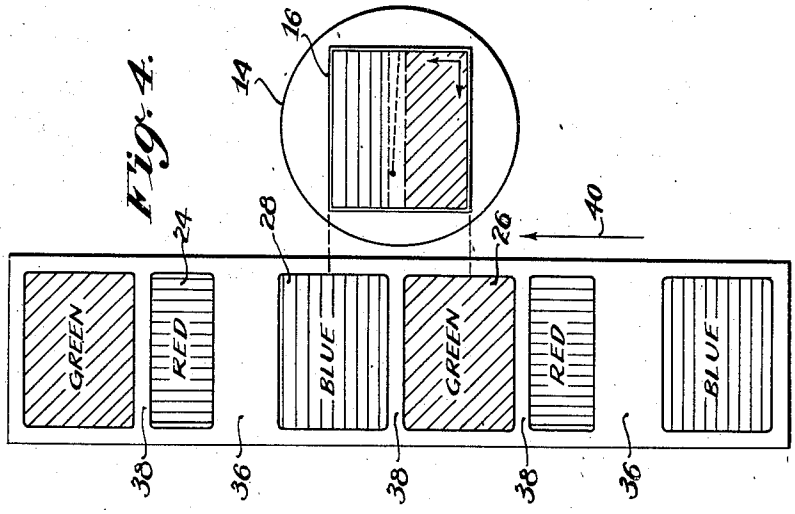
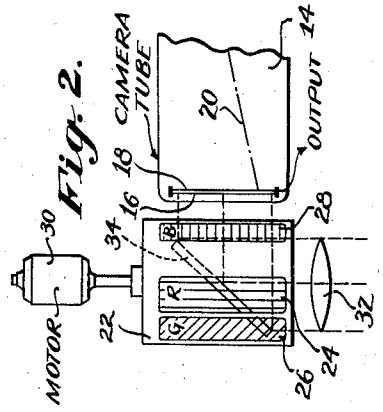
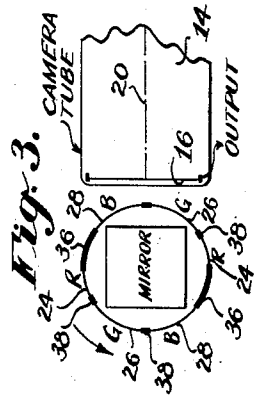
Oct. 28, 1947. F. J. SOMERS 2,429,849

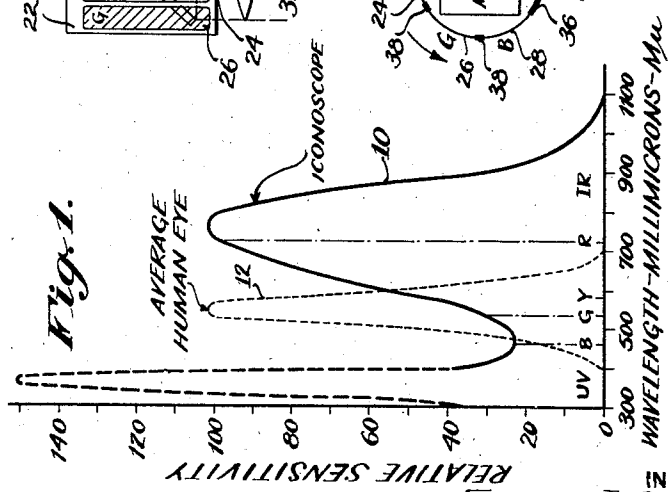
COLOR TELEVISION SYSTEM

Filed Sept. 15, 1945 2 Sheets-Sheet 1









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COLOR TELEVISION SYSTEM

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Fig. 6.

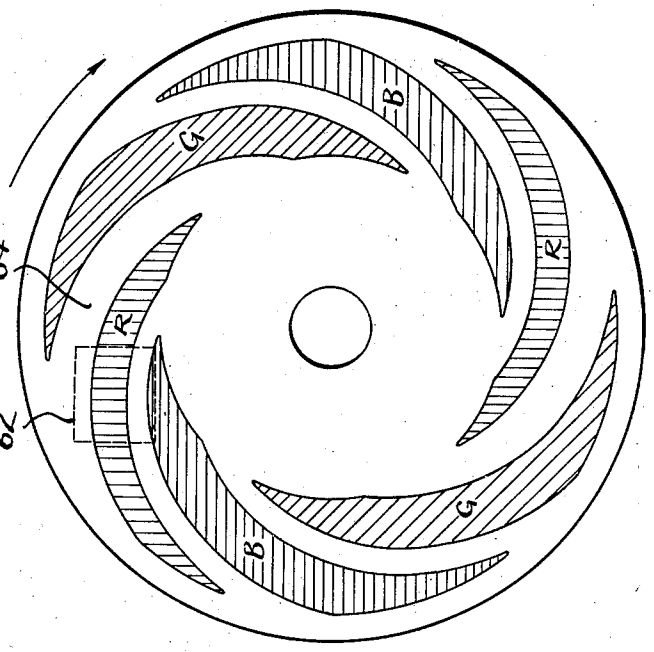
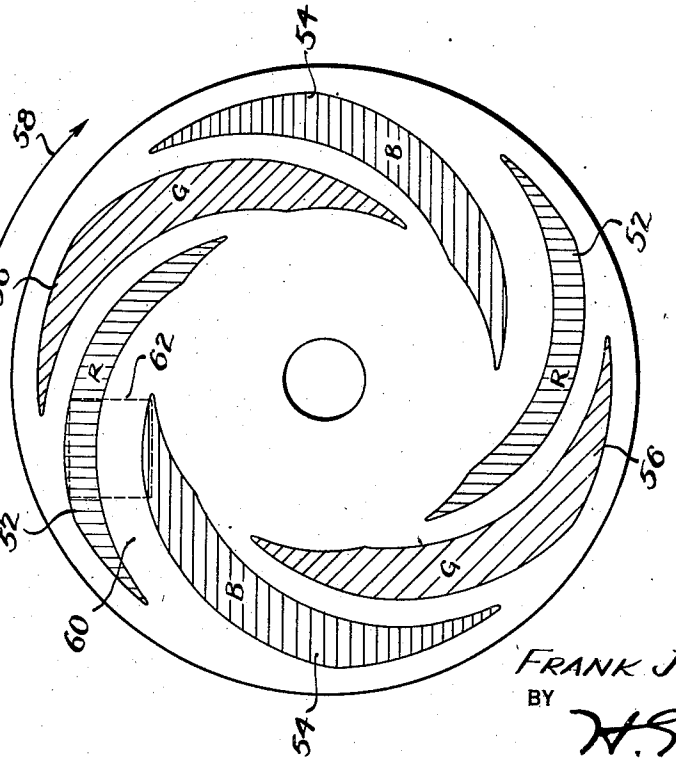


Fig. 5.



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COLOR TELEVISION SYSTEM

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Application September 15, 1945, Serial No. 616,619

25 Claims. (Cl. 178—5.4)

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This invention relates to an improvement in television systems and more particularly to an improvement in the operation of transmitter components used to provide sequential color television transmissions.

In the transmission of color television images, it is conventional to break-up the image into three colors, namely red, blue and green, and image or video signals representative of each of these component colors of which the original is formed are transmitted sequentially. In order to produce signals representative of the three selected component or primary colors, optical light filters are employed at the transmitter and these filters of appropriate red, blue and green component colors are sequentially interposed in the optical axis of the television camera or image pick-up tube. Light filters for such a purpose have been arranged in various manner but the more usual arrangements of the filters is in the form of a filter drum or filter disc. The filters that are normally used in a color television system are Wratten filters, Nos. 25, 47 and 58 for the red, blue and green respectively.

The loss of light intensity due to the necessity of using these filters for color separation makes it highly desirable to use a television camera or image pick-up tube having high sensitivity. For this reason, television camera or image pick-up tubes of the so-called storage type are generally employed. The light transmitting efficiency of the various color filters is not identical and, furthermore, the spectral response curve of the television camera or image pick-up tube for different colors is non-panchromatic and, in fact, with present tubes, is decidedly non-linear. The spectral response of the television camera tube may be altered or controlled in accordance with the choice of the photoelectric light responsive material that is employed, but, even at best, there is considerable deviation in the response to the television camera tube insofar as the particular individual colors are concerned.

Since the light transmitting efficiency of the optical light path including the filters is not uniform for all component or primary colors, and since the spectral response of the television camera tube is non-linear, the output image or video signals produced by the television camera tube corresponding to the three component colors do not bear the proper relative signal strengths to produce a desired and proper color balance in the reconstructed electro-optical images produced at a television receiver connected to receive the transmitted signals. To overcome this disadvantage and in order to produce a desired color balance at the television receiver, various circuit arrangements have been employed which operate in one manner or another to cyclically control the degree of amplification to which the signals representative of the various colors are subjected. Systems which require some form of electron switching or some form of intermittent or cyclic control of the gain of a video signal amplifier have already been proposed for this purpose.

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In the present invention a provision is made whereby it is possible to produce television image signals representing the various component colors which are more nearly properly related in signal strengths. This is accomplished broadly by controlling the amount of light of a particular color that is permitted to be projected upon the light responsive electrode of the television camera or image pick-up tube.

In some iconoscope television camera tubes of the storage type, the response for the red component color is materially greater than the response for the blue and green component colors. Accordingly, if color filter elements or segments of substantially uniform area are employed, the video signal output from the television camera tube would be materially greater for those signals representative of the red component than for the signals representative of the blue and green. In accordance with the present invention, the relative signal strengths of the signal representing the various component colors are made substantially proper by a choice in the size or area of the filter elements used. In other words, if the response of the television camera tube is much greater for the red component color, then the size or area of the red filter used at the television transmitter is reduced in order that the light responsive surface of the camera tube is exposed to an image through the red filter for a proportionately shorter length of time and accordingly a less intense electrostatic image is produced on the mosaic electrode of the television camera tube with the result that the signal strength of the signals representative of the red component color are reduced to a value that will give substantially proper color balance at a television receiver.

It is, therefore, one purpose of the present invention to provide in a television transmitter a series of color filters, the effective areas of which are chosen so as to produce substantially proper color balance at a television receiver.

Another purpose of the present invention re-

sides in the provision of a plurality of filters in a television transmitter in which the sizes of the filters are so chosen as substantially to compensate for the lack of uniformity in light transmitting efficiency of the filters and the lack of linearity in the spectral response of the television camera or image pick-up tube.

A still further purpose of the present invention resides in the provision of a color filter drum or disk in a television transmitter in which the effective areas of the various filters used in the drum or disk are so chosen that substantially proper color balance will be produced at a television receiver.

Various other purposes and advantages will become more apparent to those skilled in the art from the following detailed description particularly when considered in connection with the drawings, wherein:

Figure 1 shows curves used in explaining the operation of the present invention;

Figures 2 and 3 show a television camera or image pick-up tube and an associated color filter drum incorporating the present invention;

Figure 4 shows a development of the color filter drum shown in Figures 2 and 3; while,

Figures 5 and 6 show color filter disks incorporating the present invention for use in connection with a television transmitter.

For explaining the theory and operation of the present invention, Figure 1 shows the spectral response curve **10** of a television camera or image pick-up tube of iconoscope type. It must be pointed out that this curve, although representative of a particular light responsive electrode surface, is shown only by way of example and that the light responsive electrode surfaces used in various other television camera or image pick-up tube of storage type may, in fact, have somewhat different spectral response curves. The curve **10** is plotted to show the relative sensitivity of the light responsive electrode or photosensitive mosaic element as a function of the wave length of the light projected thereon where the wave length is measured in millimicrons ($m\mu$). As a matter of comparison, the response of the average human eye with respect to the spectrum is also shown in Figure 1 by curve **12**. By an inspection of curve **10** of Figure 1, it may be seen that the response of the light responsive electrode for actinic radiation having a wave length corresponding to red is materially greater than the response of that surface for radiations having a wave length corresponding to blue or green. Furthermore, it will be observed that the relative sensitivity of the electrode is not materially different insofar as the two colors blue and green are concerned, although of these two, the response of the surface of the tube referred to for one example is least for blue.

Figure 2 shows a portion of a television image pick-up or camera tube **14** which includes a light responsive target surface **16** with which is associated a mosaic electrode element **18**. The mosaic **18** is scanned by a narrow focused cathode ray beam represented by the dash-dot line **20** in order to produce video output signals. The construction of the television camera tube or the various elements contained therein form no part of the present invention and in fact, different types of television camera tubes may be used. The text "Television Engineering" by O. G. Frick published by McGraw-Hill Publishing Co., Inc., N. Y. in 1940, shows various types of suitable camera tubes.

Positioned in front of the television camera tube is a color filter drum **22** which carries red, green and blue component color filters **24**, **26** and **28** respectively. The color filter drum is rotated by means of a motor **30** or any other appropriate driving means. A lens system **32** is also provided for focusing the image of the objects to be televized upon the light responsive electrode **16**. In order to direct the image upon the light responsive electrode, a mirror or reflecting surface **34** is positioned inside the color filter drum. This mirror or reflecting surface remains stationary as the drum is rotated and rotation of the drum causes the filters to be successively interposed in the optical axis. In order that the speed of rotation of the color filter drum may not be excessive, it is conventional to utilize more than a single one of each of the three filters and in Figures 2 and 3 it will be observed that the filters are arranged in pairs positioned diametrically with respect to the color filter drum. Since two sets of color filters are employed about the periphery of the drum the speed of rotation of the drum is reduced to one-half of the color field repetition rate.

For maintaining the filters in position, "spokes" are provided about the periphery of the drum for providing a rigid support means for the filters and, furthermore, these spokes cast a shadow on the light responsive electrode of the television camera tube. It is desirable that the scanning operation be carried out in the shadow of these spokes since increased video signal strength results by such operation. Production of television image signals by scanning in the shadow of the spoke is shown and described, for example, in Schade application, Serial No. 376,770, filed January 31, 1941, and in Schade Patent No. 2,413,-075, issued on Dec. 24, 1946.

In accordance with the present invention, the effective area or color filter signals is not uniform for all the filters, but instead their effective areas, i. e., the distance that they extend around the periphery of the filter drum is chosen as an inverse function of the light transmitting efficiency of the filters and the response of the television camera tube. It will be observed, therefore, that the width of spokes or the opaque portions between the filters is not uniform and that the peripheral dimension of the filters is similarly not uniform. The red filters **24** extend around the periphery of the filter drum by an amount substantially less than do the blue and green filters **28** and **26** respectively. The opaque or spoke portions **36** that separate the red and blue color filters are, therefore, materially wider than are the spokes or opaque portions **38** that separate the other color filter segments.

For a better conception of the construction of the color filter drum, a development of the drum is shown in Figure 4 and with it is associated the television camera tube **14** and the light responsive surface **16**. The direction of movement of the color filters with respect to the camera tube is represented by the arrow **40**. The color sequence is, therefore, red, blue and green. The areas or the relative dimensions of the filters in the direction of motion is clearly apparent from an inspection of Figure 4 and it will be observed that the blue and green filters are substantially like size or area whereas the red filters have been reduced in size (in the dimension of the direction of travel) by an amount of approximately 50 percent. The ex-

tent of this reduction, which may be from 40 to 60 percent, for example, depends upon the spectral response curve of the particular light responsive surface employed together with the relative light transmitting efficiency of the various filters.

When such a filter drum is employed, it will be apparent that the length of time that the light responsive electrode is exposed to light transmitted through the red filter is materially less than the length of time that it is exposed to light transmitted through the blue and green filters. Accordingly, an electrostatic charge image of lower intensity will be produced upon the tube mosaic electrode for the red image than would be the case if a normal full-sized filter element were employed. Since the response of the television camera or image pick-up tube is greatest for actinic radiations having a wave length in the vicinity of the color red, then by properly reducing the effective size of the red filter element, or by properly proportioning the relative effective areas of the color filters, a series of television video signals may be produced which may be effective to cause the production of a substantially balanced color television image at a receiver without the necessity of in any way altering the relative signal strengths of the signals representing the various colors after once they have been generated.

The use of a color filter drum such as shown in Figures 2 and 3 results in a compact construction and has certain advantages, although such a construction is also undesirable in certain respects. When such a filter drum is employed, it is necessary to utilize a mirror or reflecting surface **34** (preferably a front surface reflecting mirror) which absorbs some light and correspondingly reduces the amount of effective light that is permitted to strike the light responsive surface. Furthermore, the necessity of placing the lens **32** at right angles to the light responsive surface results in an unsymmetrical mechanical design of the television camera proper. Furthermore, by reason of the relatively long path or space that intervenes between the lens **32** and the light responsive surface **16**, short focal length lenses cannot be readily employed. A further objection to the use of the drum resides in the fact that the width of the shadow cast by the spokes of the drum does not remain uniform over the entire light responsive surface **16** since the distance between the spoke and the light responsive surface is a function of the angular position of the drum. The shadow cast by the spoke is narrowest when the spoke is nearest the light responsive electrode, but this shadow is wider at both the top and the bottom of the light responsive electrode.

All of these disadvantages may be overcome through the use of a color filter disc such as shown in Figures 5 and 6. In both of these figures the color filter discs as shown incorporate the present invention and in each case, the discs include the three color filter elements arranged in sequence. The particular configuration of the color filter segments is such that each filter progresses in as nearly a vertical direction as is possible with respect to the light responsive electrode of the television pick-up tube.

In Figure 5 the red filter segments are shown at **52** while the blue and green filter segments are shown at **54** and **56**, respectively. The direction of rotation of filter disc is shown by the arrow **58**. It will be observed that the width of the red filters **52** is materially less than the width of the blue and

green filters and, accordingly, the spoke **60** between the red and blue filters is wider than the remaining spokes of the disc. The relative position of the light responsive electrode is represented by the dotted rectangle **62**. As the disc is rotated in a clockwise direction, the progress of the filters with respect to the light responsive electrode of the camera tube is from bottom to top since the vertical scanning is carried out in this direction. This is actually from top to bottom insofar as the optical image is concerned, since the image is inverted by the optical system. By proportioning the relative effective sizes of the filter elements of the disc as shown in Figure 5, for example, color television video signals will be generated which bear the proper relative intensity with respect to the various color components so that a substantially properly balanced color television image may be produced at a television receiver.

Figure 5 differs from Figure 6 only in that the wide spoke **64** of Figure 6 occurs between the green and red filters rather than between the red and blue filters as in Figure 5. It is more or less immaterial whether the reduction in size is made at the leading or trailing edge of the filter element and, in fact, it is possible to position the red filter segment such that substantially equal amounts are removed from each side, i. e., so that the spokes on adjacent sides of the red filters are substantially of the same width but of a width greater than the spoke between the blue and green filter elements.

If a disc such as shown in Figure 5 is employed and if the scanning operation is carried out in the shadow of the spokes, then the light responsive electrode will be in darkness for a longer period of time following an exposure to the red component color image and before the scanning operation takes place than will be the case with respect to any other color filter. During this interval, it is possible that some averaging of the electrostatic charge might take place although the extent of such an action will be small indeed. If it is desired to eliminate any such possibility a disc having a construction such as shown in Figure 6 could be used since in this instance, any particular point on the light responsive electrode is scanned by the cathode ray beam a predetermined time interval after ocultation by a spoke regardless of the width of that spoke. After an image corresponding to the green component color has been scanned, there is a time lag before the light responsive electrode is exposed to an image corresponding to the red component color. In any respect, the configuration of the disc should be such that the shadow produced by the spokes as the disc is rotated, travels parallel to itself from bottom to top across the light responsive electrode. This construction gives rise to a uniform output signal as the scanning progresses from left to right (for each individual line) because all areas included in the shadow have had the same exposure time, or, more precisely, the same charging time, under the influence of the color filter just preceding. By regulating the relative effective areas of the filters, the relative signal strengths of the video signals produced for the various component colors may be so controlled that substantially correct color balance will result in the image produced at a television receiver.

The same result cannot be accomplished by a change in the density of one of the filters while reclaiming substantially equal effective areas for all of the filters. A change in the density of a

filter alters its pass band characteristics but does not appreciably alter the amount of transmitted light in the region of maximum transmission. In color television it is desirable that certain pass band characteristics of the filters be retained in order to obtain best results and for this reason filter density changes or alterations cannot be used to accomplish proper color balance. A desired color balance of an image at a receiver can be obtained, however, by altering the relative sizes of the filters, as explained above.

I claim:

1. A color television transmitter for producing video signals representative sequentially of a plurality of different component colors of an object area including a television camera tube for converting optical light images into video signals, a plurality of light filter elements of different predetermined colors, means for sequentially introducing the filter elements into the optical light path of the camera tube, and means for establishing dissimilar effective areas of the plurality of filter elements.

2. A sequential color television transmitter wherein are produced video signals representative of a plurality of different component colors of an object area including a television camera tube for converting optical light images into video signals, an optical system for the pick-up tubes, a plurality of light filter elements of predetermined different colors, means for sequentially introducing the filter elements into the optical system of the camera tube, and means associated with said last named means for establishing different and dissimilar effective areas of the plurality of filter elements.

3. A sequential color television transmitter for producing signals sequentially representative of selected component colors of an object area including a television camera tube having a light responsive electrode upon which an electrostatic charge image is produced when an optical image is projected thereon, a plurality of light filters including at least one of each selected component color, means sequentially to introduce the individual component color filter elements into the optical light path of the television camera tube sequentially to produce electrostatic charge images individually representative of the said color components of an object area, and means for altering the effective area of one of the component color filter elements relative to other component color filter elements thereby to alter the intensity of the electrostatic charge image produced during the time interval that the said one filter element is in position in the optical light path of the camera tube.

4. A sequential color television transmitter for producing signals sequentially representative of red, blue and green component colors of an object area including a television camera tube having a light responsive electrode upon which an electrostatic charge image is produced when an optical image is projected thereon, a plurality of light filters including red, blue and green filter elements, means sequentially to introduce the filter elements into the optical light path of the television camera tube to sequentially produce electrostatic charge images individually representative of the red, blue and green components of an object area, and means to proportion the effective area of the red filter element with respect to the other filter elements thereby to alter the intensity of the electrostatic charge image produced during the time interval that the red filter element is in position in the optical light path of the camera tube.

5. A sequential color television transmitter for producing video signals sequentially representative of the plurality of different component colors of an object area including a television camera tube for converting optical light images into video signals, a plurality of light filter elements of different predetermined colors positioned on a rotatable color filter disc, means to rotate the disc to sequentially introduce the filter elements into the optical light path of the camera tube, and means incorporated as a part of the filter disc for modifying the effective area of the filter element of one particular color by a predetermined amount with respect to the effective areas of the other filter elements, whereby the sequentially produced video signals representing the component colors of the object area will bear the proper relative signal intensities to produce a substantially correctly color balanced image at a television receiver.

6. A sequential color television transmitter for producing video signals sequentially representative of the plurality of different component colors of an object area including a television camera tube for converting optical light images into video signals, a plurality of light filter elements of different predetermined colors positioned on a rotatable color filter disc, means to rotate the disc to sequentially introduce the filter elements into the optical light path of the camera tube, the effective areas of the plurality of different filter elements being so proportioned, with respect to each other, that the produced video signals sequentially representing the component colors of the object area, will be of the proper intensities relative to each other, to produce a substantially correctly color balanced image at a television receiver.

7. A sequential color television transmitter for producing video signals sequentially representative of the plurality of different component colors of an object area including a television camera tube for converting optical light images into video signals, a plurality of light filter elements of different predetermined colors positioned on a rotatable color filter disc, means to rotate the disc to sequentially introduce the filter elements into the optical light path of the camera tube, and means for proportioning the time intervals that the various filter element are in the light path so that the produced video signals representing the sequential component colors of an object area will bear the proper relative signal intensities to produce a substantially correctly color balanced image at a television receiver.

8. A color filter drum for use in connection with a sequential color television transmitter including a plurality of light filter elements arranged about the periphery of the drum, the colors of the filter elements sequentially differing in a predetermined order, and means for establishing the dimensions of the individual filter elements in the direction of rotation of the drum so that their effective areas are made unequal with respect to each other to result in the production of a substantially correctly color balanced image at a a television receiver.

9. A color filter drum for use in connection with a sequential color television transmitter including a plurality of differently colored light filter elements arranged about the periphery of the drum in substantially uniform spacing and in a predetermined order, opaque areas or spokes positioned between adjacent filter elements, and

means for so dimensioning the spokes in the direction of rotation of the drum such that the widths of the spokes between different filter elements are dissimilar, and accordingly the corresponding dimension of the plurality of filter elements are dissimilar, with respect to each other, whereby a substantially correctly color balanced image is produced at a receiver.

10. A color filter disc for use in connection with a sequential color television transmitter comprising a plurality of light filters of predetermined different colors positioned on said disc, said filter elements being substantially uniformly positioned on said disc, and means for proportioning the dimensions of the plurality of filter elements of different colors so that their effective areas are unequal, with respect to each other, thereby to compensate for unequal color response of the television transmitter.

11. A color filter disc for use in connection with a sequential color television transmitter comprising a plurality of spirally shaped light opaque spoke members, a plurality of different light filters of substantially spiral shape positioned between the spokes, said light filters being of different colors and arranged in a predetermined order, and means whereby the widths of the spiral opaque spokes are dissimilar so that the effective areas of the differently colored light filter elements are unlike with respect to each other.

12. A color filter disc for use in connection with a sequential color television transmitter comprising a plurality of spirally shaped opaque spoke members, a plurality of different light filters of substantially spiral shape positioned between the spokes, said light filters being of different colors and arranged in a predetermined order, and means for establishing the widths of the various opaque spokes and the effective areas of the differently colored filter elements so that they are unlike with respect to each other.

13. A color filter assembly for use in connection with sequential color television transmitter including a plurality of light filters of different colors arranged in a predetermined order with an opaque area intermediate each of the filter elements, said filter elements being arranged in substantially uniform displacement on said assembly, and means for establishing a non-uniform ratio of the size of the opaque portions to the adjacent filter elements.

14. A filter assembly for use in connection with a sequential color television transmitter including red, blue and green filter elements arranged in a predetermined order, opaque portions intermediate each of the adjacent filter elements, and means whereby the effective area of a filter element of one particular color is reduced by a predetermined amount over the effective areas of the filter areas of the filter elements of the other colors by an increase in the area of the opaque portion immediately adjacent the filter element of the said one particular color.

15. A color filter assembly such as defined in claim 14 in which the said immediately adjacent opaque portion of the assembly immediately follows the filter element of the said one particular color with respect to the direction of rotation of the assembly.

16. A color filter assembly as defined in claim 14 in which the said immediately adjacent opaque portion of the assembly immediately precedes the filter element of the said one particular color with respect to the direction of rotation of the assembly.

17. A movable color separator filter unit for presenting sequentially changing color versions of an optical image sequentially shifting from one color to another at a predetermined rate and through which images are directed along a predetermined optical path toward a light responsive surface, comprising a support unit having thereon a plurality of light transmitting filters each of a selected component color, each of said filters having an area of such size relative to each other area that the light passed therethrough to the light responsive surface in a selected unit time period substantially coinciding with the sequential shift from one color to another is such that the surface response to each component color of light is substantially uniform.

18. A movable color separator filter unit for presenting sequentially changing color versions of an optical image and through which images are directed upon a light responsive electrode along a predetermined optical path across which path the filter unit is arranged to move at a substantially uniform rate, comprising a support member having thereon a plurality of light transmitting filters of different selected component colors, each of said filters having an area of such size relative to each other area that the light passed therethrough to the light responsive surface is such that the surface response to each component color of light is substantially uniform.

19. A movable color separator filter unit for presenting sequentially changing color versions of an optical image and through which images are directed along a predetermined optical path toward a light responsive surface across which path the filter unit is arranged to move at a substantially uniform rate, comprising a support assembly having thereon a plurality of light transmitting filters of different selected component colors, each of said filters having an area of such size relative to each other area that the light passed therethrough to the light responsive surface during the time that each is in the light path is such as will produce substantially uniform response at the light responsive surface for each component color.

20. The method of operating a sequential color television transmitter in which a television camera tube having a light responsive electrode is employed for converting an optical image into an electrostatic charge image and in which a plurality of light filters in the optical light path of the camera tube to produce electrostatic charge images representative of the different component colors of an object area, and dimensioning the effective areas of each of the plurality of filters relative to each other so that they are dissimilar by predetermined amounts thereby to alter the relative time intervals during which the light responsive electrode is exposed to light transmitted through the said filters.

21. The method of operating a sequential color television transmitter in which a television camera tube having a light responsive electrode is employed for converting an optical image into an electrostatic charge image and in which a plurality of light filters of predetermined different colors are provided which comprises the steps of sequentially introducing the light filters in the optical light path of the camera tube to sequentially produce charge images representative of the color content of an object area for the different filters used, and selecting the effective areas

of the plurality of filters so that they are dissimilar by predetermined amounts.

22. The method of operating a squential color television transmitter in which a television camera tube having a light responsive electrode is employed for converting an optical image into an electrostatic charge image and in which a plurality of light filters of predetermined component colors are provided which comprises the steps of sequentially introducing the light filters in the optical light path of the camera tube to sequentially produce charge images representative of the different component colors of an object area, and selecting different relative time intervals that the light responsive electrode is exposed to an optical image transmitted through the various different filters.

23. The method of operating a sequential color television transmitter in which a television camera tube is employed for converting optical light images into a series of video signals and in which a plurality of light filters of different predetermined colors are provided which comprises the steps of sequentially positioning the light filters in the optical light path of the television camera tube, directing light from an object area through the filters as they are sequentially interposed in the light path so that video signals are produced corresponding sequentially to the predetermined colors of the object area, and selecting the duration of time that a filter of a particular color is interposed in the light path with respect to the duration of time for the other filters whereby the relative intensity of the video signals representing the one particular color will be altered with respect to the intensity of the signals representing the other component colors.

24. The method of operating a sequential color television transmitter in which a television camera tube is employed for converting optical light images into a series of video signals and in which a plurality of light filters of different component

colors are provided which comprises the steps of sequentially positioning the light filters in the optical light path of the television camera tube directing light from an object area through the filters as they are sequentially interposed in the light path so that video signals are produced corresponding sequentially to the component colors of the object area, and determining the duration of time that a filter of a particular color is interposed in the light path with respect to the duration of time for the other filters whereby the relative intensities of the video signals representing the different component colors of the object area will be such that a substantially properly balanced color image will be produced at a receiver.

25. The method of operating a sequential color television transmitter in which a television camera tube is employed for converting optical light images into a series of video signals and in which a plurality of light filters of different component colors are provided which comprises the steps of sequentially positioning the light filters in the optical light path of the television camera tube directing light from an object area through the filters as they are sequentially interposed in the light path so that video signals are produced corresponding seqnentially to the component colors of the object area, and selecting different durations of time that the different light filters are interposed in the light path whereby the relative intensity of the video signals representing the different component colors will be altered.

FRANK J. SOMERS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,193,722	Hardy	Mar. 12, 1940
2,378,746	Beers	June 19, 1945