Oct. 6, 1959 J. SUCHER 2,907,917

COLOR TELEVISION TUBE WITH POLARIZING FILTER

Filed Oct. 3, 1956

FIG. 1.

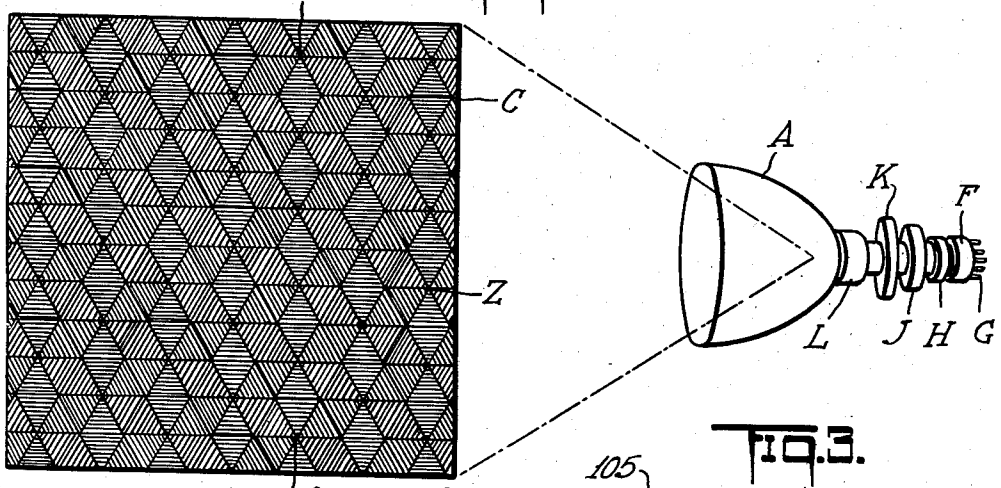


FIG. 2.

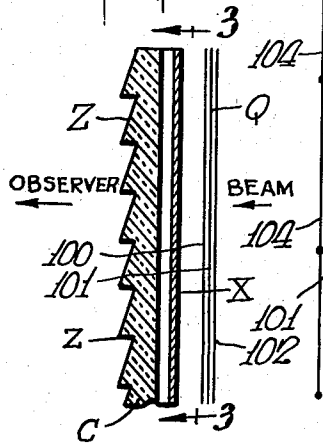


FIG. 3.

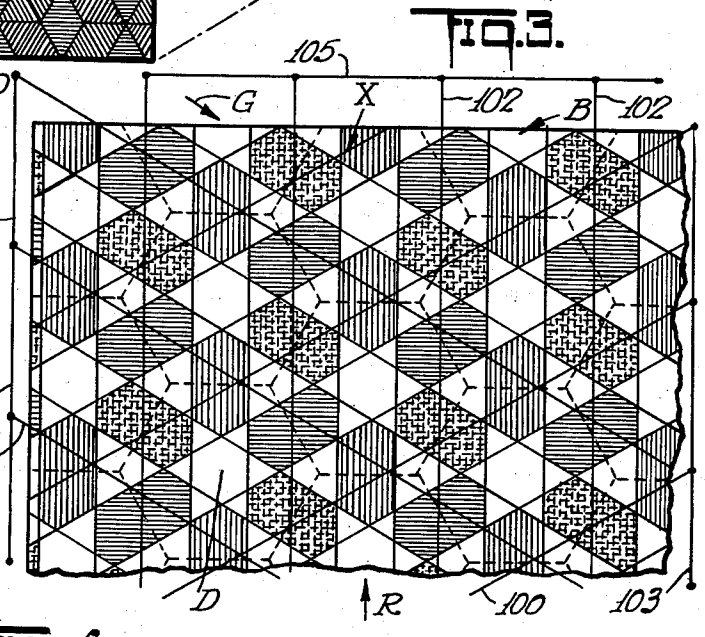


FIG. 4.

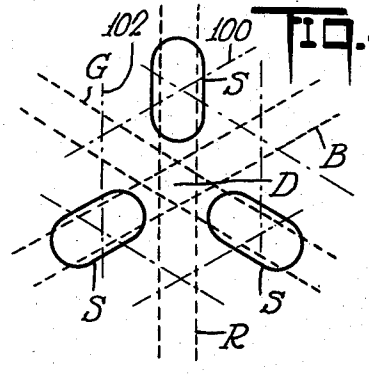
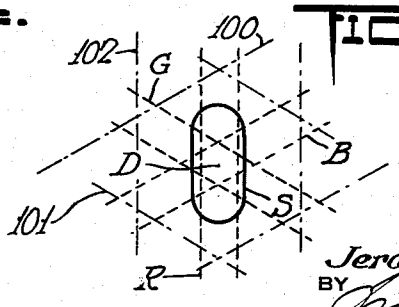


FIG. 5.



INVENTOR
Jerome Sucher
BY
ATTORNEY

United States Patent Office

2,907,917

Patented Oct. 6, 1959

2,907,917

COLOR TELEVISION TUBE WITH POLARIZING FILTER

Jerome Sucher, East Paterson, N.J.

Application October 3, 1956, Serial No. 613,725

10 Claims. (Cl. 315—21)

The present application is a continuation in part of my prior application, Serial Number 467,505, filed November 8, 1954, and it particularly relates to a method of filtering and purifying the color values which are achieved according to the novel color production system of said prior application.

It is among the particular objects of the present invention to provide a novel color kinescope or other cathode ray tube in which there will be a sharp definition of the image in the various primary colors on the face or screen of the color tube and in which there will be high optical resolution by a relatively simple low cost kinescope construction with a relatively simple circuit.

Another object of the present invention is to provide a novel electrical control assembly for use with cathode ray tubes which will give a colored light image of high brilliance or brightness, of highly useful life and of maximum freedom from color dilution and color bleeding and which will produce clear and accurate color images without haziness or bleeding.

A further object of the present invention is to provide a novel color control system particularly adapted to cathode ray tubes in which the cycle of operation may be maintained at high frequency without color contamination and with actual alignment and definition of the color images.

In present systems of colored television there is great difficulty in obtaining correct registry of the electron beam onto the particular colored phosphors and there is usually a bleeding of the color or a production of incorrect color values, and it is among the objects of the present invention to readily obtain proper registry without the use of masking plates or complicated screens and without the necessity of using a plurality of electron guns which are usually required in prior dot registration or dot projection systems, and with relatively simple and readily color filter means.

A further object is to obtain registry without the use of plates having $\frac{1}{100,000}$ to $\frac{1}{400,000}$ openings and which require correct alignment of the beam, the opening in the masking plate or screen and the colored phosphor upon the face plate, which prior methods result in wastage of the effectiveness of the beam and in decreased brightness and with greatly increased intensity and brightness in each color value.

Still further objects and advantages will appear in the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

The primary feature of the present invention resides in using a single electron gun and by sweeping or elongating the dot to form a bar which is angularly turned or displaced for each respective color by an angle of 120°.

The screen or face plate in turn will have the colored phosphors arranged in lines or in striations which are respectively positioned at 120° to one another, for example the red being in vertical position, the green being at 120° in one angular direction, and the blue being at 120° in the other angular direction.

The elongation and turning of the electron beam for each respective primary color will be effected by magnetic deflection means or by electrostatic deflection means and the length of the swept or elongated beam will normally be about 3 to 15 times its width and preferably 8 to 12 times its width.

This shaping is done purely by means of the sweep signal, either arising from current or voltage, which is developed in the ion flow path or beam flow path by electromagnetic or electrostatic means.

It has been found most suitable to provide a face plate or screen susceptible to polarization which will have a plurality of closely spaced lines composed of red, green and blue lined phosphors, each set of which in parallelism will be arranged at an angle of 120° to the next parallel set so that the polarized colors will form an obliquely crossing grid on the face of the kinescope.

An important feature of the present invention resides in the fact that superimposed by the hexagonal crossing system of the phosphor lines there will be a transverse polarizing arrangement which will preferentially leave the desired colors pass through in full intensity and at the same time block out any alternative undesired color values.

Although many different types of polarizing or filtering arrangements have been provided, it has been found most satisfactory according to one embodiment of the invention to provide a fresnel arrangement which will extend transversely across the colored lines.

Actually the lens arrangement which is positioned between the screen and the observer may consist of a plurality of hexagonal units each consisting of a series of concentric fresnel wedge arrangements which will act as a polarizing filter or diffraction grating which will shield out the light or filter out the light arises from adjacent obliquely positioned colored stripes and which will only permit passage of the color values from the main stripe.

The hexagonal diffraction patterns will encircle the cross overs between the colored lines.

The thickness of the color bars may be varied in the grid with the space between the bars varying between 25 and 75% and the thickness of the bars varying between 25 to 50% in any parallel series or arrangement.

Normally, in the preferred arrangement, the red and blue bars may be of minimum width, say from 20 to 30%, whereas the green bars could have maximum width of from 30 to 40%.

The number of colored phosphor lines of each different color would be the maximum obtainable for proper definition and resolution for any size picture tube. The spacing and thickness will vary to give the desired result.

By this combination of red, green and blue bars in crisscross arrangement, it is possible to produce the subsidiary or merged colors by illuminating two primary colors either simultaneously or in rapid succession.

Although the screen face may be provided on one side with crisscross color lines and on the other side with the hexagonal diffraction patterns around each crossing point, they are desirably formed into two plate elements with the crisscross color lines being positioned closest to the source of the electron beam and with the hexagonal diffraction pattern being positioned closest to the eye of the observer.

The spacing between the diffraction grating and the colored lines may range from ¼ inch to 1 inch to 2 inches.

Desirably where two color lines are outlined transverse to one another to give a partially colored picture, the position of the crossing point is such that the fresnel or filter arrangement will consist of a series of squares centered upon the crossing point.

Although not limited thereto, it has been found in one embodiment of the present invention to place the red lines vertically in a closely parallel spaced arrangement with the green and blue lines being positioned 120° on either side of such vertical axis. However, this arrangement may be widely varied depending upon the control electrical arrangements which will swing or rotate the activating electron beams in accordance with the layout upon the face plate of the tube.

A particular feature of the present invention resides in the fact that the activating electron beams are elongated or swept to form bars, the longitudinal axis of which will always be parallel to the longitudinal axis of the respective corresponding color lines on the face plate or screen of the kinescope.

In the preferred arrangement, the neck of the tube is provided with a deflection coil closest to the face plate, a color phase sweep coil for each primary color, a focus coil, an ion trap and an emitter in that order along the neck of the tube from the face plate.

Finally, there will be the base shell provided with the connection pins and prongs.

The color phasing sweep coil may work either in front or in back of the focus coil regarding the color screen or grid as the front. The important features of the present invention is that each electron beam is elongated or flattened into a bar, substantially and simultaneously with the angular displacement so as to sweep and illuminate the corresponding color line on the face plate of the kinescope with the result that the invention makes use of electron bar beams rather than dots to achieve the final colored images.

The polarized color lines will be illuminated by the angular sweeping effect corresponding to the color desired and the number of colors which will result will be determined by the color information furnished by the color demodulator.

With either electromagnetic or electrostatic deflection methods there will be used three pairs or three sets of deflection coils or deflection plates, two being provided for each color, which will have the effect of elongating the spot into a bar and also turning such bar so that it will be aligned with the particular color to which it corresponds.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described, and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which fall within the scope of the claims hereunto appended.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:

Fig. 1 is a diagrammatic view in side perspective of a kinescope with the face plate removed and enlarged, showing the superimposed hexagonal grid arrangement crisscross grid thereon of varying color effect.

Fig. 2 is a transverse sectional view upon the line 2—2 of Fig. 1, showing the diffraction grating applied to the side of the screen toward the observer.

Fig. 3 is a rear elevational view showing the portion of the screen upon which the electron beam travels with its crisscross grid effect.

Fig. 4 is a diagrammatic layout view showing the effect sweeping the electron beams by the electromagnetic electrostatic means of the present invention and how such swept beams are aligned with the color lines.

Fig. 5 is a diagrammatic plan view showing how the swept beam will overlap a crossing point and give a color value.

Referring to Figs. 1 to 3, there is shown a tube A having a face plate or screen C with a criss-cross grid X of primary colors adjacent the beam source.

On the other side there is positioned a diffraction grating pattern Z, which will purify the light and filter out any wrong light values.

In the form shown, although not restricted thereto, the vertical bars or bands R will be red; the oblique to the left upwardly bars G will be green; and the obliquely upwardly to the right bars B will be blue. This color arrangement may be widely varied, but the uniform 120° angle spacing should be maintained.

At the colorless crossing points D, the black and white pictures may be facilitated. It will be noted that the spacing between the color lines B, G and R is always greater than the width of the color lines themselves by a ratio varying between 5 to 1 and 2 to 1, but preferably in the order of between 4 to 1, and 3 to 1. Desirably, the green lines in turn may be heavier and wider than the blue lines. These ratios could vary depending on the desired color rendition and toning to be effected.

Referring to the neck E of the tube A in the form shown in Fig. 1, there is shown the end cap F with the electrical connection and location pins on prongs G, the ion trap H, the focus coil J, the color phase sweep coils K and the deflection coils L.

Referring to Fig. 4 the red lines R, the blue lines B and the green lines G are shown approaching a crossing point D, and for purposes of contrast there are shown the elongated or swept beams or bars S sweeping the red vertical lines R, or sweeping the green lines G, or sweeping the blue lines B. Desirably these bars S are slightly wider than the colored lines R, G and B, respectively, so that they will extend beyond the side edges of the lines R, G and B.

In Fig. 4 it is indicated that these swept beams S also extend beyond the crossing point D so that there will be an effective color value equivalent to one-half to three-quarters of their length when they pass across the crossing point D and there will be no substantial loss in color value when they are moving across the neutral points D.

No special claim is made for the construction and arrangement of the cap F, the ion trap H, the focus coil J, the color phase sweep coils K and the deflection coils L.

However, the present invention is directed to the provision of an elongated or swept electron spot as indicated at S in Figs. 4 and 5, which will sweep along the colored lines or striations B, G and R, depending upon the particular color which is to be achieved.

It will be noted that in Fig. 5, for example, the spot S will slightly overlap the oblique striations B and G, and will produce some color values in blue and green, whereas the color value to be produced should be in red.

Therefore, at this critical position, it is desirable to intensify the red and filter out the blue and green.

This will occur more frequently at the crossing points, depending upon the width and length of the spot S than it will at the positions away from the crossing points as shown in Fig. 4.

The relative position of the red, blue and green lines or striations may be varied but they should be 120° apart as indicated in Figs. 3, 4 and 5, and actually, although the width is shown as about ⅓ the length in Figs. 3 and 4, the width may be anywhere from ⅓ to 1/10 the length of the swept beam.

It is possible to vary the intensities by varying the length of the bars S and it is possible to vary the intensities of intermediate colors and change their shades by the relative proportionment of the length of the bars.

The particular feature of the present invention provides in the provision of the fresnel hexagonal arrangement which encircle each crossing point D, as best shown in Figs. 1 and 3.

These striations or tooth effects, as indicated at Z will have the effect of intensifying the colored light which is transverse thereto, and cutting off the bleeding values from adjacent and oblique lines.

The preferred feature here is to use a system or a

plurality of color lines to obtain maximum of color purity, in which the colored lines cross each other according to a predetermined angular pattern.

Each pattern or crossing point is provided with a polarizing filter or diffraction grating so that the light which is parallel to the direction of the main color stripe or striation will be preferentially permitted to pass.

The particular color which is coming off from an oblique line at a substantial angle will be blocked out.

Maximum color purity is thus achieved by placing a continuous pattern of diffraction gratings or fresnel lines transverse to the direction of the color lines upon the main color screen, which lines will extend substantially to a medium point between the main color lines with the diffraction gratings covering the entire area and filtering the entire area.

Where a 3-color system is utilized, the diffraction grating will be arranged in the form of hexagons, whereas with a 2-color system will be arranged in squares.

In the preferred form of the invention the color screen is positioned between the source of illumination or the electron beam and the diffraction grating so that the only light that goes through to the diffraction grating is that from the bars S, which have been generated by the electron beam acting on the color screen.

By the use of a diffraction grating filter on the observer side of a polarized color screen, it is possible to correct for the elongated electron beam spots which might cause generation of unwanted color values from adjacent angular color lines.

The purity of the color may be further enhanced by the use of an electron polarizing element positioned between the source of the electron beam and the color screen, which will decrease the spread of the beam or the elongated spot. Such electron screen will be keyed to the criss-cross pattern of the color screen and is provided with lines which are coincidental with criss-cross lines of the color screen.

In obtaining additional color purity, it has been found most satisfactory to utilize electron positioning elements or electron lens devices with such lens devices being positioned between the phosphor screen X and the deflection coil or coils L.

As indicated at Q in Fig. 2 the preferred form of electron lens consists of three groups or wires such as the group **100** for the green lines, the group **101** for the blue lines, and the group **102** for the red lines.

These wires may extend, as indicated by the dot and dash lines in Figs. 3, 4 and 5, along each side of the green bands G, blue bands B, and red bands R.

Desirably these lines may be spaced equally from the edges of the red bands, the blue bands and the green bands.

The edges of the screens may be connected together so as to have a common electrical potential, the green bands being connected by the connection **103**, the blue bands being connected by the connection **104**, and the red bands being connected by the connection **105**.

These groups of wires are desirably positioned being ⅛ to ½ inch in front of the phosphor screen.

Such positioning wire elements or screens may be used even without the fresnel lens filter Z to give the desired color purification effect.

These electron positioning wire screens may be formed of a wire mesh, the polygonal pattern of which will correspond to the polygonal pattern of the phosphor screen X with each group of parallel wires being insulated from each other group of parallel wires, but with the respective wires being positioned midway between the corresponding bands on the phosphor screen.

Instead of one screen it is, of course, possible to use separate screens with the parallel wires, two screens being used for a 2-color system and 3-screens being used for a 3-color system.

These electron screens Q will be synchronized with the elements F to L and will receive a synchronized voltage ranging from 50 volts to 500 volts D.C. source or synchronized by the color sweep amplifiers to coincide with the electric bar, beam, angular sweep application.

The automatic registry of the elongated electron beam spot will be obtained with greater light output and greater color purity.

Desirably the fresnel line arrangement is separated from the color screen by predetermined distance of ⅛ inch to ½ inch, which is about five to ten times the average wave length of the green line.

The preferred arrangement therefore consists of criss-cross color screen positioned between and spaced from the electron screen on the beam source side and a fresnel polygonal color filter on the viewing side, the spacing being regulated so that there will be a maximum elimination of undesired color values with production of predetermined colored hue.

Therefore, the essential feature of the present invention is limited to a swept or elongated activating beam which is coordinated with a criss-cross or polarized color screen and with a polarizing fesnel filter arrangement in which the primary color values, red, green and blue, are produced in great intensity and purity without bleeding or haziness. The color phosphor lines being positioned in an angularly direction of movement of the elongated beam spot which is caused to travel the color screen parallel to and upon the angular direction corresponding to the color line which is to be produced.

A pre-directing electron filter and/or the fresnel filter which are placed before and after the criss-cross color phosphor screen will assure maximum intensity and clarity.

The variation in length of the bar will give wide variety of different intensities and tonal gradations. The present system avoids mis-registry and seepage or fuzziness of color outline characteristic in the masking plate and dot procedure and it results in a much more effective use of the electron beam with greatly enhanced power, brightness and color definition.

The essential feature of the present invention resides in the sweeping and rotation of the ion spot which, instead of consisting of a dot when applied to the face plate, consists of a bar which is rotated to a predetermined 120° position and which is lined up with a similar set of rotated color lines.

To produce the final image, the polarized color screen will be illuminated by the electron bar beam spot corresponding to the color desired. Since the physical length of the electron bar beam is limited on the face plate, it will only extend to that vertical portion which will exist between two horizontal scanning lines within each vertical scanning period. If two colors or combinations of colors are required, two electron bar beams will exist and both colors will be displayed.

The number of colored phosphor lines of given color will vary for any size picture tube depending on the maximum amount permissible consistent with picture definition and resolution desired. The spacing and thickness therefore will vary accordingly.

The scanning of the swept bar may be simultaneous or sequential.

This method which utilizes a conventional single electron gun kinescope which, with special face plate arrangement will give a high quality, true colored image.

The invention thus provides a true tri-color picture tube where the three primary colors are obtained by three colored phosphors rearranged as criss-cross lines upon a single face plate. By means of angular displacement of the electron beam which is swept to form a thin elongated bar, the desired color effect will be obtained on the face plate resulting in a true colored image of the desired picture.

While there has herein been illustrated and described the preferred embodiment of the invention, it is to be

understood that applicant does not limit himself to the precise construction herein disclosed, and the right is reserved to all changes and modifications coming within the scope of the invention as defined in the appended claims.

Having now particularly described and ascertained the nature of the invention, and in what manner the same is to be performed,

What is claimed is:

1. In a filter color television tube having a neck and having a face plate with a criss cross series of colored bands, an electron beam source and means to sweep said beam so as to give an elongated bar and turn said bar so as to sweep said face plate at a predetermined angle to pass upon and along said bands and a diffraction fresnel lens grating positioned to screen out unwanted color values.

2. In a color television tube having a neck and having a face plate, an electron beam source and means to sweep said beam so as to give an elongated bar and turn said bar so as to sweep said face plate at a predetermined angle to pass upon and along said bands, said face plate having a plurality of criss-cross color lines at angles to each other and a diffraction fresnel lens grating positioned to screen out unwanted color values.

3. In a color television tube having a neck and having a face plate, an electron beam source and means to sweep said beam so as to give an elongated bar and turn said bar so as to sweep said face plate at a predetermined angle, said face plate having a plurality of red, blue and green lines at angles of 120° to each other, and a hexagonal arrangement fresnel lens member to screen out unwanted color values.

4. In a color television tube having a neck and having a face plate, an electron beam source and means to sweep said beam so as to give an elongated bar and turn said bar so as to sweep said face plate at a predetermined angle, said beam being swept so that its length in the direction of movement is from 3 to 10 times its width in the transverse to the direction of movement, and a hexagonal arrangement fresnel lens member to screen out unwanted color values.

5. A color television system comprising a face plate having a plurality of closely spaced differential color lines spaced at angles to each other, a source of an electron beam and means to elongate and turn said beam to sweep said lines at the predetermined angle, and a hexagonal arrangement fresnel lens member to screen out unwanted color values.

6. A color television system comprising a face plate having a plurality of closely spaced differential color lines spaced at angles to each other, a source of an electron beam and means to elongate and turn said beam to sweep said lines at the predetermined angle, said face plate consisting of a criss-cross color pattern and a fresnel lens arrangement.

7. In a filter color television tube having a neck and having a face plate, an electron beam source and means to sweep said beam so as to give an elongated bar and turn said bar so as to sweep said face plate at a predetermined angle and means to screen out unwanted color values, said means including a fresnel lens arrangement on the side of the face plate away from the electron beam source.

8. A color television tube with a polarizing filter comprising a tube with a cylindrical power source end portion and a divergent conical viewer end portion with a face plate having parallel bands of colored phosphors arranged in criss cross fashion at angles to each other, a set showing red, another set oblique to said first set showing green and a third set oblique to the other two sets showing blue and a fresnel lens positioned between the phosphor arrangement and the position of the viewer, a single electron beam source to sweep said bands and means to elongate said beam so that its length will be 3 to 10 times its width and to turn the direction of reciprocation of said beam so that it will pass along the bands the respective color of which is to be produced.

9. The tube of claim 8, said different colored bands being at angles of 120° to each other.

10. The tube of claim 8, the fresnel lens having a plurality of closely interlocked hexagon lens units, the sides of which are parallel to and extend in the same directions as said colored bands.

References Cited in the file of this patent

UNITED STATES PATENTS

1,724,298	Miller	Aug. 13, 1929
2,091,152	Malpica	Aug. 24, 1937
2,728,013	Tourshou	Dec. 20, 1955
2,807,737	Wright	Sept. 24, 1957
2,813,211	Sucher	Nov. 12, 1957