May 2, 1939. W. HICKOK 2,156,391

TELEVISION TRANSMITTING TUBE

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Fig. 1

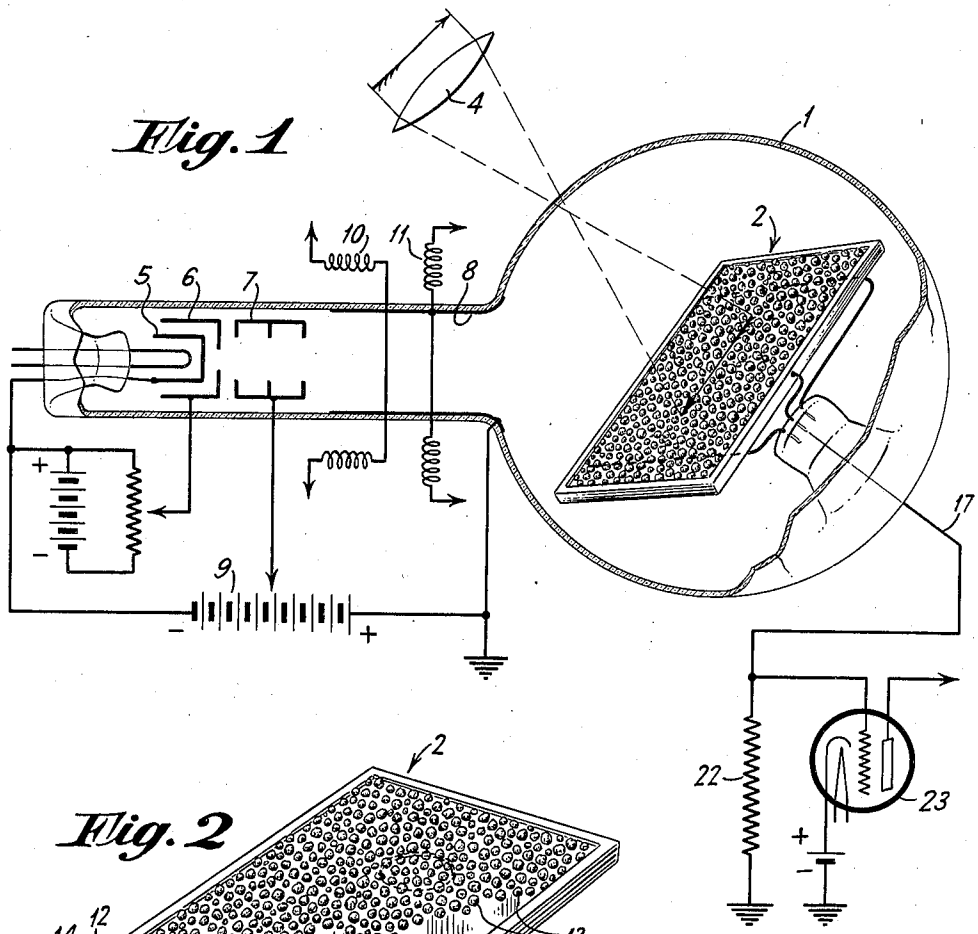
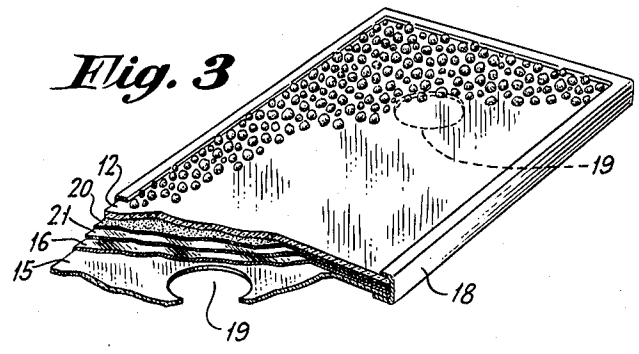


Fig. 2

Fig. 3



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TELEVISION TRANSMITTING TUBE

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5 Claims. (Cl. 250—153)

My invention relates to improvements to cathode ray television transmitting tubes, and particularly to an improved photosensitive electrode structure for use in such tubes.

In the usual form of cathode ray transmitter the image of an object to be transmitted is focused on the front surface of a target or mosaic electrode consisting in general of a thin transparent insulating sheet, such as mica, with a great number of discrete photoelectrically sensitive elements on the front and a signal electrode comprising a metallic coating on the opposite surface, the front or illuminated surface being scanned by a cathode ray beam to generate picture signals which are collected from the metallic coating. These picture signals which are electrical impulses representative of the light values of elemental areas of the image, may be amplified and applied to a cathode ray type of receiving tube to produce a visible reproduction of the image. With such transmitters the transmission of sharply focused images with good contrast of light and shade is sometimes difficult. The lack of sharp focus and good light and shade contrast is particularly noticeable when a brilliant image is formed on the mosaic electrode, probably because part of the light is reflected by the metallic coating of the electrode assembly to the interior of the tube and reflected back to the mosaic electrode from some light reflecting structure in the tube, such as the glass wall of the tube and the metal parts comprising the electron gun. In addition, a portion of the light reflected by the metallic coating is absorbed by the photoelectrically sensitive elements on the front surface of the insulating sheet and inasmuch as this reflected light is somewhat diffused and no longer represents a sharply focused image, the net result is to add an image component which is out of focus, thereby diminishing the detail and at the same time reducing the contrast of the received television image.

An object of my invention is to provide an improved cathode ray transmitter with which better focus and contrast of the image transmitted can be obtained. Another object of my invention is to obtain better focus and contrast in a simple and inexpensive way without decreasing the intensity of the image to be transmitted.

In accordance with my invention I provide the target or mosaic electrode with a black non-reflecting and preferably electrically conducting surface on the side of the photo-electrically sensitive electrode opposite that side on which the optical image of an object is focused.

These and other objects, features, and advantages of my invention will appear from the following description taken in connection with the accompanying drawing in which:

Figure 1 is a diagrammatic view illustrating one form of my television device;

Figure 2 is a diagrammatic view partially in section showing in enlarged detail a portion of the electrode structure shown in Figure 1;

Figure 3 is a similar view of one modification of the electrode structure shown in Figure 2.

In the illustrative embodiment of my invention shown in Figure 1 the tube comprises a highly evacuated glass envelope or bulb 1 with a tubular arm or neck section enclosing a conventional type electron gun and a spherical section enclosing a flat target or mosaic electrode 2 so positioned that its front surface may be scanned by a beam of electrons from the electron gun and also may have projected upon it the optical image to be transmitted. Since the image is produced from an object situated outside the tube, that portion of the spherical section opposite the electrode 2 is made optically uniform so that the image to be transmitted may be projected upon the electrode with a minimum of distortion by the lens 4.

The electron gun assembly is of the conventional type, and comprises a cathode 5 from which an electron stream may be drawn, a control electrode 6 connected to the usual biasing battery, and a first anode 7 maintained positive with respect to the cathode 5. The electron stream leaving the first anode 7 is accelerated and concentrated into an electron scanning beam focused on the front surface of the target 2 by a second anode 8, which is preferably a conductive coating on the surface of the envelope 1 near the neck of the bulb but removed from that portion through which is projected the optical image to be transmitted. The first anode 7 and the second anode 8 are maintained at the desired positive potentials with respect to the cathode 5 by a battery 9. Conventional deflection means such as deflection coils 10 and 11 may be used to sweep the beam in a horizontal and vertical plane, respectively, to scan the mosaic electrode. It is obvious that conventional electrostatic deflection plates may be substituted for the deflection coils if desired.

In accordance with my invention the photosensitive mosaic surface which is scanned by the electron beam and on which the image to be transmitted is focused, is, as best shown in Figure 2, formed on one side of a thin transparent

sheet of insulation, such as mica, which has been found to be very satisfactory for the purpose. On the opposite side to that on which the image is focused the sheet of mica is covered with a black non-reflective coating, preferably of graphite, or other material which will produce a black non-reflective surface and has satisfactory electrical conductivity. Such non-reflecting material is in inductive relationship with the mosaic surface and serves as an electrode for collecting the picture signals.

In making the mosaic electrode 2 I select a sheet of mica 12 of the desired area having a uniform thickness of approximately two thousandths of an inch and as a first step coat one side of the sheet with finely divided silver oxide which is reduced to provide a surface of individually separated silver globules 13, which are subsequently oxidized and sensitized with caesium during the evacuation process. Such an electrode structure is disclosed by Essig in his U. S. Patent 2,065,570, Serial No. 594,779, issued December 29, 1936, and assigned to Radio Corporation of America.

The next step in preparing the electrode is to deposit on the opposite side of the sheet of mica a uniform coating of graphite or other black non-reflecting electrically conducting material 14, which may conveniently be done by spraying with the desired material. I have found that a 50% aqueous solution of substantially colloidal graphite, such as the material commercially referred to as "Aquadag", is very suitable for the purpose.

To strengthen the thin mica sheet 12, which carries the individual silver globules on one side and the black coating on the opposite side, and which is inherently weak because of its thinness, I prefer to use a relatively thick backing sheet 15, also preferably of mica and of the same size as the sheet 12. On the side of the backing sheet facing the black coating 14 I provide a conductive coating 16, preferably of metal such as platinum, in good electrical contact with the black coating 14 to assure minimum resistance between various points on the coating 14 and the external circuit which is connected through the lead 17 to a frame or clip member 18 which grips the edges of the two micas and which is in electrical contact with the coating 16.

The mosaic supporting mica 15 also serves as a cover or mask for the electrically conducting non-reflecting material on the mica 12 which if grahphite or carbon has the property of absorbing the caesium with which the silver globules are sensitized. It may, however, be advantageous to provide means whereby excess caesium may be absorbed and to this end I provide openings 19 in the member 15 thereby exposing a portion of the coating 14 to the atmosphere of the tube.

It may be desirable to form the non-reflecting coating on the mosaic electrode of materials which have little or no electrical conductivity. Figure 3 shows a modification wherein the black non-reflecting coating 20 is of such material and in this modification, I prefer to deposit directly on the non-reflective coating a layer or film of metal or other electrically conducting material 21 to serve as the signal electrode of the device. It is preferable to make the layer or film 20 very thin in order that the capacitance between the individual globules on the front of the electrode and the signal plate 21 is reduced as little as possible. Adequate mechanical support for the mosaic electrode may likewise be given by the mica sheet 15 which may be coated with an electrical conductor 16 whereby electrical contact may be accomplished as in the foregoing example.

Referring again to Figure 1 the frame or clip member 18, in contact with the conductive coating or signal electrode 14 is connected through the impedance 22 to ground and the second anode 8, and in operation the current flow in this circuit produces a voltage drop across the impedance 22 which may be impressed on the input of a translating device 23, further amplified, and applied to a transmitting network in a manner well known to the art.

The above examples illustrative of my invention are considered in connection with photosensitive surfaces of the mosaic type which utilize a large number of individually isolated particles each of which is electrically and mechanically separated one from the other. My invention is particularly but not exclusively directed to this type wherein a portion of the optical image projected on the particles or globules may pass through the interstices and be reflected back to both the particles and the wall of the tube, in which latter case the light will again be reflected onto the surface of the mosaic. Transparent or translucent insulators having continuous films of light sensitive materials have been used in place of the mosaiclike structure and my invention is likewise applicable to these modifications wherein the films are semi-transparent or translucent to such a degree that light may be reflected by any other than a black non-reflective coating on the opposite side of the insulator.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

I claim:

1. A cathode ray television transmitting tube comprising an envelope having a light transmitting vitreous portion which is inherently light reflecting on the surface facing the interior of the envelope for the transmission of an optical image, an electrode assembly including a translucent base exposed to said portion, a light sensitive material on the side of said base facing said vitreous portion, and a black coating substantially non-reflective to light on the opposite side of said base.

2. A cathode ray television transmitting tube comprising an envelope having a light transmitting vitreous portion which is inherently light reflecting on the surface facing the interior of the envelope for the transmission of an optical image, an electrode assembly including a translucent base exposed to said portion, a light sensitive material on the side of said base facing said vitreous portion, a coating substantially non-reflective to light on the opposite side of said base, and an electrically conductive coating in contact with said non-reflective coating.

3. A cathode ray television transmitting tube comprising an envelope having a light transmitting glass window for the transmission of an optical image, an electrode assembly including a

translucent base exposed to said window, a light sensitive material on the side of said base facing said window, a coating of carbon on the opposite side of said base, and a cover over said coating having means for exposing a portion of said coating to the interior of said envelope.

4. A photosensitive electrode structure which comprises a translucent base, a translucent photosensitive mosaic on one side of said base and a black light absorbing and non-reflecting coating on the opposite side of said base.

5. A photosensitive electrode structure which comprises a translucent sheet of mica, a plurality of isolated photosensitive particles formed on one side of said translucent sheet of mica and a black substantially non-reflective coating of carbon on the opposite side of said base.

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