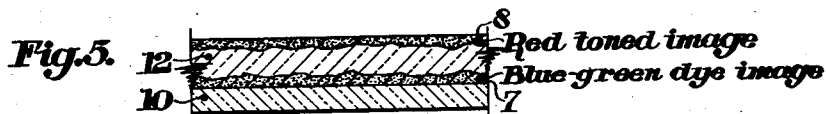
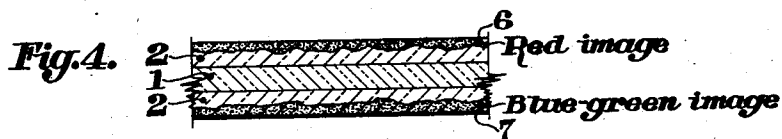
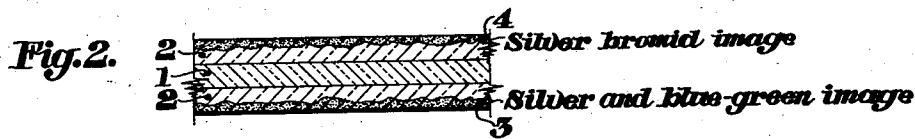
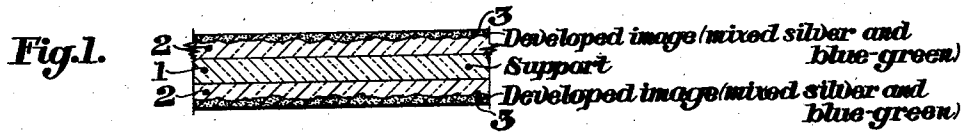


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R. L. BURWELL, JR
PROCESS FOR MAKING TWO-COLOR SUBTRACTIVE PHOTOGRAPHIC
PRINTS ON DOUBLE COATED FILM
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Inventor
Robert L. Burwell, Jr.

By *Newton M. Parnell*

Attorney.

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PROCESS FOR MAKING TWO-COLOR SUB-
TRACTIVE PHOTOGRAPHIC PRINTS ON
DOUBLE-COATED FILMRobert L. Burwell, Jr., Annapolis, Md., assignor
to Eastman Kodak Company, Rochester, N. Y.,
a corporation of New York

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12 Claims. (Cl. 95-2)

This invention relates to color photography and more particularly to a process for making two-color prints on double-coated film. It is particularly suited for the making of color motion picture film.

A large number of so-called color-forming developers are known and more recently, in a co-pending application (No. 536,659, filed May 11, 1931), M. W. Seymour has disclosed certain such developers which are also well suited to my purpose. These color-forming developers develop a silver image and associated therewith a color image. The silver may be removed by suitable reagents leaving the color undisturbed. I utilize this procedure with other steps in my invention.

I employ a photographic film which is coated on both sides of the support with a light-sensitive emulsion, preferably containing a water soluble non-actinic dye to prevent printing through. This film is printed on one side from a red filter negative and printed either successively or simultaneously and in register on the other side from a blue-green filter negative. The film is then developed on both sides in a developer which forms a silver image and an associated color image. After fixing and washing, the film is now treated on one side with a reagent which destroys or eliminates the color and which converts the silver to a silver salt. The silver salt image is then converted to an image complementary in color to the color first formed.

More specifically the invention is carried out as given in the following examples, although it is understood that I do not limit myself by the particular method of treatment or reagents described.

Reference will be made to the figures of the accompanying drawing wherein the figures are sectional views of film represented in a large scale and somewhat diagrammatically. The same reference characters designate the same parts in the several figures.

Fig. 1 represents the film after the first step of the process,

Figs. 2, 3 and 4 represent successive steps of the preferred process,

Figs. 2A, and 3A represent successive steps of an alternative process, and

Fig. 5 illustrates a still further modification.

Example I

A photographic film of the type described, coated on both sides of the support and containing either in the base or the emulsion a water-soluble yellow dye, is exposed on opposite sides

to red and green color separation negatives. Both sides of the film are developed by immersion in a developer such as the following:

Solution A

3.5 Dibromo-o-cresol	2.0 grams	60
Ethyl alcohol, 95%	20 c. c.	
Sodium carbonate, 10% solution	75 c. c.	
Potassium bromide, 10% solution	3 c. c.	
p-Aminodiethylaniline hydrochloride	2 grams	65
Water to	250 c. c.	

This developer produces a silver image associated with an image of blue-green color. The film is now washed, fixed in plain hypo solution, and again washed. Fig. 1 illustrates the film at this state, the support being indicated at 1 and the two layers, one on each surface of the support as 2. Each of these layers 2 at this point carries an image 3 of mixed silver and blue-green particles formed by development. It is next submitted to the action of an acid ferricyanide-bromide bleach only on the side printed from the green filter negative. This may be done by drying the film and floating it on the surface of the bleaching solution or by passing the film over an absorbent pad or roller saturated with a bleaching solution or by various other methods known to the art. An example of such a solution is:

Solution B

Potassium bromide, 10% solution	20 c. c.	85
Potassium ferricyanide, 10% solution	20 c. c.	
Sulfuric acid, 200 c. c. of concentrated acid per liter	2.5 c. c.	90
Water to	100 c. c.	

The acid in this bath removes the blue-green dye image from the one side of the film and the ferricyanide and bromide convert the silver image on the same side to one of silver bromide 4, as shown in Fig. 2, the other elements of this figure being the same as in Fig. 1.

After washing, accompanied by abundant exposure to light, the film is developed, preferably by immersion in a developer such as the following:

Solution C

Cyanacetophenone	1 gram	105
Ethyl alcohol	20 c. c.	
Ethyl- α chloroacetoacetate	1 gram	
Sodium carbonate, 10% solution	75 c. c.	
p-Aminodiethylaniline hydrochloride	1 gram	
Potassium bromide	3 c. c.	
Water to	250 c. c.	110

This developer acts on the silver salt image, which has received during the normal processing a sufficient exposure, to produce a silver image associated with an image of a red color.

5 As shown in Fig. 3, the film now bears on the one side, as indicated by 3, a blue-green image associated with a silver image and on the other designated by 5, a red image associated with a silver image. It is completed by washing, bleaching the silver image in a suitable non-acidic solution, fixing out the silver salts, and washing. The last bleaching and fixing operations may be carried out in one solution, such as Farmer's reducer, which is suitable for the purpose, or in separate solutions, such as a 1% solution of potassium ferricyanide followed by a 30% solution of plain hypo. Other baths that remove silver without destroying the dye images are permissible and useful. This leaves the film as shown in Fig. 20 4 with a red image 6 in one coating 2, and a blue-green image 7 in the coating 2 on the other side of the support 1.

Example II

25 A type of film as described in Example I is exposed as before to two-color separation negatives and developed in a color-forming developer, such as Solution A mentioned above. The film is washed, fixed in plain hypo solution and again washed, and its condition is represented in Fig. 1.

30 It is now submitted to the action of a red toning solution only on the side printed from the green filter negative. Such a solution is the following:

Solution D

35 Uranium nitrate	5 grams
Potassium oxalate	5 grams
Potassium ferricyanide	2 grams
Ammonium alum	12 grams
40 Hydrochloric acid, 100 c.c. conc. acid per liter	10 c.c.
Water to	2 liters

This tones the silver image on the one side of the film to the desired intensity of color, the toned image being designated 8 in Fig. 2A, and simultaneously destroys the dye image on the same side, all the remaining silver and silver salts on both sides are then removed with suitable bleaching and fixing agents that do not attack either the dye image or the colored uranium salt image. A solution of potassium ferricyanide and bromide, followed by a solution of plain hypo is an example of a suitable combination of reagents. This leaves the final product indicated in Fig. 3A, 50 having a support 1 with a layer 2 on each surface, one layer carrying a red toned image 8 and the other layer a blue-green dye image 7.

It will be evident that a large number of modifications may be made in the procedure I have described. The photographic film itself may contain either in the support, in a suitable substratum, or in one or in both emulsion coatings various dyes or substances to prevent printing through. It will usually be satisfactory to have in either one of the emulsion layers or a substratum, a water soluble yellow dye.

It is also obvious that the process is capable of being carried out with substantially the same procedure in a rather thick heavily dyed single layer. In such instances, the images will be formed at or near the opposite surfaces of the same layer. Where treatment of one image only is specified, a concentrated bath would be used for a controlled short interval followed by a step bath; but because of the greater delicacy of

handling, I do not prefer this procedure. A film thus treated is shown in Fig. 5 where the support is designated 10, the sensitive layer 12, and the final images 7 and 8 as before.

It will be evident also that a number of color-forming developers may be used other than those I have mentioned. Other stages of the processing may also be varied, such as the bleaching steps and the toning step. For example, the first color-forming developer might be one giving a red color and the second color component might be obtained by using a toning solution which gives a blue-green color, the particular developers and toning solutions being known and not a part of my invention.

I consider as included in my invention, all modifications and equivalents coming within the scope of the appended claims.

What I claim is:

1. A process for making a multicolor photograph that comprises exposing to light images directed thereon from opposite sides, a film carrying yellow dyed sensitive material in layer form, and developing the images with a single color forming developer, thereby producing simultaneously two images, each comprising mixed silver and color particles, and treating one image to remove the colored particles and transform the silver into a colored image different in color from the other image.

2. A process for making a multicolor photograph that comprises exposing to light images directed thereon from opposite sides, a film carrying yellow dyed sensitive material in layer form, and developing the images with a single color forming developer, thereby producing simultaneously two images, each comprising mixed silver and color particles, and treating one image to remove the colored particles and transform the silver into a colored image different in color from the other image, and removing the silver from the said other image.

3. A process for making a multicolor photograph on a film carrying two sensitive layers, which comprises light printing in said layers in registration two images, developing the images in both layers with a single color forming developer, thereby producing simultaneously in each layer a silver image and an associated color image, removing the color image from one layer and transforming the silver image of said layer into a colored image different in color from the image in the other layer.

4. A process for making a multicolor photograph on a film carrying two sensitive layers, which comprises light printing in said layers in registration two images, developing the images in both layers with a single color forming developer, thereby producing simultaneously in each layer a silver image and an associated color image, removing the color image from one layer and transforming the silver image of said layer into a colored image different in color from the image in the other layer, and then removing the silver from the image in the other layer.

5. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, developing the images on both sides of said support with a single color forming developer, thereby producing simultaneously in each layer a silver image and an associated color image, removing the color image on one side and converting the associated sil-

ver image on the same side into an image of a color different from the color first produced.

6. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, the two light images constituting complementary color components of the subject, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color complementary to the color first produced.

7. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color different from the color first produced by converting said silver image to a silver salt image and redeveloping the silver salt image in a color forming developer yielding a color different from the first.

8. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, the two light images constituting complementary color components of the subject, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color complementary to the color first produced by converting said silver image to a silver salt image and redeveloping the silver salt image in a color forming developer yielding a color complementary to the first.

9. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color

image, removing the color image on one side and converting the associated silver image on the same side into an image of a color different from the color first produced by bleaching the said color image and toning the associated silver image to the desired color.

10. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, the two light images constituting complementary color components of the subject, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color different from the color first produced by bleaching the said color image and toning the associated silver image in an inorganic toning bath to the desired color.

11. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color different from the color first produced by bleaching the said color image and simultaneously toning the associated silver image to the desired color.

12. A process for making two-color photographs on a film coated on both sides which comprises exposing each side to a light image in register with that on the opposite side, the two light images constituting complementary color components of the subject, developing the images on both sides of said support with a single color forming developer which produces simultaneously a silver image and an associated color image, removing the color image on one side, and converting the associated silver image on the same side into an image of a color different from the color first produced by bleaching the said color image and simultaneously toning the associated silver image in an inorganic toning bath to the desired color.

ROBERT L. BURWELL, JR.