Jan. 1, 1929. 1,697,194

J. F. LEVENTHAL

METHOD OF COLOR PHOTOGRAPHY

Filed Jan. 31, 1923

Fig. 1

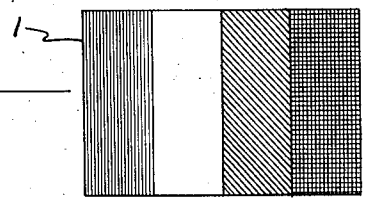


Fig. 2

RED NEGATIVE

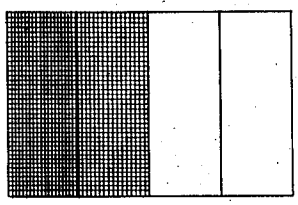


Fig. 3

GREEN NEGATIVE

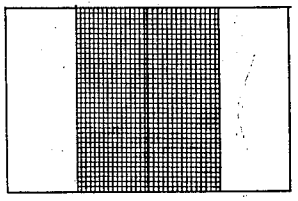


Fig. 4

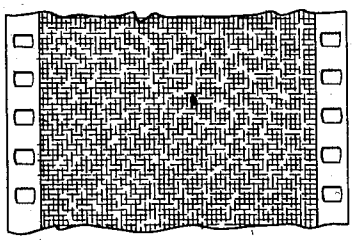


Fig. 5

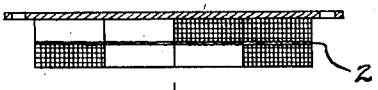
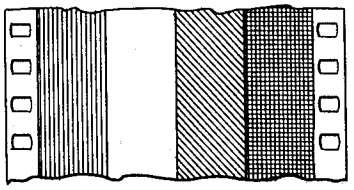


Fig. 6



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UNITED STATES PATENT OFFICE

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METHOD OF COLOR PHOTOGRAPHY.

Application filed January 31, 1923. Serial No. 616,174.

This invention relates to photography, particularly to what is known as color photography, and more especially to a process for producing a multicolor picture or print by the use of a transparent support coated on one side only with gelatine or other colloid, suitably sensitized and to an article which may be designated as a multicolor picture or print.

The principal object of my invention is to produce in a single coating on a transparent support or carrier substantially complementary colored images, which images will be representative in a general way, and as approximately as possible of substantially complementary color values existing in a subject of which they are images, to the end that light such as light from an ordinary carbon arc may be transmitted therethrough and thereby produce, to an observer, a substantially correct representation of a subject, substantially in its true colors.

Other objects and advantages of applicant's invention will appear as the description of the method, the means and an article produced thereby constituting a preferred physical embodiment of applicant's invention progresses, and the novel features of the invention will be particularly pointed out in the appended claims.

In describing the invention in detail reference will be had to the accompanying drawing, wherein like characters of reference designate corresponding parts throughout the several views, and in which:

Figure 1 is a schematic illustration of a colored object; Fig. 2, is a red color selection negative made therefrom; Fig. 3, is a green color selection negative made of the colored object Fig. 1; Fig. 4, is a view of a fragment of positive film; Fig. 5, is a cross sectional view of Fig. 4 after printing and developing using the negatives Fig. 2 and Fig. 3; Fig. 6 is a fragment of completed positive film, showing the colors as they would appear by transmitted light.

In practicing my invention, I first, using gelatine or other colloid coated, transparent plates or films, sensitized suitably and preferably pan-chromatic, make a plurality of negative images on different supports or on different separated portions of the same support, preferably by simultaneous exposure to the light from a colored subject. One negative is made by light from the subject which is caused to pass through a colored filter, preferably what is known as an orange to red filter, that is, a suitably colored transparent member is placed between the subject to be photographed and the coated support. Another negative is made by light from the subject which is caused to pass through a filter of a color substantially complementary to the first and preferably, a blue to green filter.

As a subject or object I have taken the body 1 shown in Fig. 1 colored as shown.

Upon developing and fixing, in the usual way, the negatives so made, one negative represents one of the color values of the subject photographed, and the other represents substantially the complementary color value of the subject photographed. In the particular case selected for illustration one represents the orange to red color value and the other the blue to green.

Fig. 2, illustrates the completed red color selection negative and Fig. 3 the green color selection negative.

The process and means for producing negatives, one representing one color value, and the other representing a substantially complementary color value of a subject, is well known to those skilled in the art of color photography. These negatives may be designated color selection negatives.

It has been heretofore proposed, using the two color selection negatives hereinbefore referred to, to produce in a single colloid layer, supported on a transparent carrier, such as is shown by Fig. 4, two separate images. This was to be done by applying one of the negatives to the exterior face of the coating or colloid layer and the other negative, suitably registered, to the back of the colloid carrier, and to then expose the negatives to light sources. This process was intended to form in the colloid layer two registered separated latent images, one adjacent the exterior face of the colloid, and the other adjacent the interior face or face in contact with the carrier. A subsequent treatment of these images was to produce a color in one image and a substantially complementary color in the other image. The difficulty with this process is, that it is quite impossible to prevent one image from invading the plane which should be ex-

clusively occupied by the other image, and the consequent inability to differentially treat the two images.

The difficulties of the prior process I obviate by using a carrier having a single coating of gelatin or other colloid colored with a fugitive dye, as shown in the drawing Fig. 4, which acts as a light retardant, or shield, preferably a yellow dye, and impregnated with a suitable light sensitive salt, such as a silver salt. Yellow dye acts as a light retardant while the images are being formed in the coating, so that due to its retarding action the process of printing can be so controlled that one image will not invade the plane intended to solely contain the other image, so that a subsequent differential treatment of the images may be effected.

I not only dye the coating preferably yellow, but I also differentially expose the color selection negatives when in position on the two sides of the coating to differential light action, that is I subject the negative in contact with the exterior face of coating to less light action than I do the other negative, so that I thereby obtain a "thin" image adjacent the exterior face of the coating which is particularly advantageous in the later steps of the process, especially the bleaching process, because I am enabled to successfully bleach this image without affecting the image adjacent the interior face of the coating.

In my process, therefore, I follow the prior art in making color selection negatives and in producing images from these negatives in a single coated carrier, except that, my coating is dyed preferably with a yellow dye, and I cause the light to act differentially. Such carriers having a single coating, which coating is dyed with a fugitive dye, such as yellow, are a commercial article and may be obtained in the market. This yellow dye may well be tartrazine.

After having exposed my sensitized coating in the manner hereinbefore set forth, I wash out the dye in the sensitized coating with water. This washing takes about two, to three minutes. The time is determined by a simple test in ordinary day light using water at a given temperature, say 65° F. and then thereafter followed in the dark room as a fixed conditions operation not requiring skilled observation during its continuance.

After washing I then develop the positive latent images by use of a well known developer, such as diamidophenol or metol hydrochinon, which is a mixture of monomethylparamidophenol and paradihydroxybenzene. I may use the following formula: diamidophenol 80 grams, sodium sulphite 480 grams, potassium bromide 5 grams, water 32000 c. c.

The developing bath will be allowed to act for two minutes at substantially a fixed temperature, say 65° F.

I then fix the image by the use of a well known fixing agent such as sodium thiosulphate which gives me a positive having two images thereon or therein, one representing orange to red color values, and the other representing blue to green color values, and these images are separated by a body of gelatin more or less thick, as shown by Fig. 5, the separating body being distance 2.

The next step in my process is to treat the positive with what may be called a bleach retardant, that is with a substance which so acts upon the coating, that if the coating is exposed to a bleach, that bleach will penetrate relatively slowly into the gelatin to act upon any of the substance deposited therein which forms the images.

A suitable bleach retardant for this purpose may be made in accordance with the following: formaldehyde, ten per cent solution, 10 c. c., water 90 c. c.

The positive is subjected to the action of this bath for substantially ten minutes at normal temperature.

I next subject the positive to a bleach, in order to render the substance forming the image adjacent the exposed surface of the coating, transparent and susceptible to the action of a dye, that is, I really mordant it. The bleach which I consider preferable and which I allow to act at normal temperature for about one and one half minutes and which renders the image formed adjacent to the exposed coating, transparent, is made as follows:—ammonium bromide 27 grams, potassium iodide 43.5 grams, iodine 1.5 grams, water 1000.00 c. c.

After bleaching the outer image, which bleaching does not affect the image formed adjacent to the transparent support, by reason of the particular concentration of bleaching bath which I use, and the length of time which I allow it to act, together with the retarding effect of the bleach retardant, to which the coating was exposed as hereinbefore set forth, I wash the positive, to remove iodine stains.

A suitable bath for this purpose may be made in accordance with the following: potassium meta bisulphite 14 grams, water 1000 c. c.

This bath should be allowed to act from one half to one minute as determined by observation.

After clearing I place the positive in a suitable basic aniline orange to red dye solution such as chrysoidine R or fuchsine in water which causes the image adjacent the exposed face of the coating to become orange to red in those portions which at first were black, and after suitably dyeing this image, the positive is washed with

water to remove all surplus of dye. This dyeing bath is allowed to act a length of time, determined by test and observation, such that the dyed image will have sufficient color to properly exhibit the color of the object originally photographed.

The next step in my process is to place the positive in a toning bath.

A suitable toning bath may be formed of the following: potassium oxalate 12 grams, ferric nitrate 12 grams, potassium ferricyanide 10 grams, hydrochloric acid (1.19 sp. g.) 5 c. c., water 2000 c. c.

This bath is allowed to act at normal temperature such a length of time that the image will have the proper color value to properly show by transmitted light substantially the color of the object photographed.

By the action of the toning bath the image adjacent the transparent support which is originally black becomes a blue to green, and after sufficient exposure to this toning bath to get the proper depth of color the positive is put through a final fixing bath.

A suitable bath for this purpose may be made as follows:—sodium thiosulfate 400 grams, sodium acetate 200 grams, glacial acetic acid 20 c. c., water 4000 c. c.

This bath is allowed to act for substantially one minute at normal temperature.

As the image formed in the positive adjacent the exterior surface of the gelatine was formed from the negative representing blue to green color values, and the image formed adjacent to the transparent support was formed from the negative, representing properly registered orange to red color values, I have when I have completed the procedure above outlined, a positive print having images therein corresponding to my negatives, one colored orange to red, and the other a somewhat blue to green, so that if I then examine those images by transmitted light, as shown in Fig. 6, I observe an image of the subject photographed in approximately its true colors, or may throw the images upon a screen, and when observing the same upon the screen would see the subject photographed in approximately its true colors, in so far as the true colors of a multi-colored object may be reproduced by means of two substantially complementary colors as orange to red and somewhat blue to green.

The process hereinbefore described makes possible the production of complementary colored blended images in a single coating on a transparent support. This result depends on the differential exposure to light of the negatives, which combined with the retarding effect of the yellow dye in the colloid enables me to form latent images in the coating substantially in two planes separated more or less by a body of colloid. Then by my bleach retardant and suitable bleach combined with the special separation of the images I am enabled to bleach and mordant one image without affecting the other so that I am thereby enabled to then dye the mordanted image without affecting the other image. Then by using a toning solution which does not affect the dyed image I am enabled to produce a color in that image which is effective as the complementary color of the dyed image so that when the coating so treated is viewed by transmitted light the observer is given the impression of a subject in substantially its true colors.

Although I have particularly described my process in connection with definite times, definite temperatures, definite concentrations and particular specific substances, I desire to have it understood that these definite and particular specifications are merely illustrative, but do not exhaust the possible temperatures, concentrations and substances applicable for use in carrying out a process embodying the fundamental conception of my invention.

I claim:

1. The steps in a method of producing a color photograph which consist in producing separated registered images in a single layer of colloid containing a light sensitive salt developing and fixing to form an image capable of being bleached and then treating the colloid with a bleach retardant which diminishes the rapidity of action of a subsequently applied bleach.

2. The steps in a method of producing a color photograph which consist in producing separated registered images in a single layer of colloid containing a light sensitive salt supported by a carrier developing and fixing to form an image capable of being bleached and then treating the colloid with a bleach retardant and subsequently bleaching the image adjacent the exterior face of the colloid.

3. The method of preparing a colloid containing a light sensitive salt for producing a color photograph which consists in producing separated images in the colloid by differential light action, developing and fixing to produce an image capable of being bleached and then treating the colloid with a bleach retardant and bleaching only the image adjacent the exterior surface of the colloid so that it is mordanted for a basic dye.

4. The steps in a method of producing a color photograph which consists in subjecting a carrier supporting a colloid dyed yellow and containing a light sensitive salt while a different color selection

negative is applied to each side thereof to differential light action, developing and fixing to produce an image capable of being bleached and then treating the colloid with a bleach retardant and then bleaching the image formed adjacent the exterior surface of the colloid.

5. The steps in a method of producing a color photograph which consists in subjecting a carrier supporting a colloid dyed yellow and containing a light sensitive salt while a different color selection negative is applied to each side thereof to differential light action, developing and fixing to produce an image capable of being bleached and then treating the colloid with a bleach retardant.

6. The method by which impressions from two color selection negatives are simultaneously and differently printed upon single coated film containing a fugitive light restraining dye to form images capable of being toned, which consists in developing, fixing, and treating with a bleach retardant both images at the same time, then bleaching the outer image only so that it may be dyed without affecting the inner image, dyeing the outer image red, and lastly coloring the inner image blue green.

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