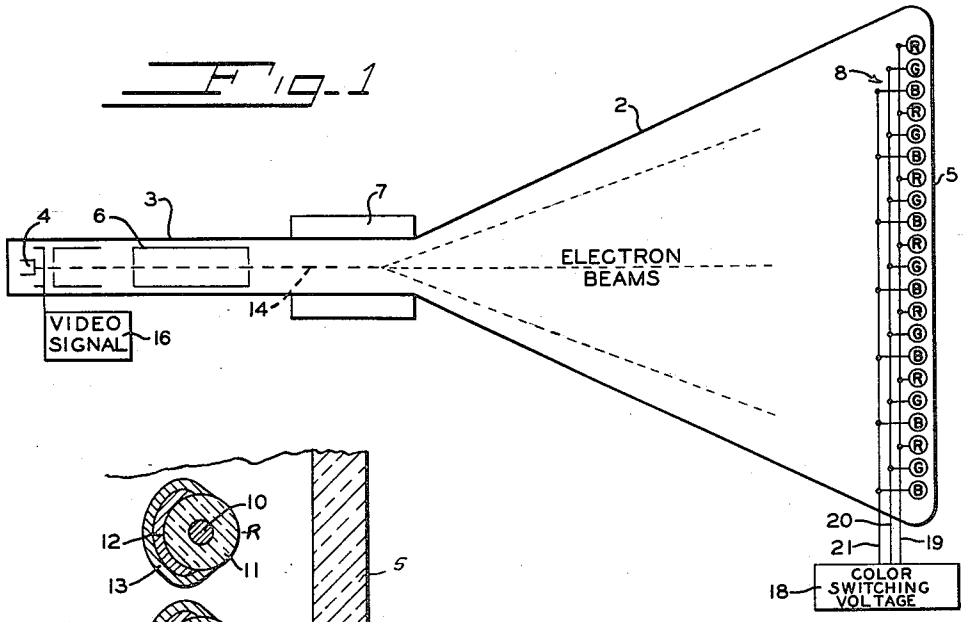
Jan. 6, 1959 A. E. CHARLTON 2,867,749

COLOR TELEVISION

Filed Feb. 27, 1956

Fig. 1



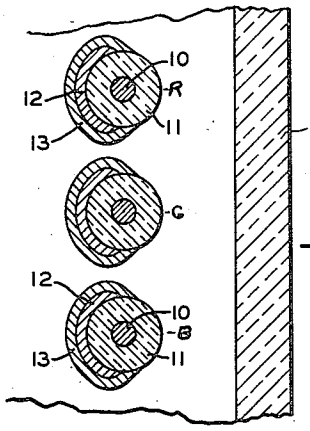


Fig. 2.

Fig. 3

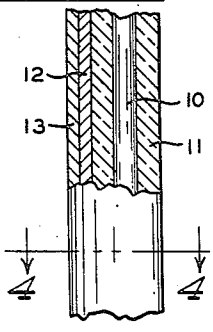


Fig. 4

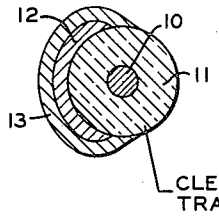
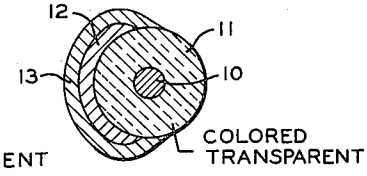


Fig. 5



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COLOR TELEVISION

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16 Claims. (Cl. 315—21)

This invention relates to color television, and, more particularly, to cathode-ray tubes used in color television reception.

Many types of cathode-ray tubes and systems have been proposed for reproducing color signals into corresponding colors. One of these which has had some commercial use employs a metal shadow mask, perforated with an array of holes or apertures, disposed adjacent a transparent glass end or face plate having a series of triangular tricolor phosphor dots positioned in respect to each of the apertures in the mask. Three electron scanning beams are deflected through the metal apertured shadow mask to converge at different angles to strike the red, green and blue fluorescing phosphor dots of the triad for producing the color at a particular picture or image point. This shadow mask type is expensive and difficult to manufacture as well as being inefficient in operation because about eighty-five percent (85%) of the electron beam power is dissipated at the shadow mask. This dissipation of the electron beam power limits the brightness of the reproduced picture or image.

Other types of proposed color receiving tubes employ color emitting phosphor strips deposited vertically or horizontally on the viewing screen. Some of these types employ a plurality of electrodes, referred to as a grid, extending transversely across the tube, parallel or horizontal to the phosphor strips, and located in a plane spaced a short distance from the plane of the phosphor strips. By the application of proper potentials to these electrodes, the electron beam scanning the phosphor strips can be controlled so that it will strike and fluoresce the intended colored phosphor at any given time. These other types have definite disadvantages which have made them unacceptable for commercial use, and they have characteristics which make their manufacture extremely difficult.

The above referred to types are illustrated and generally described on page 139 of the November 1955 issue of Fortune.

It has long been recognized that a color cathode-ray tube which could be developed with its beam control, or a supplementary beam control, at the phosphor screen for selecting and changing colors, would have definite advantages over other types of color cathode-ray tubes. The present invention overcomes the disadvantages of the above referred to types and does provide a screen controlled color cathode-ray tube, and one of the main objects of the invention is an improved grid type screen-controlled cathode-ray tube for converting transmitted color signals into corresponding colors.

Another object of the invention is a cathode-ray color tube for color television reception which is easy and economical to manufacture and is efficient in operation.

Another object of the invention is a cathode-ray color tube in which the converted pictures or images are reproduced into corresponding colors with a high degree of control and purity.

Another object of the invention is a cathode-ray color tube in which the hue of the primary colors can be reproduced in any desired wave length and is not dependent upon the limitations of existing fluorescing phosphors.

Another object of the invention is a cathode-ray color tube which requires less current for operation than do present color tubes.

A still further object of the invention is a cathode-ray color tube using only white fluorescing phosphors for reproducing colors.

A still further object of the invention is a cathode-ray color tube comprising a grid structure which functions as a supplementary beam control, as a post accelerator to the electron beam, and as the viewing screen.

A still further object of the invention is a cathode-ray color tube having parallel grid members which will not vibrate due to mechanical or electrical causes with the resultant loss of color purity.

A still further object of the invention is a grid type cathode-ray color tube in which the fluorescing phosphors are not on an adjoining member but are on the grids.

A still further object of the invention is a cathode-ray color tube having maximum efficiency of light utilization of the fluorescing phosphors.

A still further obect of the invention is a novel grid structure for a cathode-ray color tube, and a tube comprising said novel grids.

A still further object of the invention is a new and novel electronic apparatus.

Further objects, and objects relating to details of construction and economies of operation, will readily appear from the detailed description to follow. The invention is clearly defined and pointed out in the appended claims. A structure constituting embodiments of the invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a schematic view of a cathode-ray tube embodying the invention.

Fig. 2 is an enlarged detailed view in vertical cross section of a portion of the grid structure showing three color forming parts.

Fig. 3 is an enlarged longitudinal cross sectional of one of the color forming parts of the grid.

Fig. 4 is an enlarged vertical cross section on line 4—4 of Fig. 3.

Fig. 5 is an enlarged vertical cross section similar to Fig. 4 of another embodiment.

Referring specifically to the drawings in which like numerals refer to like parts, numeral 2 is a conventional cathode-ray tube having an envelope 3 comprising an electron beam source 4 and a viewing end 5.

Mounted within the tube adjacent the transparent end face plate 5 (Figs. 1 and 2) is a grid structure 8 composed of a plurality of red, green and blue electron sensitive grids R, G and B, alternately disposed. Inasmuch as these colors, red, green and blue, are conventionally used in cathode-ray color tubes, this color series is illustrated, it being understood that more or less colors could be used for the number of colors desired, or, the colors could be disposed in different order or sequence than as illustrated. The grids of the grid structure are parallel to each other and can be slightly spaced apart or abutting. Said grids are illustrated by metal wires 10 coated with dielectric material 11, such as glass, which may be clear transparent or of a transparent color.

On one side of the dielectric coating 11, there is applied a white or color emitting electron sensitive material 12, such as phosphor, which is preferably overlaid with a film of light-reflecting material 13, such as aluminum or other metal or non-metallic light-reflecting material, substantially as shown in Figs. 4 and 5. The electron beam 14 from the electron gun 6 will penetrate the light-reflecting film coating 13, causing the white or color emitting phosphor 12 to fluoresce. The surrounding over-

lay film of light-reflecting material **13** acts as a mirror and will concentrate the emitted light which passes through the transparent or color dielectric coating **11**, around the wire, for it to be intensified and viewed through the face plate **5**. The light emitting material **12** on grid element R will emit one color, such as red, that on grid element G will emit another color, such as green, and that on grid element B another color, such as blue.

In operation, the electron beam formed from a video signal **16** is emitted by the electron gun **6** to be deflected by the deflection yoke **7** to scan the red, green and blue grid elements in the grid structure. Each of the grid elements of one color is electrically insulated from the other colors, and each color, such as grid elements R, is connected to a color switching voltage control **18** through line **19**, grid elements G through line **20**, and grid elements B through line **21**. By applying a high positive potential in synchronization with the electron scanning beam, through the color switching voltage control **18** to the grid elements whose color is to be excited and with a lower positive potential or even a negative potential applied to the grid elements of the other colors in the grid structure, a maximum degree of scanning accuracy can be obtained.

In accordance with one modification of this invention (Fig. 4) the grid wires of the grid structure can be coated with a clear transparent dielectric material with the electron sensitive phosphor or color emitting coating of a fluorescing color, such as red, green or blue. Grids composed of red, green and blue fluorescing colors are disposed alternately in the grid structure.

In another modification of the invention (Fig. 5) the coating **11** next to the wires of the grid structure may be a transparent colored dielectric material, such as glass, there being different colored grid elements, such as red, green and blue, disposed alternately in the grid structure. The fluorescing color material applied to the coating next to the wire will be one which will flouresce white when bombarded by the electron beam. The essential difference between this embodiment of Fig. 5 and that of Fig. 4 is that in the one embodiment the dielectric coating **11** next to the wires is transparent with the different colors formed by different fluorescing colored materials **12**, whereas in the other the different colors are obtained by different colored transparent dielectric coatings **11** next to the wires.

A cathode-ray tube, with the novel grid structure of this invention, can be operated with one electron gun, thereby providing for simplified circuitry. A positive potential on the grid elements whose colors are to be excited not only acts as an adjunct for accurate scanning but also as a post accelerator to the electron beam so that such a tube can be operated at lower voltages. There is no masking of the fluorescing screen by wires or grids or shadow masks to intercept the electron beam with the consequent inefficiency. The film of light-reflecting material partly surrounding the coated wires of the grid intensify the light produced by impingement of the electron beam on the fluorescing medium.

Then, too, with the wires coated, their flexibility is materially reduced with the consequence of thereby reducing any vibration thereof due to mechanical or electrical causes to which they are subjected in use and which impairs the purity of color.

In that structure (Fig. 5) where the grid wires are coated with transparent colored dielectric material **11**, this colored material can be chosen to produce colors of any hue or wave length. Therefore, the primary colors are not limited to the fluorescing wave length of existing phosphors.

The transparent dielectric coating **11** next to the wires, whether colored or not, may be of any suitable material and is not limited to glass. In fact, it could be a suitable conductive transparent material which would elminate the need for the wires. Or it can also be of a non-conductive transparent material without the need for connection to a color switching voltage. In such case, the electron beam can be coupled to a feedback circuit for accurate scanning. However, with some means, such as the wires, embedded in the dielectric material, the grid elements of the grid structure are less subject to vibration as they are reinforced as well as being conductive. While the grid elements of the grid structure have been illustrated as of the same size, as to diameter, those of one color may be of larger diameter than those of another color to accentuate one color over the others. The grid structure readily lends itself to making the grid elements of any size in relation to each other.

The invention is novel with or without the light-reflecting film coating, which is preferably used to concentrate the emitted light and intensify it for viewing, and also to reduce secondary electron bombardment. It will also be understood that while phosphors are preferably used as the electron sensitive coating over the dielectric coating, the invention is not limited to them as any material which will fluoresce when subjected to an electron beam is satisfactory.

It is to be understood that the novel structure herein described is not limited to use only in a cathode-ray tube, but can be readily adapted for use in other electronic devices.

I am aware that there may be various changes in details of construction without departing from the spirit of my invention, and, therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by United States Letters Patent, is:

1. A cathode-ray color tube having an electron emitting means and a grid structure against which electron beams are projected, said grid structure comprising parallel wire grid elements coated with a light transmitting material and provided with means for fluorescing different colors.

2. The cathode-ray color tube of claim 1 in which the grid elements are of different transparent colors and have fluorescing white material applied thereto.

3. The cathode-ray color tube of claim 2 in which an electron permeable light reflecting coating is applied over the fluorescing material.

4. The cathode-ray color tube of claim 1 in which the grid elements are clear, transparent, and a fluorescing color emitting material is applied to said elements.

5. The cathode-ray color tube of claim 4 in which an electron permeable light reflecting coating is applied over the fluorescing material.

6. A cathode-ray color tube having an electron emitting means and a grid structure against which electron beams are projected, said grid structure comprising parallel electrically conductive wire grid elements coated with light transmitting material and provided with means for fluorescing different colors, and means for providing varying amounts of negative or positive potentials to any color group of the elements.

7. The cathode-ray tube of claim 6 in which the grids are of different transparent colors and have fluorescing white material applied thereto.

8. The cathode-ray tube of claim 7 in which an electron permeable light-reflecting coating is applied over the fluorescing material.

9. The cathode-ray tube of claim 6 in which the grid elements are clear transparent, and a fluorescing color emitting material is applied to said grid elements.

10. The cathode-ray tube of claim 9 in which an electron permeable light-reflecting coating is applied over the fluorescing material.

11. A cathode-ray tube grid element comprising a transparent body having a fluorescing coating applied thereto and an electron permeable light-reflecting coating over the fluoresecing coating.

12. A cathode-ray color tube having an electron emit-

ting means and a grid structure against which electron beams are projected, said grid structure comprising parallel wire grids, disposed in a common plane, which are coated with a light transmitting material and provided with means for fluorescing different colors, said grid structure being free of the fluorescing material at the viewing end of the tube.

13. The cathode-ray color tube of claim 12 in which the grids are of different transparent colors and have fluorescing white material applied thereto.

14. The cathode-ray color tube of claim 13 in which an electron permeable light reflecting material is applied over the fluorescing material.

15. The cathode-ray color tube of claim 14 in which

the grid elements are clear transparent, and a fluorescing color emitting material is applied to said grid elements.

16. The cathode-ray color tube of claim 15 in which an electron permeable light reflecting coating is applied over the fluorescing material.

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