United States Patent

[11] **3,569,760**

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[54] **COLOR TUBE WITH PHOSPHOR STRIPS SEPARATED BY GUARD BANDS**
7 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **313/92,** 178/5.4
[51] **Int. Cl.** **H01j 29/32,** H01j 29/30, H04n 9/26
[50] **Field of Search** ..... 178/5.4 (F); 313/92 (PDF)

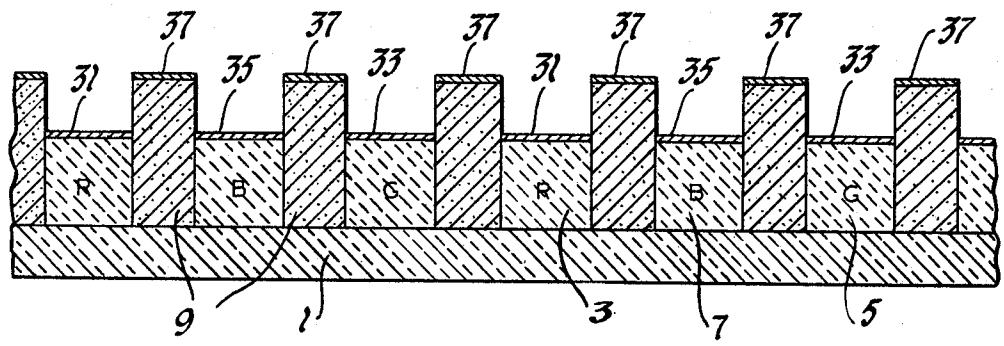
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ABSTRACT: The subject matter of this invention is a single gun color TV tube having a means for generating a beam of electrons such as an electron gun, and a means for sequentially receiving red, green, and blue color information in a predetermined order for modulating the electron beam, such as a control electrode. The target area of the tube includes a plurality of spaced red, green, and blue phosphor strips generally vertically disposed and arranged in a predetermined order. On the electron receiving face of each phosphor strip there is deposited a conductive coating. In operation the coatings on the strips corresponding to the color information modulating the beam have applied thereon a positive potential while a lower or negative potential is being applied to the coatings on the other phosphor strips for focusing the electron beam. A guard band preferably having a height greater than that of the phosphor strips is disposed between adjacent phosphor strips, each of which has deposited thereon a conductive coating for receiving a fixed positive potential so as to attract stray electrons generally due to secondary emission.



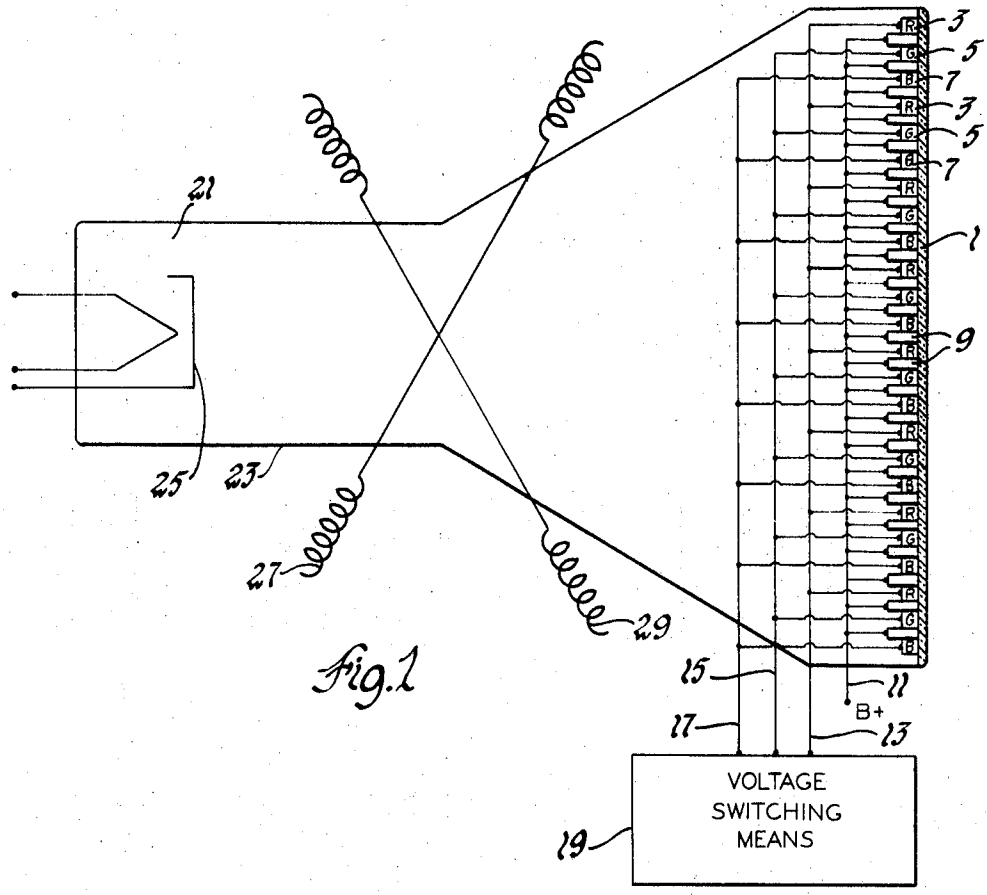


Fig. 1

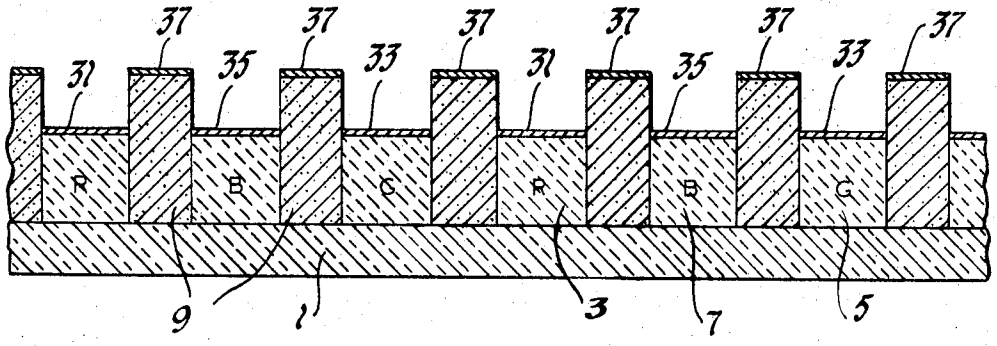


Fig. 2

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COLOR TUBE WITH PHOSPHOR STRIPS SEPARATED BY GUARD BANDS

Various cathode ray display tubes and associated systems have been developed for color television, though in the United States the three gun tube utilizing a shadow mask is in universal use. This tube employs a metal disc perforated with an array of holes known as a shadow mask that is positioned rearwardly from a series of tricolor phosphor dots, each set of three dots, red, green, and blue being known as a triad, and each triad is in a functional relationship with one perforation of the shadow mask. Three electron guns are employed to create three electron beams, the beams are so directed as to pass through each perforation at different angles so as to insure that each beam will only strike its associated dot of each triad. Unfortunately a shadow mask is expensive to manufacture and since roughly 85 percent of the electrons emitted fail to pass through the shadow mask, the efficiency of a shadow mask tube is quite low. In addition, this type of color tube necessitates adjustments of color purity and convergence that often require frequent and not inexpensive service calls.

To eliminate or alleviate the defects of the three gun shadow mask tube, various forms of single gun color tubes have been proposed. Generally, such tubes utilize as a target area a large number of parallel horizontal strips of material fluorescent on electron impact in three primary colors, typically for the three color additive process, red, green and blue, with the strips being laid down in cyclically repeating order. Color information for each color is sequentially applied to the control electrode of the tube and the tube operates with standard vertical and horizontal line frequencies so that as the beam passes, for example, a green strip, green information is applied to the control electrode. Some form of switching circuitry is generally employed conventionally at the color carrier frequency, 3.58 Hz., so that red, green, and blue information is sequentially applied to the control electrode at a switching frequency of 3.58 Hz. One of the principal difficulties with such tubes results from the tendency of some of the beam electrons carrying, for example, green information to strike a neighboring red or blue strip rather than the intended green strip as well as the tendency for electrons resulting from secondary emission to strike such strips.

Various prior art techniques have been tried in an attempt to overcome this problem. One such technique is the use of a focusing grid in front of the target area. Tubes using such grids are known generally as Lawrence or Chromotron tubes. Another technique employs a means for furnishing indexing information relating to the position of the scanning beam at each instant. This information is utilized in a servo system to maintain synchronism by controlling beam deflection or by controlling the color-processing rate in the video circuits. This type of tube is generally known as the Apple or beam indexing tube.

Unfortunately, the Lawrence tube requires an expensive and precise alignment of the grid and continues to suffer from difficulties arising from secondary emission. The Apple tube necessitates considerable additional circuitry and also continues to suffer from difficulties arising out of secondary emission. Hence, there is a considerable need in the color tube art for a single gun tube that is inexpensive to manufacture, but which is capable of excellent electron beam focusing and which substantially eliminates secondary emission electrons from striking undesired strips. The present invention fulfills this need.

Briefly, the present invention contemplates a single gun tube utilizing a plurality of substantially parallel, spaced phosphor strips laid down on a target surface, the strips being laid down in a predetermined order such as red phosphor, green phosphor, blue phosphor, red phosphor etc. Although such phosphors may have sufficient conductivity so that they are capable of receiving and maintaining a substantial positive potential, it is preferred that each strip have deposited on its electron receiving face a thin conductive coating. Spaced between adjacent strips are guard bands maintained at a positive potential. These guard bands are preferably made from an inert material and in the preferred embodiment are raised above the phosphor strips with the potential being applied to a conductive coating deposited on the surface of the guard band facing the electron beam. The conductive coating of all red strips are electrically coupled, and similarly the green and blue strips for enabling a positive potential to be applied to, for example, the red strips when red information is applied to the control electrode while simultaneously applying a lower potential or even a negative potential to the blue and green conductive strips.

In operation, conventional switching circuitry may be utilized to apply a positive potential to the red strips when red information is applied to the control electrode to insure that the electron beam carrying, for example, red information falls on the red strip that it is directed to and not on an adjacent blue or green strip. The difference in potential between such a red strip and its associated blue and green strips accomplishes this result. The potentials on the strips are switched substantially simultaneous with the switching of color information on the control electrode. Most significantly, secondary electrons tend to return to the strip from which they are emitted and those which would otherwise land on unwanted strips are trapped by the charged guard bands, thus achieving the desired beam focusing and secondary emission control in a practical and inexpensive manner.

A more complete understanding of the invention may be obtained by reference to the accompanying drawings.

FIG. 1 is a schematic horizontal cross-sectional view of a color TV tube embodying the invention; and

FIG. 2 is an enlarged view of that portion of FIG. 1 showing the vertically disposed phosphor strips interlaced with vertically disposed guard bands.

Turning now to the drawings, there is shown a single gun cathode ray tube having a transparent face plate 1. Deposited on face plate 1 are a series of vertically disposed spaced phosphor strips, the strips formed of a red phosphor are shown as strips 3, those of green phosphor as strips 5, and those of blue phosphor as strips 7. Strips 3, 5, and 7 are arranged in a predetermined order. Disposed between every adjacent strip is a guard band strip 9 formed of nonconductive, nonfluorescent material, preferably dark in color and made of a material having a low atomic number. The height of each guard band 9 is preferably greater than that of the strips 3, 5, and 7.

Conductive focusing coatings 31, 33, and 35 preferably formed of aluminum are deposited on the electron receiving surfaces of strips 3, 5, and 7 respectively and conductive coatings 37 preferably also of aluminum are deposited on guard bands 9 in a manner so as to be insulated from conductive coatings 31, 33, and 35, preferably on the surface facing the electron beam. Coatings 31, 33, and 35 are electrically coupled to conductors 13, 15, and 17 respectively which in turn are electrically coupled to voltage switching means 19. As is apparent to those skilled in the art, various circuit designs may be employed as voltage switching means 19 for sequentially applying a positive potential to one of said conductors while applying a lower potential or even a negative potential to the other two conductors, and then switching the conductor having the positive potential synchronously with the sequential application of the color information to electrode 25. Clearly, the utilizing of phosphors having substantial conductivity would theoretically eliminate the necessity for coatings 31, 33, and 35, but the use of such coatings is much preferred. A positive potential is provided for coatings 37 by means of connecting such coatings to conductor 11 which is connected to a source of positive potential B+.

In other respects the color TV tube is a conventional single gun tube comprising an electron gun indicated generally at 21, disposed in the neck portion of envelope 23. The color signal is applied at electrode 25 and the electron beam scans the target area by means of field scanning currents of the usual type applied to a set of deflection coils 27 and 29. However, it is preferred that an oblong electron beam be employed instead

of the conventional circular beam, thus providing a beam having a geometry more closely aligned with that of strips 3, 5, and 7.

In operation, the electron beam modulated by a color video signal applied at electrode 25 is emitted by gun 21 and is deflected by coils 27 and 29 to scan the phosphor strips 3, 5, and 7. The video signal is composed of sequential applications of red, green, and blue color information respectively. Simultaneous with the application of, for example, the red video signal to electrode 25, voltage switching means 19 causes a positive potential on coatings 31 while applying a lower or even a negative potential on coatings 33 and 35. Thus, the beam is focused on the strip corresponding to the video information. However, in order to insure that stray electrons caused generally by secondary emission land only on the desired phosphor strip, the positively charged guard bands attract such electrons that are directed at undesired strips thus preventing them from striking such strips. The result is a relatively inexpensive single gun tube that is efficient in operation and whose electrons strike only the desired phosphor strip at all times.

I claim:

1. A color tube comprising means for generating a beam of electrons; means for sequentially receiving color information for various colors in a predetermined order for modulating said beam; a target area comprising a plurality of spaced phosphor strip means of such colors arranged in a predetermined order, each of said phosphor strip means being adapted for receiving and maintaining a substantial positive potential and the phosphor strips of identical colors being electrically coupled to each other and electrically insulated from other phosphor strips; guard band means disposed between adjacent ones of said strip means, said guard band means including means electrically insulated from said strip means for receiving and maintaining a positive potential for trapping stray electrons.

2. The tube of claim 1 wherein said guard band means includes a guard band strip raised above said phosphor strips.

3. A color tube comprising means for generating a beam of electrons; means for sequentially receiving red, green, and blue color information in a predetermined cyclical order for modulating said beam; a target area comprising a transparent face plate; a plurality of spaced red, green and blue phosphor strips deposited on said face plate and arranged in a predetermined cyclical order; an aluminum coating deposited on the electron receiving face of each of said strips forming thereby a plurality of spaced conductive coatings, the conductive coatings on the phosphor strips of identical color being electrically coupled to each other and insulated from other coatings; a guard band strip formed of a nonconductive, nonfluorescent material disposed between adjacent ones of said phosphor strips and coextensive therewith; and aluminum coating deposited on each of said guard bands and being electrically insulated from said aluminum coatings on said phosphor strips.

4. The tube of claim 3 wherein the height of said guard bands is greater than the height of said phosphor strips.

5. The tube of claim 4 wherein said coating on each of said guard bands is deposited on at least a portion of said surface facing said electron beam.

6. The tube of claim 5 including means for applying a positive potential to said coating on each of said guard bands.

7. The tube of claim 6 including means for applying a positive potential to each of said coatings on similar color phosphor strips while simultaneously applying a lower potential to said coatings on the other phosphor strips.