A. HERNANDEZ-MEJIA.

PROCESS OF MAKING COLOR PHOTOGRAPHIC TRANSPARENCIES.

APPLICATION FILED JUNE 21, 1912.

1,174,144. Patented Mar. 7, 1916.

Fig. 1

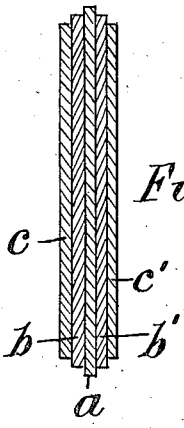

Fig. 2

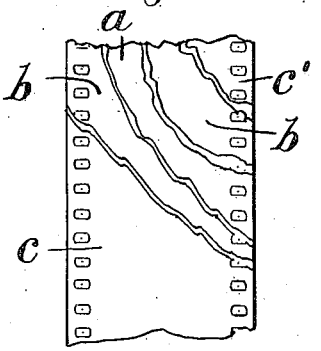

Fig. 3.

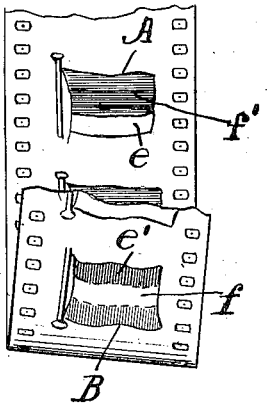

Fig. 4.

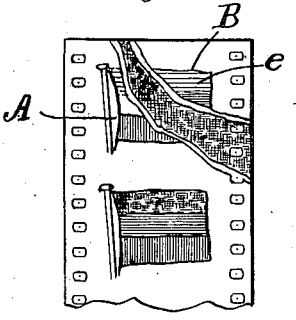

Fig. 9.

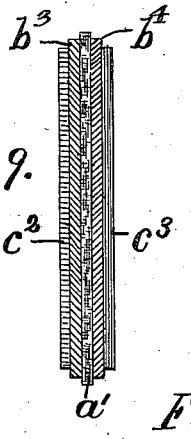

Fig. 6.

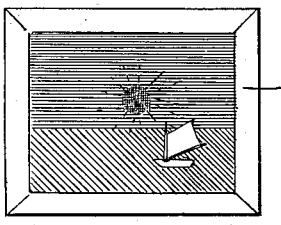

Fig. 5.

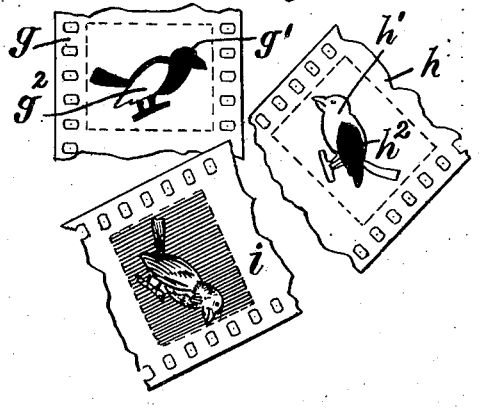

Fig. 7.

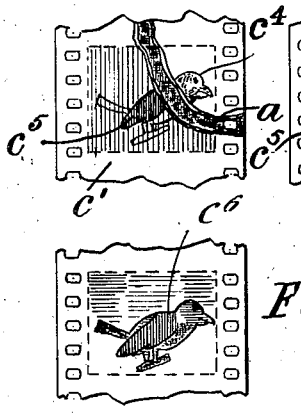

Fig. 7a.

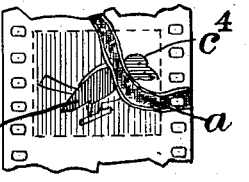

Fig. 8.

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ARTURO HERNANDEZ-MEJIA, OF NEW ROCHELLE, NEW YORK.

PROCESS OF MAKING COLOR PHOTOGRAPHIC TRANSPARENCIES.

1,174,144. Specification of Letters Patent. Patented Mar. 7, 1916.

Application filed June 21, 1912. Serial No. 705,095.

To all whom it may concern:

Be it known that I, ARTURO HERNANDEZ-MEJIA, a citizen of the Republic of Venezuela, residing at 6 Alpha Place, New Rochelle, county of Westchester, and State of New York, have invented certain new and useful Improvements in Processes of Making Color Photographic Transparencies, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain methods of producing transparencies which, projected from a lantern or motion-picture machine, will reproduce upon a suitable screen or plain surface, the image photographed, in approximately the colors of nature.

The invention has for its object the production of transparencies either singly, or in films or ribbons which can be used for projection by any ordinary lantern or moving-picture machine without alteration of such machines, and without the use of special mechanism or contrivances, or of more than one lantern or moving-picture machine for said projection, and which will reproduce approximately the colors of nature without the aid or separate process of hand-coloring or machine stenciling.

In the following description, merely for illustration, I have suggested certain colors and combinations of colors; but it is obvious that in practice any suitable colors may be used. The steps necessary to carry out the invention will be readily understood from the following description.

The invention will be understood by reference to the annexed drawing, in which—

Figure 1 is a diagrammatic section of the plate, film or ribbon embodying the invention; Fig. 2 represents a strip of the blank or unprinted film with different layers broken away; Fig. 3 shows a strip of moving-picture film with images printed from the prepared negatives, and colored, a portion of the rear side being represented as turned into view; Fig. 4 represents a portion of the same film after the complementary colors are formed upon such printed images; Fig. 5 shows a green-screen negative, a red-screen negative, and a "positive" printed from such negatives. Fig. 6 shows a lantern-slide; Fig. 7 shows portion of a film with the printed coating broken away; Fig. 7^a represents a portion of the same film with a part of the same broken away to the coating upon the rear side; Fig. 8 represents the picture viewed through the film of Fig. 7^a; and Fig. 9 is a diagrammatic section like Fig. 1, of a film having the body and coating supplied with complementary colors.

Similar letters refer to similar parts throughout the several views.

In Figs. 1 and 2, a is the body of the transparent supporting means, such as a plate, film or ribbon. b and b' are coatings of gelatin, collodion, or other substance upon the opposite sides of the body a, to hold the sensitizing agent. These figures show the blank film merely sensitized, c, c' representing the layers of sensitizing material. The layers a, b, b', &c., are broken away to expose the ones in the rear.

Fig. 3 shows a portion of a finished film with one end folded over to show the opposite side, to present two views A and B of a flag, for contrasting the complementary colors upon the opposite sides of the film, each view showing only the color on the side exposed, in proportion to the separation made by the screens, for instance, in the upper part of Fig. 3, the lower bar e of the flag is shown blank, while the corresponding space e' on the lower part of Fig. 3 indicates density, which is shown as colored red. For the same reason, the blank space f in the lower view corresponds to the blue density f' in the upper view. The remaining bars on the flag are shaded in proportionate relation to the separation of color affected by the screens.

Fig. 4 shows that the views A and B on the opposite sides of the film are in register with one another, all the assumed layers of the film, excepting the gelatin and image upon the rear side being broken away to exhibit such condition. The opposed views are complementarily colored.

Fig. 5 shows a negative g taken through a green-screen, a negative h of the same object taken through a red-screen, and a positive film i printed from these negatives previous to any coloring of the images. In the negative g, the body of a parrot is shown with dense shading g' in some parts, while the corresponding area h' in the negative h shows a blank or lack of density, while the bird's wing h^2 in negative h, shows density, and the corresponding space g^2 in the negative g shows a blank or lack of density. In

the positive, *i*, while only one side is shown, it represents the combined effects of the printing from both negatives, as if viewed in front of a light.

Fig. 6 shows a lantern-slide, *j*, consisting of a double coated transparent support having opposite sides printed from negatives of the same object, taken through complementary screens, and colored as described herein. Such slides are usually mounted between cover glasses and bound together.

Fig. 7 shows a film with the nearest layer *c'* bearing an image c^5 colored red and broken away to show a yellow tinted body *a*, and the registration with the image c^4 on the opposite side, which at the stage shown is uncolored.

Fig. 7^a shows the same view after the opposite image *c'* has been colored blue.

Fig. 8 shows the composite picture viewed from the film of Fig. 7^a.

Fig. 9 shows a film in section with the various layers colored, as could be used when it might be desirable to photograph special subjects, requiring a preponderance of some color.

The body *a* is hatched to conventionally represent the color yellow. The image c^2 upon one side may be changed to a blue color by suitable toning or developing solutions, and the gelatin coating *b* or *b'* dyed a different color as green or purple or left unchanged, as may best suit the general tone of the picture which is being reproduced. When one image c^2 is of a blue color, the image c^3 upon the opposite side may be changed by chemical action such as toning or developing to a red or crimson color. In such case, the gelatin coating which carries such red image may be dyed a different color, if desirable, or left unaltered or free from dye.

It is obvious that any of the well known methods or combination of colors for coloring gelatin or silver deposit before, during or after development, can be used to produce these color films. With such combinations, the picture formed by throwing light through such a film upon a white screen will be shown in colors sufficiently like those of nature to give an impression to the eye of an exact reproduction in colors of the original object.

I have obtained good results by converting the silver salts into compounds of various metals, for instance, into silver iodid by immersing in potassium-iodid solution, then immersing in a basic dye, and then dissolving the silver iodid, leaving a dyed image in the clear gelatin, the colors of the dyes being varied upon each side of the plate or film in complementary relation to one another; that is to say, the image on one side which has been obtained from the negative through the red screen will be dyed with a green dye, or chemically changed to green, and the image on the other side which has been obtained from the negative through the green screen will be dyed with a red dye, or chemically changed to red, the hue of the red and the hue of the green being of a shade complementary one to the other.

Suppose the subject photographed to be a Venezuelan flag the colors of which are yellow, blue and red. Two separate negatives are taken thereof by means of a suitable camera which will simultaneously take the two negatives directionally reversed, from the same point, through screens of complementary colors. These negatives are affected by different regions of the spectrum, as one may be taken through a green screen and the other through a red screen. A suitable printing machine is then used to accurately register the two negatives thus taken, and to simultaneously embrace between the negatives a specially prepared positive film coated on both sides with a substratum or support, as gelatin, and a sensitive emulsion. The green-screen negative and the red-screen negative are thus held close to the unexposed opposite sides of the sensitized film, and the whole is then so exposed that light strikes on both sides simultaneously and a positive transparency, after development, is thus obtained with corresponding images upon both sides of the doubly coated film. The film will have on one side the impression printed from the green-screen negative, and after or during development and fixing, the printed image on that side is rendered red by chemical action, as shown in the lower part of Fig. 3. The gelatin, or substratum, on that side is, if desired, dyed with a contributory color (as yellow) one which when combined in projection, would be required with the red and green to make total opacity or black, a degree of coloring being employed which will not permit the actinic light, or will do so very sparingly, to pass through the film to the opposite side during the printing operation. Provision is made during the chemical operations for preventing the chemicals from action on the side opposite to the one under treatment. Satisfactory coloring having been obtained on one side, the other side is treated in a similar manner, the image obtained through the red-screen negative being reduced chemically to a blue-green color, complementary to the red-screen through which it was taken. The gelatin or substratum on this side may also be dyed a contributory color, such as yellow.

While the process of coloring each side by chemical means is explained in detail, as if done first on one side and then on the other, it is evident that in carrying out the invention the coloring of both sides can be done in one operation provided the chemicals that

change the silver salts to complementary colors are separately incorporated in the emulsion, each being put separately upon one side of the support, at the time of coating; for instance, copper salts, as cupric sulfate, on one side and iron salts, as ferric chlorid, on the other, and the whole treated with a restrained potassium ferricyanid solution, which uniting with the iron and silver salts on one side will form a blue iron and silver ferricyanid, and with the copper and silver salts on the other side will form a red, copper and silver ferricyanid.

Upon examining the positive two-faced color film thus obtained, it is found that, where the subject photographed, a Venezuelan flag for example, showed a red-bar, the green-screen side showed a strong red color on this bar, while the red-screen side showed little or no green, the intense red overcoming the light yellow on the substratum. In fact, if the red-screen has done its work properly there should be no color at all on the green colored side where the red-bar is photographed, excepting in the folds or shadows, and there would be a correspondingly strong deposit of red, copper and silver salts upon the opposite side. Where the flag showed yellow, the green side of the film has a mezzo-tint of green which, viewed by holding it to the light, loses its blue components by the same being absorbed by the mezzo-tint of red on the opposite side, and there is imparted to the eye an impression of yellow aided by the yellow contributory color of the gelatin or substratum. Where the color of the flag is blue, a similar condition exists, blue-green is deposited on one side and correspondingly no red is deposited on the opposite side by the action of the screens or filters and the dyes and chemical changes above described; thus giving the eye a distinctly vivid blue sensation, the deepness of the blue deposit completely overcoming the light yellow of the gelatin or substratum, if thus colored.

For the purpose of carrying out this invention, any two negatives of the same subject taken from the same point can be used, which are taken through complementary screens, separating the spectrum as evenly as possible; whether they have been taken by ordinary cameras in two exposures or with cameras arranged for taking two exposures at one time, by a lens or lenses arranged to take views from the same point.

I have, in practice, found the following the most effective method of obtaining negatives to carry out my invention: For this object, I use a camera having only one lens, provided with a reflector transparent enough to permit both the reflection and the passing through (refraction) of the light-rays. I utilize reflection to secure the negative to be used in printing one side of my two-faced coated film, and I use the transmitted light, that is to say, the direct rays, to produce the negative to be used in printing the other side of my two-faced coated film. The secondary image in the reflected picture, is absorbed by the color of the screen used in the reflector. In this manner, two negatives are obtained, reversed right and left with respect to one another, a condition that is undesirable in other methods used for producing super-imposed color photographs or transparencies, but it is a distinct advantage where the images are to be printed on both sides of a two-faced coated film.

Motion pictures, reproducing in colors the subjects or scenes photographed, have been publicly shown by methods which require expensive and elaborate apparatus, making them unsuitable for general adoption in most moving-picture theaters. This deprives the general public in country towns, schools, institutions, clubs, private houses, &c., from the enjoyment of this most desirable achievement, the viewing of nature in its own colors through motion photography. In my invention, I succeed in producing one film in colors, which, (by coating it on both sides, and chemically coloring each side separately) can be used in any ordinary projecting apparatus, with ordinary or usual light, using the same speed of projection as with ordinary black and white pictures, and without unusually darkening the room or theater where they are shown, and without providing the audience with any appliances for viewing the image on the screen.

In my invention, the cost of producing colored motion or still photography is greatly reduced, as only the same amount of film and the same number of projections per second are necessary as with black and white films, and the volume of electric current necessary for light and for operating the projector is not increased, nor is the cost of manufacture materially greater, because the amount of emulsion on both sides of the film is no greater than the amount now used on only one side.

I am aware that photographic negatives, taken through colored screens, and separate transparencies made therefrom, have been superimposed to reproduce on suitable devices, the colors of nature; and that moving-pictures in colors have been shown which utilize the frequency of projection of one color after another in rapid succession to blend in the eye the impression of various colors, and I do not claim invention of those methods or processes, but

What I claim and desire to secure by Letters Patent is:

1. The improved process of making a colored photographic transparency, for projection or viewing by direct or reflected light,

which consists in simultaneously taking two negatives of the same subject, from the same point, respectively through screens of complementary colors, one of said negatives being directionally reversed with respect to the other, printing from one of said negatives upon one side of a single transparent positive film, sensitized on both sides, and from the other of said negatives upon the opposite side of said positive film, with the images in register, treating one side of the positive so that the image thereon will appear in one color, and treating the opposite side of said positive so that the corresponding image will appear in a complementary color.

2. The improved process of making a single color photographic transparency, or a series of color photographic transparencies in bands or films, for projection by direct or reflected light, which consists in simultaneously taking two negatives of the same subject, from the same point, respectively through screens of complementary colors, one of said negatives being directionally reversed with respect to the other, printing from one of said negatives upon one side of a single transparent positive film or support, colored in a suitable manner with relation to the colors of the images, photographically sensitized on both sides, and from the other of said negatives upon the opposite side of said positive film, with the images in register, treating one side of the positive so that the image thereon will appear in one of the primary colors, and treating the opposite side of said positive so that the corresponding image will appear in another and complementary primary color, the color of the support being the third primary color.

3. The improved method of making a color photographic transparency, which consists in taking two negatives of the same subject, from the same point, respectively through screens of complementary colors, one of said negatives being directionally reversed with respect to the other, printing from one of said negatives upon one side of a single transparent positive film, photographically sensitized on both sides, and from the other of said negatives upon the opposite side of said positive film, with the images in register, treating one side of the positive so that the image thereon will appear in one color, and treating the opposite side of said positive so that the corresponding image will appear in a complementary color.

4. The improved method of making a color photographic transparency, which consists in taking two negatives, respectively through screens of complementary colors, one of said negatives being directionally reversed, with respect to the other, printing from one of said negatives upon one side of a single transparent positive support or film sensitized on both sides, and from the other of said negatives upon the opposite side of said film, with the images in register, treating one side of the positive so that the image thereon will appear in one color, and treating the opposite side of said positive so that the image on that side will be colored in a complementary color, and dyeing the support of the sensitizing emulsion on at least one side with a color which will supplement the other colors.

5. The improved method of making a color photographic transparency, which consists in taking two negatives of the same subject respectively through screens of complementary colors, printing from one of said negatives in contact, emulsion to emulsion, upon one side of a single transparent positive support or film sensitized on both sides, and from the other of said negatives printing on the transparent support, directionally reversing the image with respect to the other negative upon the opposite side of said film, the images being registered permanently, treating one side of the positive so that the image thereon will appear in one color, and treating the other side of the positive so that the image on that side will appear in a complementary color, the support or film thus obtained containing permanently superposed images forming a composite color picture for projection or viewing by direct or reflected light.

ARTURO HERNANDEZ-MEJIA.

Witnesses:

GEO. H. RACHE,

J. S. MAXWELL.