

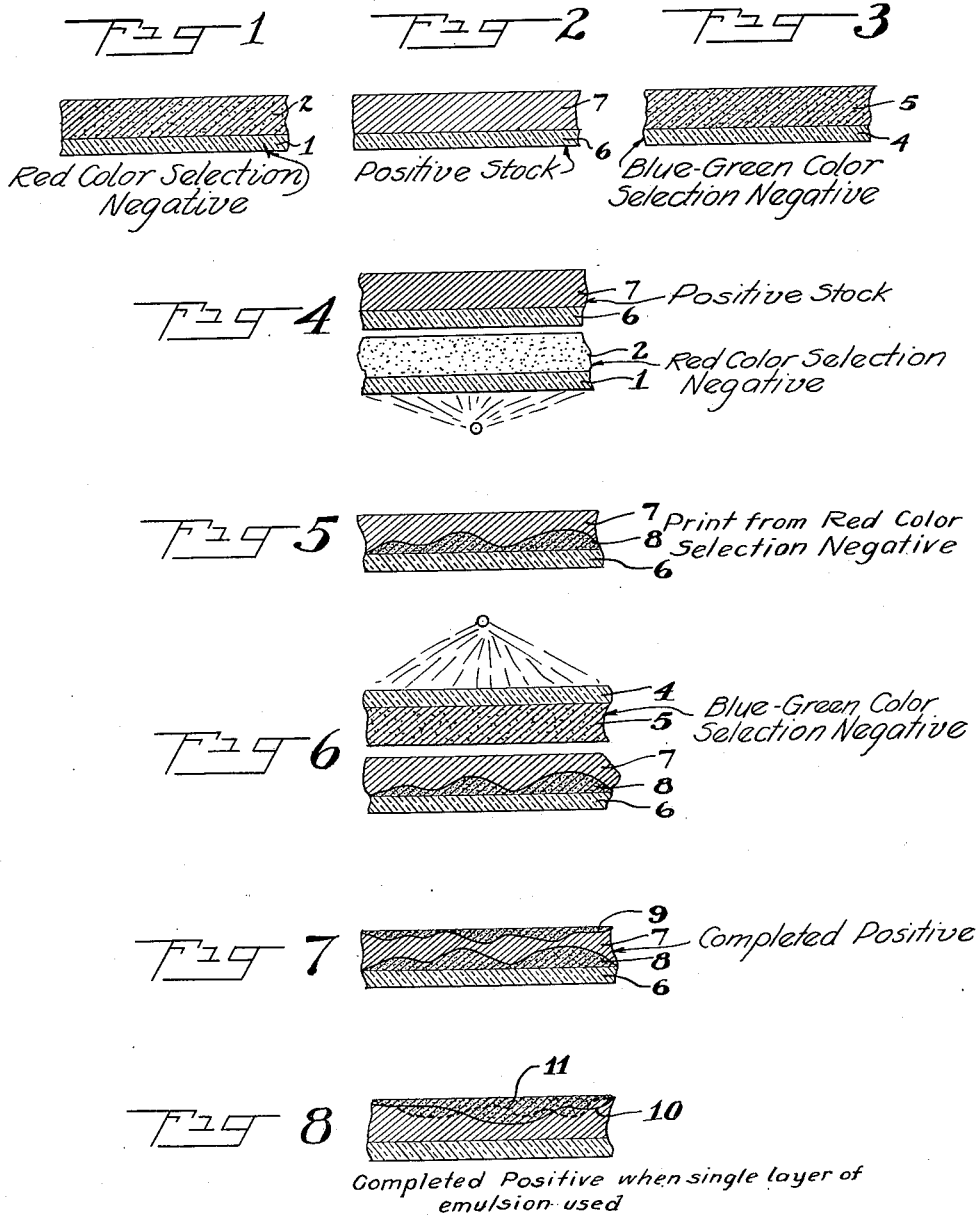
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COLOR PHOTOGRAPHY

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# UNITED STATES PATENT OFFICE.

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## COLOR PHOTOGRAPHY.

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This invention relates to color-photography and particularly has reference to the production of a plurality of colored registered images in a single coating on a transparent carrier.

Heretofore quite a few processes have been proposed for forming what is known as a color-photograph, that is, a photograph which exhibits an image of a subject wherein a color appears in kind and position corresponding to the coloring of the subject.

For making colored photographic motion picture film it has heretofore been proposed to form two registered superimposed images in the same picture space, one being formed of one color and the other being formed of a substantially complementary color. It has heretofore been proposed to secure one of the colors by a toning process and the other by a dyeing process or both by a dyeing process.

The principal object of applicants' invention is to provide a process by which at least two substantially complementary colored superimposed images in the same picture space, in a single coating on one side only of a carrier may be obtained by methods which involve the toning of two images without degradation of either.

Other objects and advantages will appear as the description of a particular manipulation involving the novel features of applicants' invention progresses and the novel features will be particularly pointed out in the appended claims.

In describing the invention in detail and the particular physical product selected to illustrate the invention, reference is had to the accompanying drawing wherein we have illustrated a particular preferred physical product resulting from the practice of our invention, and wherein like characters of reference designate corresponding parts throughout the several views, and in which:

Figure 1 illustrates a red color selection negative; Fig. 2, illustrates positive stock upon which the finished colored images are to appear; Fig. 3, illustrates the blue-green color selection negative; Fig. 4, illustrates the printing of the first image; Fig. 5, illustrates the positive stock carrying the developed first image; Fig. 6, illustrates the printing of the

second image after toning the first; Fig. 7 illustrates the positive stock carrying both developed images; Fig. 8, illustrates a modified form of final product.

In order to carry out applicants' process it will be necessary to secure two images one representative of one color in a subject and the other representative of a substantially complementary color of the subject. These images of course must be suitable to be used as negatives and in the further description of this process will be referred to as negatives. One will be designated the blue-green negative and the other the red negative. There are many ways of securing these negatives well known to those skilled in this art and as applicants' process does not depend upon the particular methods used for securing the negatives no particular manner of securing them will be described and pointed out. The red color selection negative is illustrated by Fig. 1, in which 1 is the transparent carrier and 2 the image carrying colloid. The blue-green color selection negative is illustrated by Fig. 3, in which 4 is the transparent carrier and 5 the image carrying colloid.

Having secured the negatives, one is placed in contact with the back of a transparent support carrying a single emulsion coating. If motion pictures are being dealt with, then the negative would be placed in contact with the celluloid, that is, in contact with the uncoated side of the film and further, ordinary motion picture stock film would be used, it being unnecessary to use any dye in the emulsion to act as a light retardant. This is illustrated by Fig. 4, in which 6 is the positive stock carrier and 7 the sensitized emulsion or colloid. The negative having been placed in contact with the back of the film a printing light 12, Fig. 4, is then allowed to shine therethrough and a latent image formed in the emulsion coating. In thus forming a latent image in the emulsion coating care is taken to so regulate the intensity of the printing light and the time of printing so that if possible the light sensitive material in the emulsion which will be acted upon, will be substantially only that positioned in substantially the lower thickness of the emulsion coating.

After the printing with one negative through the back of the carrier the latent

image is developed for about three minutes. The particular developing bath considered by applicants to be most efficacious in enabling them to secure the desired result would be neutral or acid and would be made up as follows:

Diamidophenol	5 g.
Sodium sulphite	30 g.
Potassium bromide	.94 g.
Potassium iodide 10% solution	1.2 c. c.
Water	1 l.

The developed image is illustrated by Fig. 5, in which 8 designates the developed image.

After developing, the print should be washed for 5 minutes, then if the image is to be formed as a blue-green image, the print should be placed in what we term the color forming bath. A satisfactory color forming bath to develop a blue-green in the image is formed as follows:

Oxalic acid	5 g.
Vanadium oxalate 10% solution	15 c. c.
Ferric and ammonium oxalate	14 g.
Potassium ferricyanide	5 g.
Water	1 l.

The print should be allowed to remain in the blue-green color forming bath for 15 minutes and then washed for five minutes.

After the print has been washed it should be cleared. The applicants allow the clearing bath to act for ten minutes and find that a suitable clearing bath would be as follows:

Ammonium bromide	12 g.
Potassium bichromate	12 g.
Water	2 l.

After the print has been cleared it should be washed for ten minutes and dried. This drying must of course take place in the dark, or in a room illuminated by a light having no effect upon the light sensitive material in the emulsion, that is, in most cases with a ruby light.

After the print has been dried a second latent image is then to be formed in the emulsion coating. This second latent image is to be formed by printing from the other negative by placing the same in contact with the emulsion and allowing a printing light 13, Fig. 6, to shine therethrough. The intensity of the printing light and the time of printing will be preferably so regulated that the color image formed by further manipulation resulting will be substantially complementary to the first color formed. This is illustrated by Fig. 6.

After the latent image is formed in the emulsion it is placed in the developing bath hereinbefore described and developed for three minutes, resulting in that illustrated in Fig. 7, in which 9 designates the second

image, after which it is washed for five minutes and then placed in a bath that hardens the gelatine in the vicinity of the silver in proportion to the amount of silver forming the image. Several baths are available of which the following two may be given as examples:

## I.

Chromic acid	12 grammes.
Potassium ferricyanide	12 grammes.
Water	2000 ccs.

## II.

Ammonium chromium sulphate	10 grammes.
Potassium bichromate	9 grammes.
Cupric sulphate	66 grammes.
Potassium bromide	88 grammes.
Water	1000 ccs.

Bathe for 5 minutes and remove stains in a one per cent solution of potassium metabisulphite when using I and bathe for 15 minutes when using II.

After the print has been last washed it would be fixed for five minutes in a bath formed as follows:

Sodium thiosulfate	600 g.
Potassium metabisulphite	60 g.
Water	1 l.

The film is then placed in such dyes as will hold tenaciously to hardened gelatine but will be washed out of the soft gelatine. Two such dyes are serichrome blue and wool orange A, both of the dyes being classed under triphenylmethane and diphenyl-naphthylmethane coloring matters. There are many dyes suitable for the purpose but a mixture of the above two will give a color complementary to the blue-green tone.

The dye is used in a weak solution of about one gramme to the liter. Upon clearing the dye from the white portions the film is dried, thus completing the formation of the color photograph. That is, a transparent carrier having a coating on one side only and in that coating in the same picture area two registered super-imposed, substantially complementary colored images.

The action of the bleach used to prepare the gelatine for selectively absorbing the dyes is substantially a surface one. It appears also that the blue tone image is of such great hardness that no dye is absorbed by it even without the top protecting image.

The result of using the bleach in this form is that any silver reduced in the second development is changed to a salt soluble in the fixing bath and is removed.

We have not found it possible to use any sort of metallic toning bath for the first image that will so thoroughly tone the image that no silver will be reduced during second development. The amount reduced is small yet when we use any kind of ton-

ing bath for the top image, this bath will also tone the small amount of reduced silver, referred to above which is to be found in the bottom image. This therefore, causes degradation. For example, if the bottom image is toned green-blue using iron as the medium, then upon second development, necessary for obtaining the top image (or second image) some silver is turned to metallic silver which upon being placed in any mordanting or toning bath which gives color directly or indirectly is altered to that color and is mixed in with the blue or blue-green. Nearly all toning baths and all mordanting baths intensify so that this small amount of silver becomes a very important factor.

This new system does not attempt to produce color directly by toning with metallic salts for the second image but is of a nature that removes any possibility of degrading the bottom image. The silver is removed entirely from the film and merely acts to place the gelatine in condition to hold the dye in the place formerly occupied by the silver. It differs from the pinatype or kodachrome system in both of which the dyes go into the soft gelatine and in which dyes are selected having that peculiar property.

Although we have herein stated that one image is formed in the coating by printing with one negative applied to the back of the final product film and stated that the other image may be formed by applying the other negative to the face or emulsion coated side of the final product film, nevertheless, we desire to have it understood that we have found that we may make both images in the emulsion of the final product film by applying first one negative to the face or emulsion coated side of the final product film and then after treating that image as hereinbefore described we may form the other image by likewise placing the other negative in contact with the face or emulsion coated side of the final product film and then treating as hereinbefore described. This is illustrated for printing from the face by Fig. 8, in which 10 is one image and 11 is the other. We make particular mention of this matter because it is believed that applicants have devised the first process whereby may be made a color photographic picture film having two registered superimposed images in the same picture space, one being formed of one color and the other being formed of a substantially complementary color which may be carried out by doing all printing

from the face or emulsion coated side of the final product film.

Although applicants have illustrated the principle of their invention by describing the steps of a novel process which results in a novel product, nevertheless, it is to be understood that the particular manipulation described and the product formed does not exhaust the possible expressions of applicants' process and the tangible products to be thereby produced.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A process for producing a colored photograph which consists in first forming an image in substantially one section of a coating and then toning the image to a given color and without fixing, forming a second image in the same coating in a substantially different section of the coating and then rendering the colloid surrounding the reduced, light, sensitive salt of the second image receptive to an acid or azo dye and then dyeing to a color substantially complementary to the color of the first image.

2. The process of producing two superimposed images in the same picture space in the same colloid layer which consists in first printing from a negative then developing in a non-alkaline developing bath and after coloring with a metallic tone, halogenizing and again printing from another negative and developing in a neutral or acid developing bath.

3. As a step in the process of producing a photograph having two superimposed registered images in the same picture space in a single colloid layer the development of a latent image formed therein after the production of a metallic toned colored image by the use of a developer which may be used in non-alkaline solution.

4. As an intermediate step in a color photographic process the production of an image in a colloid layer by printing from a negative development by a developer usable in non-alkaline solution and toning by a solution containing a metallic salt.

5. As an intermediate step in a color photographic process the production of an image in a colloid layer by printing from a negative development by a developer usable in non-alkaline solution and toning by a solution containing a ferric salt.

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