Oct. 21, 1941. A. N. GOLDSMITH 2,259,884

COLOR TELEVISION SYSTEM

Filed Oct. 18, 1938 2 Sheets-Sheet 1

Fig. 1

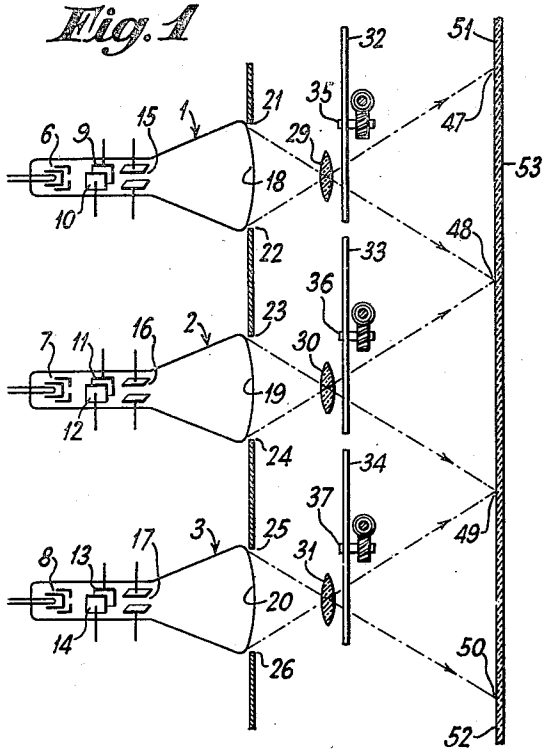


Fig. 3

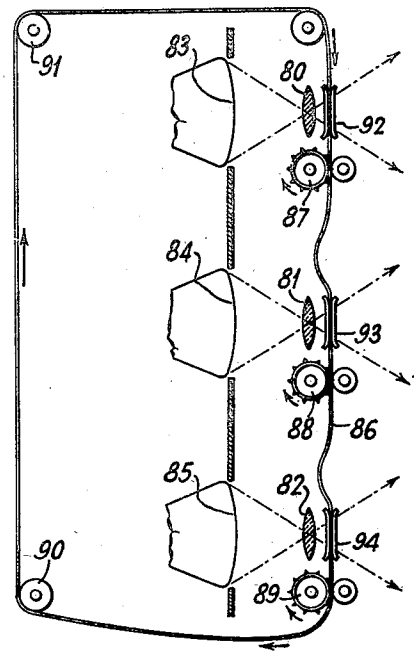


Fig. 2

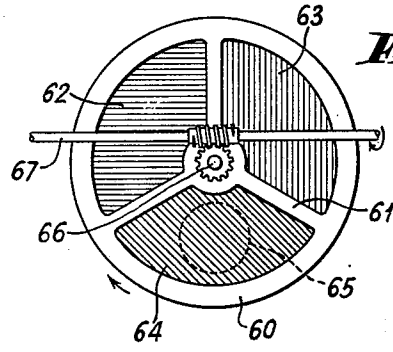
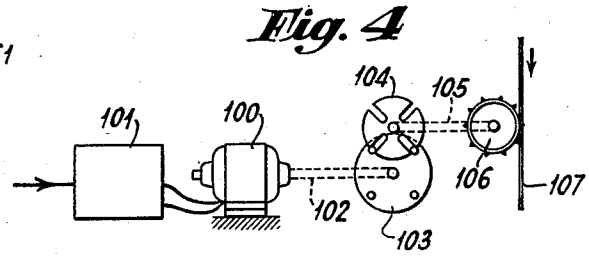


Fig. 4



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Fig. 5

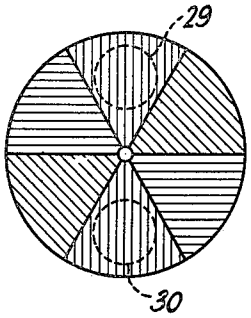


Fig. 9

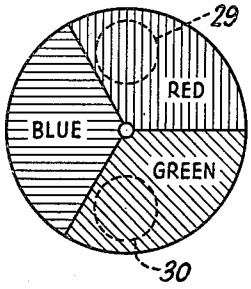


Fig. 6

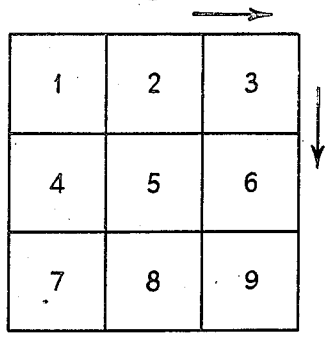


Fig. 7

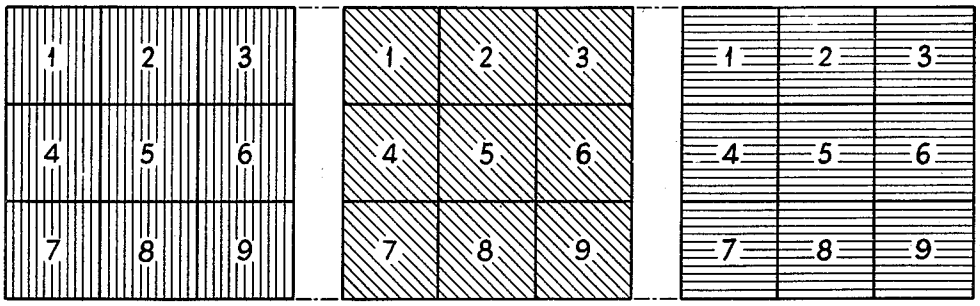
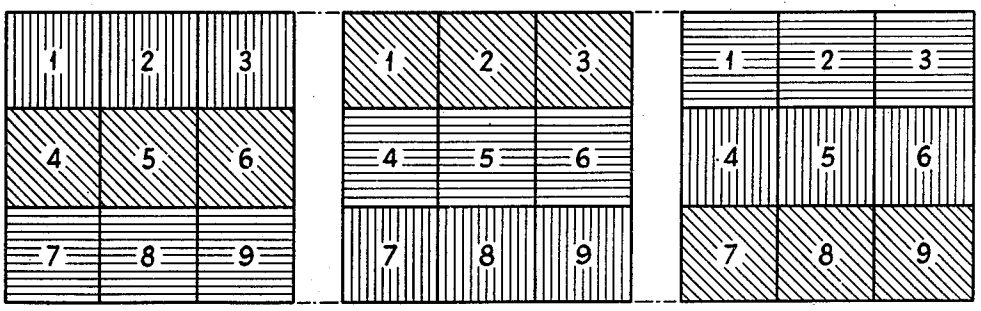


Fig. 8



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UNITED STATES PATENT OFFICE

2,259,884

COLOR TELEVISION SYSTEM

Alfred N. Goldsmith, New York, N. Y.

Application October 18, 1938, Serial No. 235,557

24 Claims. (Cl. 178—5.2)

My invention relates in general to the production of color television pictures of considerable dimensions. The arrangement particularly relates to color television production wherein there is used an array of elements such as kinescopes which are adapted each to project a portion of the picture, and to the ways and means of reconstructing these sectional portions into a color television picture.

There has been shown in my co-pending application, Serial No. 258,598, filed Feb. 27, 1939, an arrangement whereby a plurality of projecting kinescopes each reconstruct a sectional portion of the complete optical image and reference should be had thereto.

It is highly desirable in the reconstruction of a television image that the reconstructed view be of considerable size. Magnification of the image from a single "kinescope" is limited necessarily because the total light flux produced by any single kinescope of economic design when projected onto a large area is too feeble to be of any considerable value at the present time.

Accordingly, it is one of the objects of my invention to provide an arrangement which will produce a large size picture when projected, and this is done by utilizing a plurality of kinescopes each of which reproduces a sectional area of the picture.

In addition to the formation or reconstruction of a television image having comparatively large dimensions, it is also desirable to simulate to the greatest possible extent the natural colors of the image being transmitted and, accordingly, it is another of the objects of my invention to provide a device whereby a television picture may be reconstructed in its natural colors.

Again, in addition to the desirability for reconstructing the picture in its natural colors it is also highly desirable that the apparatus for accomplishing this result shall not be too complex in nature and, accordingly, it is another of the objects of my invention to provide an arrangement whereby a television picture may be reconstructed in its natural colors by a mixture in suitable proportion of three or more primary colors. It should be realized however that this is not a limitation as, for instance, a four-color method might be used in an additive color arrangement; and for some purposes, a two-color method may be acceptable.

In the reconstruction of the television image, color filters may be used in order to reconstruct the component colors. These filters of necessity must operate in proper relationship to the transmitters. It is highly desirable that instantaneous accuracy of speed in driving these filters should not have to be maintained and, accordingly, it is another of the objects of my invention to provide a system in which the filters may have a fair tolerance of speed variation and still reconstruct the image accurately.

Accordingly, the objects of my invention are:

1. To provide an arrangement which will produce a large size color picture when projected.

2. To provide a device whereby a television picture may be reconstructed in its natural colors.

3. To provide an arrangement whereby a television picture may be reconstructed in its natural colors by a mixture in suitable proportion of two or more primary colors.

4. To provide a system in which the filters have a fair tolerance of speed variation and still reconstruct the image accurately.

My invention in general comprises providing a scanning arrangement for scanning a complete television image, and by means of appropriate color filters developing impulses representative of the color values of the image. The receiver comprises a plurality of projecting kinescopes in a single array, each kinescope reconstructing a sectional part of the picture. The kinescopes are sequentially energized by signals from the transmitter and thus form a black and white image representation of the color contrast. Interposed between the screen on which the image is projected and each of the kinescopes is a color filter bearing an appropriate number and arrangement of colors. Light from the kinescope passes through the color filter which is opposite the kinescope for any particular interval of time during which it is energized, and thus the black and white picture representation of the color contrast passes through the color filter to give the correct color contrast for any single color. The filter is so arranged that the correct color filter passes in front of any kinescope at the time when that particular kinescope is reproducing a black and white picture indicative of the contrast or delineation of that particular color at the transmitter. Since when using three kinescopes, for instance, any one of the kinescopes is reconstructing only one-third of the time, it will be seen that adequate time is allowed for passing the correct filter in front of the correct kinescope before that particular kinescope again beings to form a contrasting color section of the picture.

My invention will be understood by reference to the drawings in which

Fig. 1 shows one embodiment of my invention,

Fig. 2 shows a representative color filter arrangement,

Fig. 3 shows an alternative form of my invention using a continuous color filter feed,

Fig. 4 shows an arrangement for intermittently feeding the color filters.

Fig. 5 shows a multi-sectioned three color filter arrangement,

Fig. 6 shows schematically the sectionalizing of the complete view of the image transmitted or received,

Fig. 7 shows one sequence of color scanning for the entire image, and

Fig. 8 shows another sequence of scanning of the complete color image.

Fig. 9 shows a single sectioned three-color filter arrangement.

Referring to Fig. 1, there are shown three kinescopes identified as 1, 2 and 3 respectively having electron gun structures 6, 7 and 8 respectively, and deflecting means 9, 10; 11, 12; and 13 and 14 respectively for a single coordinate, and 15, 16 and 17 respectively for deflection of the cathode ray beam of the other coordinate. Optical images or sections thereof in each may be reconstructed by impingement of the cathode ray beam on the screen which in this instance is located at the end of the tube, the screen being identified in tubes 1, 2 and 3 as 18, 19 and 20 respectively. Masking means for each of the kinescopes is provided with appropriate apertures, the edges of which are identified as 21 and 22 around the face of tube 1, 23 and 24 around the face of tube 2, and 25 and 26 around the face of tube 3. It will be appreciated of course that three kinescopes are shown purely by way of example and that a number of such elements might be used in this fashion.

Positioned immediately adjacent the fluorescing screen of each of the kinescopes is a projecting lens, in this case three being shown identified as 29, 30 and 31 respectively for projecting the image formed on the screen of tubes 1, 2 and 3 respectively.

Positioned between the lenses 29, 30 and 31 are three composite optical color filter arrangements 32, 33 and 34 which are interposed between the lenses and the screen on which the picture is projected. These filters will be shown more in detail in Fig. 2 and are shown schematically as mounted on shafts 35, 36 and 37 which are driven by an appropriate prime mover. The direction of rotation of the composite color filters is indicated by the arrow in each case but, of course, this is purely a matter of choice and is shown only for illustrative purposes. The directions of rotation need not be the same but if they are not the same, the sequence of primary colors of the various filters must be altered correspondingly.

Each of the sections reconstructed by the individual kinescopes is projected to form a complete picture by means of projecting each individual image through the indicated optical systems onto the translucent screen 53 upon which appear the adjacent and juxtaposed component picture sections 47, 48; 48, 49; and 49, 50.

The operation of the device in accordance with Fig. 1 is as follows: It may be assumed that the transmitter inconoscope is scanning the red component picture, and that this picture is being transmitted with bi-directional scanning in the usual way. Since three kinescopes are illustrated each of the kinescopes will be energized and will reconstruct one-third of the picture. During at least the time that the top one-third of the picture is thus scanned, that is to say, the section which will be reconstructed by the cathode ray tube 1, filter 32 must be in such a position that a red image is projected onto the screen 51, 52 by the kinescope 1. Of course, if a row of kinescopes is used which are placed beside the kinescope 1 so as to form a horizontal row of kinescopes the color filter in front of each should be red at this particular time.

When the scanning apparatus is scanning the second-third of the picture, the color filter positioned between the kinescope 2 and the screen must be red. As in the case of the first-third of the picture, if a horizontal row of kinescopes is used, then a red filter should be positioned between these kinescopes and the screen on which the picture is projected. Similarly, when the bottom-third of the picture is being scanned, the filter in front of kinescope 3 must be in the red position. During this time a black and white image has been formed by the kinescopes, but the contrast values of the image represent the red components of the picture at the transmitter.

It will be apparent, therefore, that each kinescope is contributing to the complete picture only one-third of the scanning time and, therefore, is "dark" with respect to the picture for two-thirds of the scanning time. It will be seen, therefore, that adequate time is allowed to change the color filter which is interposed between any kinescope and the screen on which the view is projected from one color to another. This is very important from a practical standpoint since due provision is made and adequate time is allowed for correct filter changing. Naturally the greater the number of rows of kinescopes used, the greater will be the time changing interval as, for instance, if instead of using three rows of kinescopes as illustrated here, five rows were used, then any kinescope would contribute to the picture only one-fifth of the time and would be "dark" four-fifths of the time. The advantage is always at least two to one as compared to the single picture scanning and single kinescope reproduction. The choice of three horizontal rows as illustrated here has been pure arbitrary and a number of arrays or rows of kinescopes might be used.

If it is assumed, as illustrated here, that three horizontal rows of kinescopes is used, then naturally the kinescope identified as 2 will be energized at a time different from that of kinescopes 1 and 3. Accordingly, it will be seen that the phase of any particular color filter which is used in conjunction with row 2 of the kinescopes must differ from that of the same color which is used in connection with rows 1 and 3. The preferred arrangement is one in which the filler entry of any particular color slightly precedes the beginning of the component picture scanning and contribution in the corresponding row of kinescopes. Filter 32 will lead filter 33 in phase, and a filter 33 will lead filter 34 in phase at each case by substantially the length of time required for the scanning process to be completed in a given line of kinescopes, or as illustrated in the drawing in Fig. 1, one-third of the time of scanning a complete picture. All filters in a horizontal row in this illustration are preferably and substantially in phase as to color entry and exit. As has been brought out, the position or changing of any filter from one primary color to another takes place during the

time when the cathode ray tube is "dark," or during the return frame. It is obvious that the filters 32 and 33 of this figure might at least for pictures of two rows be combined into a single rotary color wheel or film filter, the wheel or film having either three or a multiple of three color segments in accordance with this illustration (see Fig. 5). The film might be so arranged as to intercept a filtering light from two kinescopes in a vertical column with appropriate phasing of the entry and exit of each color. Also, a given color wheel may control the filtering of a horizontal row of two component picture beams.

Referring to Fig. 2, there has been shown in schematic form a plane view of a composite color filter arrangement having three primary color filters, and this form of composite color filter is such as has been illustrated as 32 in Fig. 1. The rim or holder 60 has in this case three radial arm members 61 and has mounted therein between the members 61, which act as both a holder and a divider, three color filters 62, 63 and 64. These colors might, for instance, be red, green and violet arranged in this order or any other desired order. The projecting lens is illustrated schematically as 65, and this lens would correspond to the lens 29, for instance, of Fig. 1. The composite filter is mounted on an appropriately geared shaft 66 which may be driven by a gear shaft member 67. It will be appreciated that this shaft 67 may conceivably be arranged to be common to all of the filters of a single horizontal row in order to maintain correct phase relationships and, in addition, the shaft might be interlocked with the shafts driving the color filters co-operating with the other rows of kinescopes so as to maintain correct phase relationships between all of the filters in all of the rows. It should be appreciated, of course, however that these filters might be driven separately.

The arrangement as shown has definite advantages. The shafts may be driven by a phonic, i. e., synchronous type of motor, for instance, in suitable time relationship, and the phonic motor may be actuated or controlled as to speed by the incoming vertical scanning or framing synchronizing signals which are transmitted at the end of each vertical screen. By making the color wheels sufficiently large and correctly phasing the filters with relation to the scanning operation in each row of kinescopes, it becomes unnecessary to have extreme instantaneous accuracy of speed in the filter drive motor. All that is necessary is that the average speed shall be accurate, which naturally will occur since cumulative errors in speed are avoided by the use of the incoming synchronizing signals for speed control. It will also be seen that with an arrangement of this nature, a fair tolerance in phasing is allowable, dependent on the position of the color wheels in the optical system.

Referring to Fig. 3, there is shown another embodiment of my invention in which a differing type of color filter is illustrated. In this figure, the color filters are formed on a continuous loop of film and are sequentially passed by each row of kinescopes. In this illustration, there is shown projection lenses 80, 81 and 82 respectively which project the image formed on the fluorescing screen of kinescopes 83, 84 and 85 which project along the paths illustrated by the dotted lines. The continuous loop of film 86 is driven by sprocket members 87, 88, and 89. The film may then pass over idler rollers 90 and 91 which contain guides not illustrated herein. The filter sections of the film are in general of equal length and follow a definite color sequence. The sprockets 87, 88, 89 which draw the film forward in the proper sequence cause the film to be passed through film gates 92, 93 and 94 respectively, these gates being adapted to form a frame aperture through which the image formed along the optical paths may be passed and projected onto the screen so as to form a complete picture. The rotation of the sprockets may be as shown, although naturally this is a matter of choice and the direction is shown purely for purposes of illustration and is indicated by the arrows on the drawings. When the sprockets are driven in this direction, the movement of the film will be in the direction as shown by the arrows adjacent the film. Precautions should be taken to drive and support the film filter only at its edges to avoid scratching its surface.

The color filter film may be drawn forward either in continuous or intermittent fashion, and the arrangement in accordance with Fig. 4 shows an arrangement for drawing the film intermittently. In this arrangement, the driving motor 100 whose speed is controlled by the framing impulses from the receiver 101 is arranged having its drive shaft 102 co-operatively associated with a driving and a driven cam 103 and 104 forming a Geneva movement. The driven cam 104 is joined through shaft 105 to a sprocket member 106 for drawing the film 107 intermittently past the film gates as illustrated in Fig. 3.

While the phase displacing of the filters in a vertical sense, that is to say, the difference in phase between the filters cooperating with one row of kinescopes and those of another row is important in such an arrangement as that shown in Fig. 1 where the filter wheels are rotated, it is not as important in the case of the intermittently changing filters as illustrated in Fig. 4 since phase displacement is inherently taken care of in this arrangement.

It should be appreciated that I am not restricted to rotary colored discs, translational color areas or the like in this disclosure of the utilization of a series of color filters over component picture areas in phase displaced vertical relationship and equi-phased horizontal relationship. Mechanical optical or electro-optical methods of color filtering may be used.

The sequence of filters may be manually synchronized by slippage and, therefore, a change in the phase of the filter at the kinescope with respect to that at the scanner. This may be accomplished by providing a switch arrangement which will momentarily interrupt the supply current to the phonic driving motor. In general, such slight interruption brings the filters into the correct relationship with those at the transmitter and this is readily determinable by the correctness of the reproduced colors.

Alternatively to the manually synchronizing means indicated above, there might be provided three differing types of vertical synchronizing signals each of which corresponds to a frame of the optical image scanned through a particular color filter. These three types would be adaptable to the system as illustrated in Fig. 1. Of course, where a greater number of vertical rows of kinescopes were used the number of synchronizing signals might be varied accordingly. The types of vertical synchronizing signals will occur sequentially in a repeated cycle, and the phonic motor with its associated circuits may be so ar-

ranged that it will "lock in" only in correct relationship with the indicated scanning color of the particular incoming frame.

Still further, one extra or modified vertical synchronizing signal corresponding to the scanning of a frame behind a particular color of filter at the transmitter might be provided, and at the receiver the motor might be locked in any suitable relationship to the particular filter in question, and thus the other two filters would automatically be driven in correct relationship.

Referring to Figs. 5 and 9, there is shown schematically two-disc type of filters. In one of the filters there are six segments, there being three pairs of segments, each pair formed of one component color. In this case, there has been illustrated red, blue and green, and the numerals 29, and 30 illustrate how the same filter might be used opposite two reproducings tubes 29 and 30. The three segment arrangement illustrated in Fig. 5b might readily be used where a plurality of scanning means were used for simultaneously energizing the tubes 29 and 30 with component sections of the picture.

Referring to Fig. 6, there is shown schematically the sequence of scanning using nine cathode ray tubes. As shown in Fig. 7, the image might be scanned completely in its red color and then in green, and then in blue or, as illustrated in Fig. 8, the scanning might be arranged so that instead of scanning a complete image with a single color, a single bank of cathode ray tubes might form one color of reproduction while the next bank of tubes would form a different component color reproduction.

Fig. 8 shows such an arrangement where the tubes 1, 2 and 3 are first energized and reproduce a red section; the tubes 4, 5 and 6 reproduce a green section; and the tubes 7, 8 and 9 reproduce a blue section. On the next complete scanning of the image, the tubes 1, 2 and 3 have now a green filter arranged between the tubes and the plane of viewing, and tubes 4, 5 and 6 are reproducing a blue section, and tubes 7, 8 and 9 reproduce a red section. The filters move and tubes 1, 2 and 3 then reproduce a blue section, tubes 4, 5 and 6 reproduce a red section, and tubes 7, 8 and 9 reproduce a green section. Hence, with the ordinary single scanning means, it takes three complete scannings of the optical image at the transmitter to reproduce in color a three component color picture at the receiver. It will be appreciated that there may be departures from the particular arrangement shown which are without the spirit and scope of my invention and I consider myself fairly entitled to all of these departures which may fall within the spirit and scope of the appended claims.

What I claim is:

1. A color television apparatus comprising means for scanning an optical image, means for transmitting electrical energy representative of the color components of said optical image, means for reproducing said optical image comprising a plurality of reproducing means for reproducing a series of contiguously positioned partial image areas arranged in rows and columns of said image, a plurality of said reproducers producing sections which when juxtaposed form the complete image, and means for translating said reproduced sections into color sections representative of said transmitted signals.

2. A color television apparatus comprising means for scanning an optical image, color filter means associated with said scanning means for developing electrical energy representative of the color values of said optical image, means for receiving said energy, a plurality of image reproducing means for reproducing a series of contiguously positioned partial image areas arranged in rows and columns of said complete image, a plurality of said reproducers producing sections which when juxtaposed form the complete image, a plurality of color filter means associated with said plurality of image reproducing means, and means for operating said filters synchronously with respect to the color filters at the transmitter and with respect to each other.

3. A color television system comprising means for scanning an optical image, color filter means associated with said scanning apparatus for sequentially breaking down said optical image into its color components whereby the signals developed in said scanning apparatus are representative of the color value of said image, a plurality of cathode ray tubes for reproducing a series of contiguously positioned partial image areas arranged in rows and columns of the optical image, means for projecting the image formed on said tubes whereby the complete optical image is formed by the juxtaposition of the images of a plurality of said tubes, a plurality of color filter means positioned between said cathode ray tube and the plane of viewing of the image, and means for operating said color filters at the receiver synchronously with the filter means at the transmitter and with each other.

4. Apparatus in accordance with claim 3 wherein said color filters each comprises a disc divided into a plurality of color sections.

5. Apparatus in accordance with claim 3 wherein said color filters each comprises a continuous strip divided into color sections and which is passed between the reproducing tube and the plane of view synchronously with the filters at the transmitter.

6. Apparatus in accordance with claim 3 wherein all of said color filters at the receiver are operated from a single driving means whereby synchronism is definitely maintained between all of the filters.

7. A color television system comprising means for scanning an optical image, color filter means associated with said scanning apparatus for sequentially breaking down said optical image into its color components whereby the signals developed in said scanning apparatus are representative of the color values of said image, a plurality of cathode ray tubes adapted to reproduce a series of contiguously positioned partial image areas of the optical image, means for projecting the image formed on said tubes whereby the complete optical image is formed by the juxtaposition of the images of a plurality of said tubes, a plurality of disk color filter means positioned between said cathode ray tubes and the plane of viewing of the image, motor means, and a single drive shaft means operatively associated with said motor means and all of said color filter means for operating said color filters synchronously.

8. Apparatus in accordance with claim 3 wherein said color filter means each comprises a disk divided into a plurality of color sections and wherein there is provided an individual synchronous motor means for rotating each of said color disks.

9. Apparatus in accordance with claim 3 wherein said color filters each comprises a continuous strip divided into color sections and wherein there

is provided in addition means for passing said strip between the reproducing tubes and the plane of viewing in such fashion that all images projected through said strip at any instant are formed in the same color.

10. Apparatus in accordance with claim 3 wherein said color filters each comprises a continuous strip divided into color sections and wherein there is provided in addition means for passing said strip between the reproducing tubes and the plane of viewing in such fashion as to form a cyclic recurrent progressively changing sequence of colored partial image areas.

11. In a television reproducing system, a plurality of cathode ray tubes for reproducing contiguously positioned partial image areas of the image to be reproduced, means for projecting said partial image areas onto a viewing plane, color filter means comprising a continuous strip of transparent material divided into color sections, said strip being interposed between said cathode ray tubes and the viewing plane, motor means, a Geneva movement, means for driving said Geneva movement by said motor means and sprocket means engaging said continuous strip for intermittently moving said strip, said sprocket means being driven by said Geneva movement.

12. In a television reproducing system, a plurality of cathode ray tubes for reproducing contiguously positioned partial image areas of the image to be reproduced, means for projecting said partial image areas onto a viewing plane, color filter means comprising a plurality of disks, each divided into a plurality of color sections, gear means connected to each of said disks, motor means, worm gear means positioned in driving relationship with each of the gear means connected to said color disks and means for driving said worm gear means by said motor means.

13. In a television system, a plurality of cathode ray tubes for reproducing contiguously positioned partial image areas of the optical image to be reproduced, means for projecting said reproduced partial image areas onto a viewing plane, color filter means interposed between said cathode ray tubes and said viewing plane, and means for synchronously operating all of said color filter means whereby all of said reproduced partial image areas simultaneously reproduce the same color component of the image to be reproduced.

14. In a television reproducing system a plurality of cathode ray tubes for reproducing contiguously positioned bi-dimensional partial image areas of a complete viewed image to be reproduced on a viewing plane, color filter means comprising a strip of transparent material divided into sections of predetermined and independent colors repeating throughout the strip, said strip being interposed between said cathode ray tubes and said viewing plane, and means for moving said strip relative to said cathode ray tubes at a rate such that said images are reproduced in a substantially flickerless manner and appear in the viewing plane in substantially natural color.

15. Apparatus in accordance with claim 14 wherein the movement of the color filter strip is intermittent.

16. In a television system, a plurality of cathode ray tubes for reproducing contiguously positioned bi-dimensional partial image areas of a combined bi-dimensional optical image to be produced on a viewing plane, color filter means interposed between said cathode ray tubes and said viewing plane and means for synchronously operating all of said color filter means whereby each of said reproduced partial image areas reproduces a predetermined color component of the image to be reproduced, and all of said partial image areas on said viewing plane have the color filter means interposed between said areas and said cathode ray tubes moved simultaneously relatively thereto, whereby said reproduced image appears in substantially natural color.

17. Apparatus in accordance with claim 14, wherein the color sections formed in said continuous strip of transparent material are formed in a cyclically repeating sequence of predetermined primary colors.

18. A color television reproducing apparatus for reproducing transmitted signals indicative of the color components of an optical image comprising a plurality of reproducing means for reconstructing a series of contiguously positioned partial image areas of said image arranged in rows and columns, a plurality of said reproducers producing sections which, when juxtaposed, form the complete image, and means for translating said reproduced sections into color sections representative of the received signals.

19. A color television reproducing apparatus for reproducing transmitted signals indicative of the color components of an optical image comprising a plurality of image reproducing means for reconstructing a series of contiguously positioned partial image areas of said complete image, a plurality of said reproducers producing sections which, when juxtaposed, form the complete image on a viewing plane, a plurality of color filter means interposed between said plurality of image reproducing means and said viewing plane, and means for operating said filters synchronously with respect to the color filters producing said received signals and with respect to each other whereby said reproduced image is formed in substantially natural color.

20. Apparatus in accordance with claim 19, wherein said plurality of image reproducing means comprises a plurality of cathode ray tubes.

21. A television image reproducer system having a plurality of cathode ray image reproducing tubes, each having an image target area for reproducing complete partial images of a field of view adapted to be projected in a pattern for viewing in a viewing plane, a color filter strip having successive areas thereof formed in a plurality of cyclically repeating sequences, each sequence including a predetermined number of separate primary color filters, means for intermittently moving the color filter strip areas relative to each of the image reproducing tubes and in a plane intermediate the target areas of the image reproducing tubes and the predetermined observation plane to shift the color of the filter strip in a predetermined sequence intermediate the initially produced and the finally produced image, and means for producing the several partial image areas upon the observation plane in such relationship that at least one boundary of each color field is contiguous upon the observation plane and the resulting optical image there observable appears in substantially natural color.

22. Apparatus in accordance with claim 21, wherein said target areas are located substantially co-planarly.

23. A color television apparatus for reproducing an optical image comprising means for receiving electrical energy representative of the color components of said optical image, a plurality of optical image reproducing means each of which reproduces a partial image area of the complete optical image representative of one color component thereof, all of said reproducing means reproducing the primary color components of the complete optical image in a series of contiguously positioned partial image areas arranged in rows and columns and color filter means interposed between said reproducing means and the plane of image observation, said color filter means comprising a continuous flexible endless strip of transparent material of a length which is long relative to the width thereof and having the several sections thereof of predetermined primary colors.

24. Apparatus in accordance with claim 23 wherein the continuous flexible endless strip is divided into areas of progressively changing colors having a cyclic recurrence.

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