graphite solution coating on the inside of the picture tube presents a number of problems in the manufacture of the tube. For instance, colloidal graphite solution is an unclean solution to handle and as such presents difficulty in its application to the walls of the tube. In addition, picture tubes must be thoroughly evacuated prior to sealing and, in particular, all occluded gases driven out. Tubes which have been coated with a colloidal graphite solution are difficult to "outgas" and must be heated and pumped (evacuated) for relatively long periods of time. A metallic film, on the other hand, is simple to outgas, and processing cycles and temperatures may be reduced considerably with substantial cost savings.

It has been recognized in recent years that improved registration in a color television picture tube can be obtained by mounting the shadow mask with bimetal hinges which are designed to compensate for expansion of the mask by moving the entire mask toward the faceplate of the tube.

By the present invention, the compensation factor of the bimetal mountings for the shadow mask is utilized to make the use of a metallic coating on the inner surface of the picture tube possible and thus obtain the advantages that such an arrangement entails.

The present invention also provides a means for assuring good electrical contact between various critical points at the inner surface of the tube. For instance, the high-voltage line is normally coupled to the funnel portion of the tube and provides high voltage for the shadow mask as well as for various portions of the electron gun.

In the preferred embodiment of the present invention, the shadow mask has a pair of spring clips which extend from the frame surrounding the mask to the wall of the tube. These clips make electrical contact from the mask to the high-voltage connection through the thin metallic film which is vacuum deposited on the funnel portion of the tube. However, to improve the electrical coupling to the high-voltage contact points, a strip of colloidal graphite solution may be used. The use of colloidal graphite solution in the localized area of the contacts does not materially diminish the effectiveness of the metallic deposited layer in improving the evacuating and life characteristics of the tube. In addition, the amount of application of the colloidal graphite solution to the localized contact areas is minor in comparison to the previous application of the solution to the entire surface of the funnel. The application of the colloidal graphite to the local areas requires less time than that required to apply the solution to the entire surface of the

tube. The application of the thin metallic film to the surface of the tube is done by flashing, which operation requires very little labor.

Referring to the drawings in greater detail, FIG. 1 shows a cathode-ray tube 10 according to the present invention. The cathode-ray tube 10 includes a faceplate panel 11, a funnel portion 12 and a neck portion 13. The neck portion has three guns 14, 15 and 16 sealed at the end of the neck 13, each being capable of generating an electron beam such as the beam 18. An outer conductive coating is applied to funnel portion 12.

The faceplate panel 11 is "frit" sealed to the funnel portion 12 at a rim 19, and the neck portion is sealed after the tube is evacuated to the desired level of vacuum.

The panel 11 has a faceplate 20 which has a mosaic of phosphor elements 21 formed at the inside surface 22 thereof. In this embodiment, the phosphor elements consist of triads of phosphor dots with each dot in a triad emitting either red, green or blue light when bombarded with respective ones of the electron beams generated by the guns 14, 15 and 16. A thin aluminum film 23 is deposited on the inside surface of the layer of phosphor elements, and the electron beams pass through the aluminum film to energize the phosphor dots.

The tube illustrated in FIG. 1 is of the shadow mask variety. A shadow mask 24 is mounted inside the faceplate panel 11 such that the mask is adjacent to the faceplate. The object of the shadow mask 24 is to cause respective ones of the electron beams to impinge on the proper phosphor dot of each triad. The electron beam containing the blue color information is caused to impinge on the blue phosphor dot only, while the beams from the red and green guns are caused to impinge on the red and green phosphor dots only. It is apparent then that the shadow mask must be properly positioned with respect to the faceplate panel if the openings 25 in the mask are to match the positioning of the phosphor triads on the faceplate. If for any reason the position of the shadow mask should shift from the proper orientation, registration would be lost.

As has been explained, the heating of the tube tends to cause an expansion of the shadow mask which results in a lateral spreading out of the openings 25 in the mask. As a result, it has been desired to keep the temperature of the tube as low as possible. This is one of the reasons that the colloidal graphite solution has been used in the past on the funnels of color television cathode-ray tubes, while aluminum coatings have only been used for black and white tubes. However, by the present invention, it is recognized that the compensation obtainable from bimetal mountings for the shadow mask can accommodate the higher temperatures produced in an aluminum-coated tube.

The mounting of the shadow mask used in the embodiment of the present invention is shown in FIG. 2. A series of studs 26, 27 and 28 are rigidly secured to the inner surface 29 of the faceplate panel 11. The shadow mask 24 has a rigid frame 30 for supporting the mask within the faceplate panel 11. Frame 30 has a series of fingerlike springs 31, 32 and 33 which are secured to frame 30 through a bimetal arrangement. A bimetal compensation hinge element 34 is secured, as by welding, between frame 30 and each spring 31–33. The bimetal hinge and its operation is disclosed in a copending application, Ser. No. 742,651, filed July 5, 1968. Each spring has an opening 35 which is snapped into position over the end of the respective studs 26–28 to firmly support the mask 24.

Increases in tube temperature result in the bimetal hinges, mounting mask 24, moving it toward the faceplate panel to compensate for the expansion of the shadow mask. By the present invention, it is recognized that this compensation can be utilized to permit the use of an aluminum coating on the inside of the tube.

Referring again to FIG. 1, a normal high-voltage supply 36 indicated for simplicity as a battery is coupled through the funnel portion 12 of the tube via metallic button 37 to connect the high-voltage source to the inner surface of the tube as at 38. The entire inner surface 39 of the funnel portion 12 is coated with an aluminum film 40, preferably applied by standard vacuum deposition techniques. An outer conductive coating 17 is also applied to the funnel and connected to the return of the high-voltage system. This coating, being outside the tube, may be of colloidal graphite for reasons of economy. The inner and outer coatings serve as the plates of a capacitor with the glass of the funnel being the dielectric. Thus the coatings also serve a high-voltage filtering purpose. Note that outer coating 17 does not extend to the neck portion of the tube and is spaced a safe distance away from high-voltage button 37.

In this way, the high voltage from the supply 36 is coupled to the aluminum film 40 which in turn couples the high voltage to springlike fingers 41 and 42 which extend from the shadow mask frame 30 to make contact with the aluminum film on the inner surface of the tube. Also, the aluminum film conducts high voltage to the neck portion of the tube where appropriate contact with electron guns 14, 15 and 16 may be made.

To assure good internal contact for the high voltage, a local application of a colloidal graphite solution can be made as shown in FIG. 3. In FIG. 3, the colloidal graphite solution is applied to a generally rectangular area 43 with a strip portion 44 contacting high-voltage button 37 and further extending into the neck area (as at 45) for contact with suitable connectors 46 from the electron guns 14, 15 and 16.

In practice, these internal graphite coatings are easily applied to the funnel before metallizing. In this way, the advantages of an aluminum-coated tube can be achieved without diminishing the conductivity between critical contact points within the tube envelope.

I claim as my invention:

1. A color television cathode-ray tube having a screen portion of a plurality of different color light-emitting phosphor elements and a shadow mask disposed adjacent thereto for selectably guiding an electron beam onto said light-emitting phosphors, said cathode-ray tube having a funnel portion, a thin metallic film deposited on the inner surface of said funnel portion, a high-voltage connection to said metallic film and electrical contacting means extending from said shadow mask to the metallic film for providing a high voltage connected to said shadow mask and the metallic film from said high-voltage connection.

2. A color television cathode-ray tube in accordance with claim 1 wherein an additional conducting layer is deposited in a continuous area from the high-voltage connection to said electrical contacting means.

3. A color television cathode-ray tube in accordance with claim 1 wherein said metallic coating is an aluminum layer deposited on the inner surface of said funnel portion.

4. A color television cathode-ray tube in accordance with claim 2 wherein said additional conducting layer comprises a layer of colloidal graphite solution for increasing the conductivity between said high-voltage connection and said shadow mask.

5. A cathode-ray tube in accordance with claim 1 wherein a bimetallic element is provided to automatically compensate for the position of said shadow mask with changes in temperature within said envelope due to heating effects therein.