

June 20, 1939.

R. F. THIEME

2,163,530

COLOR MOTION PICTURE SYSTEM

Filed March 27, 1936

3 Sheets-Sheet 1

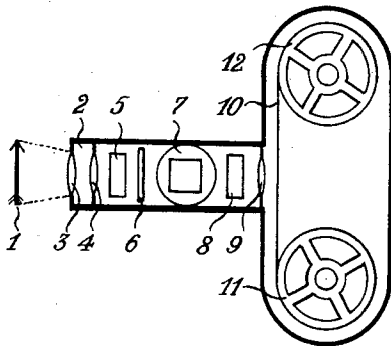


Fig. 1

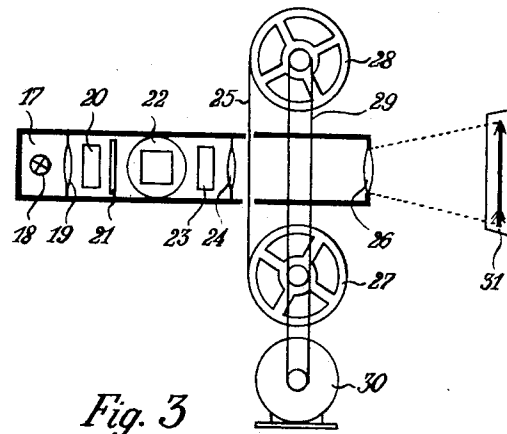


Fig. 3

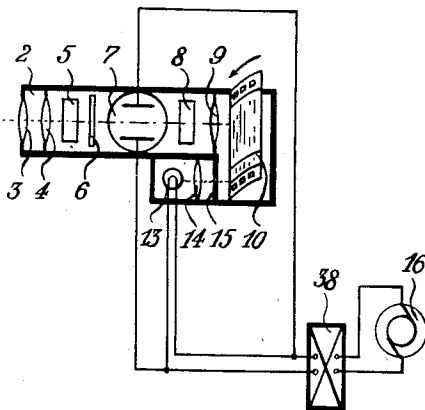


Fig. 2

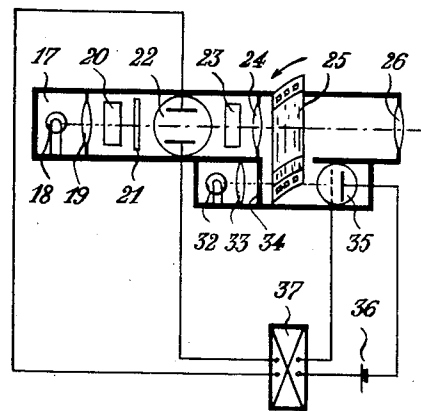


Fig. 4

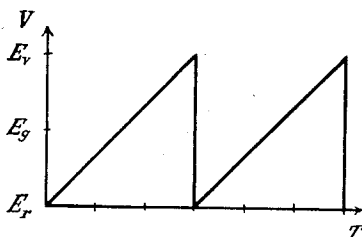


Fig. 5

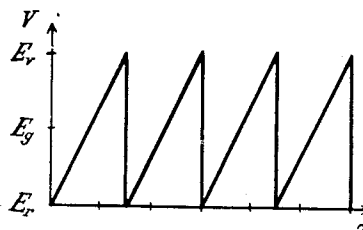


Fig. 6

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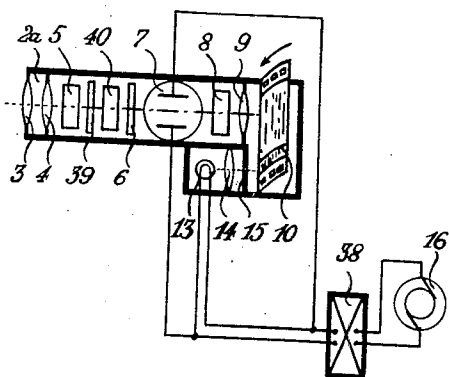


Fig. 9

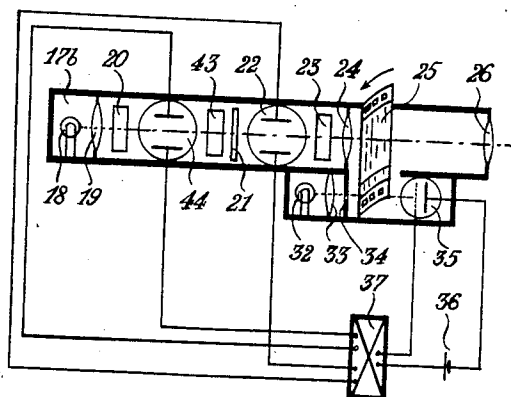


Fig. 12

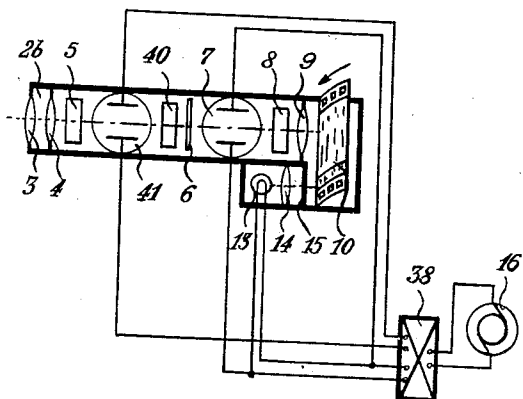


Fig. 10

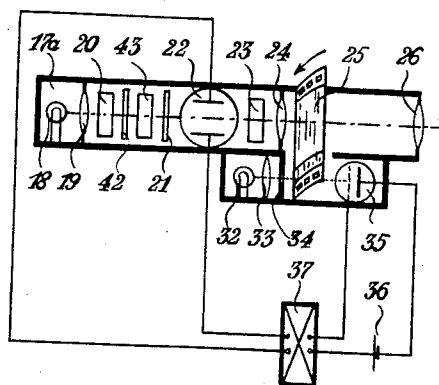


Fig. 11

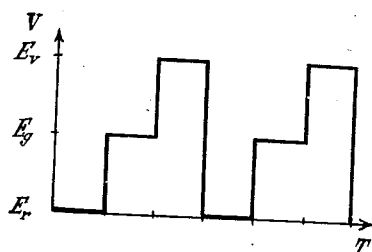


Fig. 8

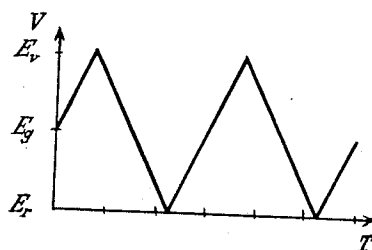


Fig. 7

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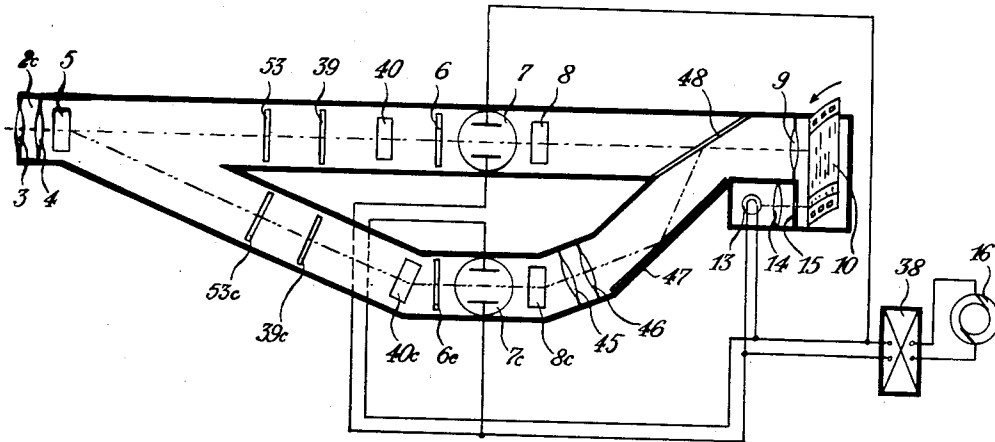


Fig. 13

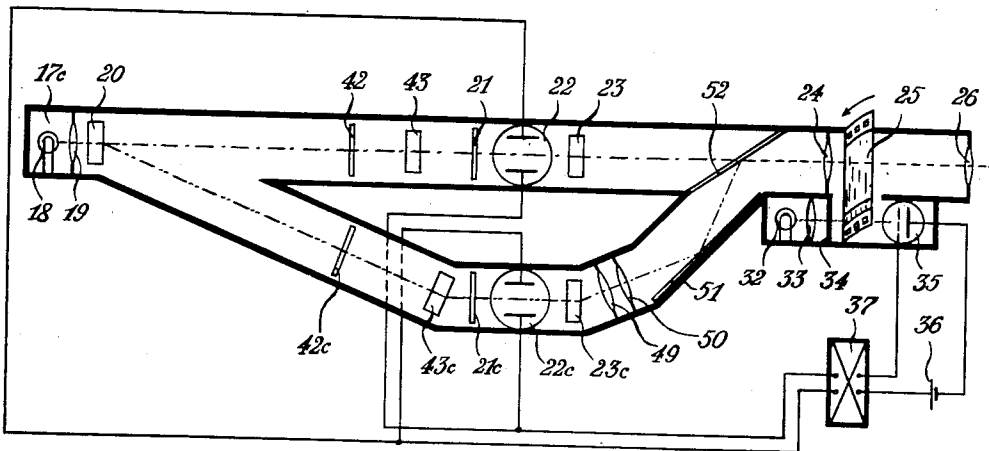


Fig. 14

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UNITED STATES PATENT OFFICE

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COLOR MOTION PICTURE SYSTEM

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Application March 27, 1936, Serial No. 71,271
In Germany April 3, 1935

5 Claims. (Cl. 88—16.4)

The object of the present invention is to provide a color motion picture system by means of which the natural colors are reproduced, and which provides for the production of color motion pictures according to economical and industrial principles. For that purpose certain effects of chromatical polarization of light are used in the present invention which improves and simplifies the production of color motion pictures. Especially, usual black-and-white film material may be used for the present color motion picture system, and too, the copying process is the same as that of black-and-white motion pictures.

In this invention an electrically controlled rotation of the planes of oscillation, using the known electrostatic or electromagnetic light controlling effect, is employed. The electrically controlling frequency used for that purpose may be photographically recorded on a secondary stripe of film. Reproducing the film, that secondary stripe is photo-electrically scanned, and so it may be used to electrically control the selection of colors. By this means the colors of the shot pictures or scenes are automatically reproduced in natural colors.

According to the present invention color motion pictures are produced by chromatically polarized rays of the picture to be photographed. The rays are chromatically selected by means of electrically controlled rotation of their planes of oscillation, and are used to expose the negative film. Normal black-and-white film material may be used. Reproducing the positive film, in an analogous manner the rays of the source of light projecting the film are chromatically polarized and chromatically selected by corresponding electrically controlled rotation of their planes of oscillation. By means of the photographic record of the electrically controlling frequency the same colors are used for exposing the individual picture of the negative film and for projecting the corresponding individual picture of the positive film. On account of the rapid succession of the individual pictures of the film the optical effect of the natural colors is represented.

The accompanying drawings illustrate the present invention in which:

Fig. 1 and Fig. 2 are diagrammatic views of sections perpendicular one to another through the camera 2 used for photographic recording and producing color motion pictures.

Fig. 3 and Fig. 4 are diagrammatic views of sections perpendicular one to another through

the reproducing apparatus 17 used for projecting color motion pictures.

Fig. 5, Fig. 6, Fig. 7 and Fig. 8 are voltage curves of examples of electrical frequencies which may be used for chromatically selecting the rays during the recording and reproducing process.

Fig. 9 is a diagrammatic view of a section through the camera 2a with a special adjustment for neutralizing the film and compensating the differently chromatic compositions of the emissions of the sources of light used in the recording and reproducing process.

Fig. 10 is a diagrammatic view of a section through the camera 2b with another adjustment for neutralizing the film and compensating the differently chromatic compositions of the emissions of the sources of light used in the recording and reproducing process.

Fig. 11 is a diagrammatic view of a section through the reproducing apparatus 17a with a special adjustment for neutralizing the film and compensating the differently chromatic compositions of the emissions of the sources of light used in the recording and reproducing process.

Fig. 12 is a diagrammatic view of a section through the reproducing apparatus 17b with another adjustment for neutralizing the film and compensating the differently chromatic compositions of the emissions of the sources of light used in the recording and reproducing process.

Fig. 13 is a diagrammatic view of a section through the camera 2c with a special adjustment for improving the effective intensity of light in respect to the sensibility of the film.

Fig. 14 is a diagrammatic view of a section through the reproducing apparatus 17c with a special adjustment for improving the effective intensity of light in respect to the picture projected on the screen.

The specific principle of this color motion picture system, the chromatical selection of rays by electric control of the rotation of the planes of oscillation of chromatically polarized rays, may be seen from Fig. 1.

As it is illustrated by Fig. 1, the rays of the picture or scene to be photographed represented by the arrow 1 are directed into the camera 2. These rays are polarized by the polarizer 5 and directed through a chromatically active medium 6. By means of this chromatically active medium the plane of oscillation of every polarized ray is rotated in a manner which is characteristic for the color of the individual ray. For instance, a pane of quartz perpendicularly ground to the optical axis may be used as chro-

5 matically active medium 6. So, the rays are chromatically polarized and directed through a light controlling cell 7 which, for example, may be able to show the known electrostatic or electro-
 10 magnetic light controlling effect. By this light controlling cell 7, for instance, an electrically controlled counter-rotation of the planes of oscillation of the chromatically polarized rays may be effected. The voltage of the light controlling
 15 cell 7 produced by the source of current 16 is regulated in such a manner that the rotations of the planes of oscillation of the polarized rays directed one against another balance one another for a certain color, and the rays of this
 20 color are selected by the analyzer 8. These chromatically selected rays are used to expose the negative film 10.

25 In order to select one after another rays of the individual colors, it is necessary to regulate the voltage of the light controlling cell 7 in a suitable manner. The optical color impulses only represent mixed colors, if they succeed one after another in a certain mixing time, about $\frac{1}{50}$ second. Therefore, it results that it is necessary to effect the selection of the various colors during that mixing time. For that purpose a suitable controlling frequency is conducted to the light controlling cell 7. As it is illustrated by Fig. 2, this electrical controlling frequency
 30 is produced by the source of current 16.

35 According as a color motion picture of three, four or n colors shall be produced, 3, 4 and n individual pictures of the film respectively are exposed during every cycle of the frequency controlling the light controlling cell 7. For example, a three colors motion picture would require to expose about 27 individual pictures of film and a controlling frequency of 9 cycles per second.

40 As it may be seen from Fig. 2, the camera 2 has a light-tight secondary box in which a source of light 13 is arranged. The emission of the source of light 13 is also controlled by the source of current 16, and therefore it indicates the phase of the frequency controlling the light controlling cell 7, and too the selected color of the picture to be photographed is characterized thereby.

45 The known methods and suitable sources of light used for photographic sound recording may be used for the above purpose of recording the controlling frequency too. The rays of the source of light 13, for example, expose a narrow secondary stripe of the negative film 10, similar to the sound recording stripe of the sound motion picture. Since this secondary stripe may be very
 50 narrow, the size of the picture is changed quite inconsiderably. In order to avoid the change of the size of the picture absolutely, the rays of the source of light 13 modulated in accordance with the controlling frequency, for example, may be
 55 photographically recorded on the margin of the film on the other side of the perforation. If desired, a difference of phase between the individual picture of the film and the corresponding photographic record of the controlling frequency may be used.

60 The negative film may consist of normal black-and-white film material. Too, other, especially panchromatic material may be used.

65 The negative film exposed in the above described way is developed and copied in the usual manner.

70 The projection of the positive film is effected by means of the reproducing apparatus 17 in Fig. 3.

75 In the reproducing apparatus 17 a source of

light 18 is arranged, the rays of which are chromatically selected in an analogous manner as in the camera 2. For that purpose the rays of the source of light 18 are polarized by the polarizer 20 and directed through a chromatically active medium 21 which, for instance, has the same optical properties as the chromatically active medium 6. Too, the chromatically polarized rays of the source of light 18 are directed through a light controlling cell 22. By means of the light controlling cell 22, for example, an electrically controlled counter-rotation of the planes of oscillation of the chromatically polarized rays of the source of light 18 is effected. Since the rotations of the planes of oscillation of the polarized rays of the source of light 18 effected by the light controlling cell 22 and the chromatically active medium 21 are directed one against another they balance one another for a certain color. The rays of that color are selected by means of the analyzer 23.

25 These rays of the source of light 18 are used to project the positive film 25 which is moved by the motor 30 through the path of these rays. The rays are directed through the lens 26, and so the colored picture of the film is projected on the screen 31.

30 As it results from Fig. 4, a special adjustment of the reproducing apparatus 17 affords to project every individual picture of the positive film 25 by means of rays of the same color which has been used to expose the corresponding individual picture of the negative film 10 in the camera 2. Said adjustment is arranged in a light-tight secondary box of the reproducing apparatus 17, and consists of a source of light 32 the rays of which are directed through the lens 33, the projection slit 34 and the secondary stripe of the positive film 25 with the photographic records of the electrical frequency controlling the chromatical selection of rays in the camera 2. The rays of the source of light 32 modulated in this manner are directed into the photo-electric cell 35. In an analogous manner the known methods and adjustments for reproducing photographic sound records of talking motion pictures may be used to reproduce the photographic records of the controlling frequency on the secondary stripe of the positive film 25.

50 The source of current 37 of the light controlling cell 22 is controlled by means of the photo-electric impulses of the photo-electric cell 35 in such a manner that by the light controlling cell 22 rays of the source of light 18 projecting an individual picture of the positive film 25 are chromatically selected which perfectly accord with those rays used to expose the corresponding individual picture of the negative film 10.

55 If the film is moved at a suitable speed, the pictures are simulated on the screen 31 in the natural colors.

60 The place of the light controlling cell effecting the chromatical selection and that of the chromatically active medium in the camera 2 and the reproducing apparatus 17 may be exchanged one for another. Reproducing the positive film 25, it is possible first to project it, and after this to select the colors in the described manner.

65 As it has been already mentioned, it is necessary that the selection of the colors is effected during the mixing time, about $\frac{1}{50}$ second. For selecting all the colors during the mixing time, it is necessary to conduct a controlling frequency to the light controlling cell 7 whose curve of voltage is diagrammatically represented by Fig. 75

5, E_r , E_g and E_v mean the values of the voltages which are required to select the three primary colors. If n individual pictures of the film are exposed and projected respectively during the mixing time, it is necessary to use the voltages E_r , E_g and E_v successively one after another during the exposing or projecting time of three of those n individual pictures of the film.

Too, it is possible that the voltage of the light controlling cell effecting the chromatical selection has a suitable value during the exposure or projection of every individual picture of the film, as it is shown in Fig. 8. Consequently, a motion picture in n colors would require n steps of voltage.

Instead of continuously photographic recording of the controlling frequency, only certain controlling impulses characterizing the phase of the controlling frequency may be recorded. For instance, these controlling impulses may be photographically recorded on the line between the individual pictures of the film. In that case the chromatical selection may be effected by analogous relaxative methods as in television are used to synchronize the decomposition and recombination of pictures by means of synchronizing impulses.

Since the controlling frequency used for chromatical selection is practically low, an electric or magnetic field may be used for controlling the rotation of the planes of oscillation of the polarized rays.

All known kinds of light controlling cells, may be used for chromatical selection according to the present invention.

Of course, the electrically controlled rotation of the planes of oscillation of the chromatically polarized rays and the rotation effected by the chromatically active medium may be in accordance as to their directions. In that case these rotations are added, and it is necessary to regulate the analyzers in the corresponding manner.

In the main, it depends on the optical properties of the chromatically active medium, whether the system is mono- or polychromatically selective. If several sorts of light are simultaneously selected, it is only necessary that the chromatically active medium affords to absorb one primary color at every moment. According to the phase of the controlling frequency all the other sorts of light may be selected.

The parallax may be avoided, if a controlling frequency is used whose curve of voltage is gradually ascending or descending or both, as it is illustrated by Fig. 6 and Fig. 7. Especially for that purpose controlling frequencies may be used which afford to select successively about one or two thirds of the spectrum during the exposing and projecting time of every individual picture of the film respectively.

If the film is continuously moved along a certain part of its course through the apparatus, just as for instance a usual sound motion picture, it is preferable to record the controlling frequency on the negative film in this part of the course of the film. Too, the photographic records of the controlling frequency on the positive film are photo-electrically scanned in that part of the course of the film along which the latter is continuously moved. In this case, of course, a difference of phase between the individual picture of the film and the corresponding photographic record of the controlling frequency is required.

For a good and natural reproduction of the

colors, the panchromatic sensibility of the negative film is of great importance. However, in general, so-called panchromatic film is not perfectly panchromatic, but it has a certain differently chromatic sensibility. It is well known, that the differently chromatic sensibility of the film may be partly compensated by neutralizing filters, however, for many reasons the use of neutralizing filters is mostly connected with difficulty. Especially in connection with the present color motion picture system another method of neutralization is preferable. This new method of neutralization automatically results from the principle of chromatical selection of rays on which the present color motion picture system is based. Fig. 9 and Fig. 10 are examples of the use of this method of neutralization.

In Fig. 9 the camera 2a is diagrammatically represented serving for the production of color motion pictures according to the present invention, and which too comprises a suitable adjustment of neutralization. The rays of the picture or scene to be photographed are directed through the lenses 3 and 4 into the camera 2a. These rays are polarized by the polarizer 5. By means of the chromatically active medium 39 the planes of oscillation of the polarized rays are rotated in such a manner, that a certain rotation corresponds to every individual color. The individual rotations effected by the chromatically active medium 39 correspond to the differently chromatical sensibility of the film. In this way the differently chromatical sensibility of the film is exactly compensated, and so the film is made ideally panchromatic.

As set forth in the description of the camera 2, the selection of colors for producing the color motion picture is effected by means of the chromatically active medium 6, the light controlling cell 7 and the analyzer 8.

For neutralization of the film instead of the chromatically active medium 39 a light controlling cell 41 may be used, as it is shown by the example of the camera 2b in Fig. 10. A suitable controlling frequency is conducted to the light controlling cell 41 serving for neutralization of the film 10. The phase of this controlling frequency is in accordance with or in a constant ratio to the phase of the controlling frequency conducted to the light controlling cell 7, serving for the selection of colors. So, the planes of oscillation of the polarized rays are rotated by the light controlling cell 41 in such a manner that the rays have a changed intensity when they have passed the analyzer 40. Since the controlling frequency of the light controlling cell 41 has a suitable characteristic, it is effected that this modification of the intensity of the rays exactly corresponds to the colors selected by the light controlling cell 7. Too, in this way the differently chromatic sensibility of the film is perfectly compensated.

So, these methods afford the production of motion pictures which correspond to the natural colors of the pictures or scenes to be photographed.

Mostly, it is preferable to compensate the spectral compositions of the emissions of different sources of light used in the recording and reproducing process. For this purpose, the described methods of Fig. 9 and Fig. 10 may be analogically used. So, for example, a color motion picture produced with artificial illumination of the scene may be represented as if sun-light has been used. According to the example shown in Fig. 9, a

chromatically active medium 39 may be used for this purpose which has the property to rotate the planes of oscillation of the polarized rays corresponding to the proportions of the spectral compositions of the emissions of the used sources of light.

According to Fig. 10, too, for that purpose a light controlling cell 41 may be used, to which a suitable controlling frequency is conducted. By this means, a modification of the intensity of the polarized rays is effected which depends on the colors selected by the light controlling cell 7 and which corresponds to the proportions of the selected colors as to the compositions of the emissions of the used sources of light.

Of course, it is possible to use in the camera both, an adjustment for neutralizing the chromatical sensibility of the film and an analogous adjustment for compensating the spectral compositions of the emissions of the used sources of light. In that case, a second chromatically active medium 53 may be added to the chromatically active medium 39 in Fig. 9 as it is illustrated by Fig. 13. The one chromatically active medium, for instance 39, effects the neutralization of the film, whereas the other medium 53 serves for compensating the spectral compositions of the emissions of the used sources of light.

In an analogous manner, the example of Fig. 10 may be modified adding a second light controlling cell to the light controlling cell 41.

Too, the combination of a light controlling cell and a chromatically active medium may be used for these purposes.

For a good reproduction of the natural colors also it is required that the spectral compositions of the emissions of the sources of light used to produce and reproduce the motion picture are in accordance one with another. This may be effected according to the above described methods using in the camera a suitable chromatically active medium or a light controlling cell with a suitable controlling frequency.

These methods also may be used in the reproducing apparatus, as it is illustrated by Fig. 11 and Fig. 12. So, in the reproducing apparatus 17a in Fig. 11 the rays of the source of light 18 are polarized by the polarizer 20 and directed through a chromatically active medium 42. By means of this chromatically active medium 42 rotations of the planes of oscillation of the polarized rays are effected which, for instance, correspond to the proportions of the spectral compositions of the emissions of the sources of light used to produce and reproduce the motion picture. When the rays of the source of light 18 have passed the analyzer 43 the intensity of these rays is changed corresponding to the proportions of the spectral compositions of the emissions of the sources of light used to produce and reproduce the motion picture. According to the above description of the reproducing apparatus 17 the selection of the colors is effected by means of the chromatically active medium 21, the light controlling cell 22 and the analyzer 23.

Instead of the chromatically active medium 42 also a light controlling cell 44 may be used to compensate the different spectral compositions of the emissions of the sources of light used to produce and reproduce the motion picture, as it is illustrated by Fig. 12. Therefore, a suitable controlling frequency is conducted to this light controlling cell 44 of the reproducing apparatus 17b. This controlling frequency and the controlling frequency conducted to the light controlling

cell 22 have the same phase or a constant difference of phase. The controlling frequency of the light controlling cell 44 is adjusted in such a manner that by means of the light controlling cell 44 and the analyzer 43 the planes of oscillation of the polarized rays are rotated, and consequently the intensity of these rays is changed. This modification of the intensity of the rays depends on the colors selected by the light controlling cell 22 and corresponds to the proportions of the selected colors as to the spectral compositions of the emissions of the sources of light used for producing and reproducing the motion picture.

Color motion pictures according to this invention and these methods are represented in natural colors.

These above described methods for neutralizing the film and compensating the spectral compositions of the emissions of different sources of light also may be used in connection with other color motion picture processes and even for the production of black-and-white motion pictures.

The effective intensity of light of this color motion picture system may be essentially improved utilizing the extraordinary rays and the ordinary rays which both result from polarization of light.

In an analogical manner as the extraordinary rays are used according to this invention, too, the ordinary rays may be chromatically selected, and their intensity is modified in a corresponding manner for neutralizing the film and for compensating the spectral compositions of the emissions of the used sources of light. Fig. 13 and Fig. 14 are examples thereof.

In Fig. 13 the camera 2c is diagrammatically represented. The rays of the picture or scene to be photographed are directed through the lenses 3 and 4 into the camera 2c. The rays are polarized by means of a suitable polarizer 5. Crystals of double-refracting calcareous spar, for instance, may be used for this purpose.

The extraordinary rays are directed through the first chromatically active medium 53, the second chromatically active medium 39 and the analyzer 40. So, the intensity of the extraordinary rays is changed in a suitable manner in order to compensate the chromatical sensibility of the film and the spectral compositions of the emissions of the used sources of light. Too, the extraordinary rays are directed through the chromatically active medium 6, the light controlling cell 7 and the analyzer 8, and so they are chromatically selected in the above described manner. The chromatically selected rays are used to expose the negative film 10.

In an analogical manner, the intensity of the ordinary rays is suitably modified for neutralization of the film and for compensation of the spectral compositions of the emissions of the used sources of light. Therefore, the ordinary rays are directed through the first chromatically active medium 53c, the second chromatically active medium 39c and the analyzer 40c. Likewise, the ordinary rays are directed through the chromatically active medium 6c, the light controlling cell 7c and the analyzer 8c, and so they are chromatically selected. These rays are directed to the mirror 47 and the reflecting pane of glass 48. Reunited with the extraordinary rays, the ordinary rays are also used to expose the negative film 10. The lenses 45 and 46 serve to make co-incident the picture produced by the ordinary rays with that produced by the extraordinary rays.

In the reproducing process the extraordinary rays and the ordinary rays may be used to project the positive film, as it is illustrated by Fig. 14. The rays of the source of light 18 of the reproducing apparatus 17c are polarized by means of a suitable polarizer 20 which affords to utilize the extraordinary and the ordinary rays.

The extra-ordinary rays may be directed through the chromatically active medium 42 and the analyzer 43, and too it is possible to modify the intensity of the extra-ordinary rays in a suitable manner, for instance, in order to compensate the spectral compositions of the emissions of the used sources of light. The extra-ordinary rays are also directed through the chromatically active medium 21, the light controlling cell 22 and the analyzer 23. By this means these rays are chromatically selected as already set forth herein.

In an analogous manner, the ordinary rays may be directed through the chromatically active medium 42c and the analyzer 43c. The chromatically active media 42 and 42c and the analyzers 43 and 43c of the reproducing apparatus 17c are not necessary, if the neutralization of the film and the compensation of the spectral compositions of the emissions of the used sources of light have been already effected by means of corresponding adjustments of the camera 2c. The ordinary rays are directed through the chromatically active medium 21c, the light controlling cell 22c and the analyzer 23c. So, the ordinary rays are chromatically selected. The ordinary rays are also directed to the mirror 51 and the reflecting pane of glass 52, and so they are reunited with the extra-ordinary rays. The lenses 49 and 50 afford to make coincident the picture produced by the extra-ordinary rays with that produced by the ordinary rays. These lenses 49 and 50 are only necessary, if the rays of the source of light 18 are projecting the positive film 25 before they have been polarized.

If the known mercury-lamps, for instance, in connection with other sources of light also emitting red rays or cadmium-mercury-lamps are used to project the color motion pictures according to this invention, about the same intensity of light may be effected on the screen as projecting black-and-white motion pictures by means of usual lamps.

Color motion pictures produced according to this invention may be cut in the same manner as black-and-white motion pictures.

On account of the process of chromatical selection of rays, which is specific to this invention, this color motion picture is especially suitable as intermediate film for color television.

It is possible to record and reproduce the sounds accompanying the scenes photographed according to this invention in the usual manner and in connection with this color motion picture.

For producing colored cinematographic pictures according to the present invention photographic plates or other light-sensitive material may be used too.

My invention is not limited to the particular arrangements and specific details of construction of the illustrated and described apparatus, but may be variously modified and even used in connection with various other motion picture processes without departing from the spirit and scope of the appended claims.

I claim as my invention:

1. In a color motion picture system a color decomposing and recomposing device comprising a

polarizer, a plane-parallel chromatically active medium for rotating the planes of polarization of polarized rays of various wavelengths in different degrees and in proportions depending on the thickness of said medium, a light controlling cell for electrical control of the rotation of the planes of polarization of said polarized rays, for predeterminedly rotating the plane of polarization by electrical impulses, means to apply electrical impulses to said cell, an analyzer for selecting color component rays of light passed by the cell, means for supporting a film to receive the selected rays, an electrical light unit cooperating with a record tract of the film, and electrical connections, between the light unit and said means for applying electrical impulses to said cell.

2. In a color motion picture system a photographic recording device comprising a camera and a light-tight secondary box, having arranged in said camera in the path of light rays a polarizer, a plane-parallel chromatically active medium for rotating the planes of polarization of polarized rays of various wavelengths in different degrees and in proportions depending on the thickness of said medium, a light controlling cell for electrical control of the rotation of the planes of polarization of said polarized rays, for predeterminedly rotating the plane of polarization by electrical impulses, means to provide said electrical impulses and means to supply said electrical impulses to said cell, an analyzer for selecting color component rays of light passed by said cell, means to support a sensitive film to receive the selected light rays, said secondary box including an electric light source, for predeterminedly modulating the emission of said light source by said electrical impulses, means to apply said electrical impulses to said light source, means to support a tract of said sensitive film to receive said modulated rays of said light source, and electrical connections, between said means for providing said electrical impulses and said means for applying said electrical impulses to said light controlling cell and said source of light.

3. In a color motion picture system a photographic recording device comprising a camera and a light-tight secondary box, having arranged in said camera in the path of light rays a polarizer, a plane-parallel chromatically active medium for rotating the planes of polarization of polarized rays of various wavelength in optically different degrees and in proportions depending on the thickness of said medium, a light controlling cell for predeterminedly and cyclically repeated rotating the planes of polarization of rays of the desired color components successively into the free-passage-direction of an analyzer by electrical impulses, means to provide said electrical impulses and means to apply said electrical impulses to said cell, said analyzer for selecting said color component rays of light passed by said cell, means to support a sensitive film to receive the selected light rays, said secondary box including an electric light source for predeterminedly modulating the emission of said light source by said electrical impulses, means to apply said electrical impulses to said light source, means to support a tract of said sensitive film to receive said modulated rays of said light source, and electrical connections, between said means for providing said electrical impulses and said means for applying said electrical impulses to said light controlling cell and said source of light.

4. In a color motion picture system a cine-

matographic reproducing device comprising a projector and a light-tight secondary box, having arranged in said projector in the path of rays of a first source of light a polarizer, a chromatically active medium for rotating the planes of polarization of polarized rays of various wavelengths in different degrees and in proportions depending on the thickness of said medium, a light controlling cell for electrical control of the rotation of the planes of polarization of said polarized rays, for predeterminedly rotating the planes of polarization by electrical impulses, means to provide said electrical impulses and means to apply said electrical impulses to said light controlling cell, an analyzer for selecting color component rays of light passed by said light controlling cell, means to support a cinematographic positive film of color component pictures to modulate said selected color component rays of light, said secondary box including a second source of light, means to support a tract of said positive film to modulate the intensity of the rays of said second source of light in accordance with photographic records of variations of intensity of electrical control impulses photographically recorded on said tract of said positive film, a photo-electric cell to receive said modulated rays of said second source of light and to control the intensity of the photo-electric current of said photo-electric cell in accordance with the variations of intensity of said modulated rays of said second source of light, said means for providing electrical impulses to be controlled by said photo-electric current of said photo-electric cell, and electrical connections, between said photo-electric cell and said means for providing electrical impulses and said means for applying said electrical impulses to said light controlling cell.

5. In a color motion picture system a cinematographic reproducing device comprising a projector and a light-tight secondary box, having arranged in said projector in the path of rays of a first source of light a polarizer, a chromatically active medium for rotating the planes of polarization of polarized rays of various wavelengths in optically different degrees and in proportions depending on the thickness of said medium, a light controlling cell for predeterminedly rotating the plane of polarization by electrical impulses, means to provide said electrical impulses and means to apply said electrical impulses to said light controlling cell, an analyzer for selecting color component rays of light passed by said light controlling cell, means to support a cinematographic positive film of color component pictures to modulate said selected color component rays of light, said secondary box including a second source of light, means to support a tract of said positive film to modulate the intensity of the rays of said second source of light in accordance with photographic records of variations of intensity of electrical control impulses on said tract of said positive film, a photo-electric cell to receive said modulated rays of said second source of light and to control the intensity of the photo-electric current of said photo-electric cell in accordance with the variations of intensity of said modulated rays of said second source of light, said means for providing electrical impulses to be controlled by said photo-electric current of said photo-electric cell, and electrical connections, between said photo-electric cell and said means for providing electrical impulses and said means for applying said electrical impulses to said light controlling cell.

ROMEO FRITZ THIEME.