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COLOR PHOTOGRAPHY

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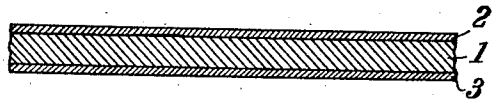

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COLOR PHOTOGRAPHY

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My present invention relates to color photography and more particularly to a process of color photography in which more than one picture is located in one emulsion layer.

One of its objects is an improved process of the kind just mentioned. Another object is the film adapted for the production of multi-color pictures according to my improved process. Further objects will be seen from the detailed specification following hereafter. In the accompanying drawing there is shown by way of example a film suitable for carrying out my invention.

According to this invention I have found that very satisfactory multi-color pictures are obtainable by printing part color picture negatives on film of which the support is coated on one or both sides with a light sensitive emulsion layer when suitably sensitizing and coloring these emulsion layers and treating the exposed layers as will be hereinafter more fully described particularly in the examples. The layers of the film bearing on each side a light sensitive emulsion layer are provided with a dye of a color complementary to that for which each layer is sensitized and which is easily and permanently decolorized in the photographic treating liquids used for the production of the pictures or by another suitable after treatment bath. The layers are further more sensitive for different spectral colors, that is, if one layer is sensitized for green the other layer must be sensitive to red or blue, in the latter case no special sensitizing is necessary as the emulsion is initially sensitive to blue. Thus there may be used, for instance, for the production of a three color picture a film which is coated on one side with an emulsion layer sensitized for green and dyed with a red filter dye and the other side with an emulsion layer that is not specially sensitized but has its initial sensitiveness to blue, and is provided with a yellow filter dye. On this film there is printed, for instance, the green part-color negative by means of green light through the not specially sensitized layer and the support on the emulsion layer sensitized for green and provided with the red filter dye. In view of this red filter dye the exposure proceeds not throughout the emulsion layer sensitized for green but the production of a picture is limited to the strata next the support. The remaining part-color negatives may be printed in any desired manner on the two layers, there may be used light of that color to which the emulsion layer to be exposed is sensitive, or there may be used blue light which color corresponds with that to which the emulsion layers are initially sensitive.

The exposure is effected in several stages as it is rather difficult to transform two developed silver pictures comprised in a single emulsion layer into color pictures. Therefore, after the first exposure the film is developed and the developed silver image is transformed into a color picture by chemical toning. After the chemical toning, the undeveloped silver halide of the layers not yet exposed is resensitized because its sensitiveness has suffered. This resensitizing is effected according to this invention, by means of a reducing agent, a treatment which has been found to be most effective. As reducing agents which are suitable I mention among others, sulfites, for instance, sodium sulfite, sodium bisulfite, potassium metabisulfite, hydrazinsulfate and hydroxylamine. After this resensitizing the remaining part-color negatives are printed and the exposed layers developed with a developer that does not influence those strata of the layers which have been chemically toned, for instance, amidol. Hereon the prints are fixed, washed and the silver pictures transformed into color pictures.

The following examples serve to illustrate the invention:

Example 1:—A film coated with an emulsion layer dyed yellow, for instance, with tartrazine is exposed behind a red part-color negative and developed but not fixed. The silver picture is converted into the dark toned iron blue by treatment with a mixture of equal parts of the following three solutions:

Solution I: 10 grams of potassium ferricyanide
1.3 cc. of a sodium bichromate solution of 1 per cent strength
1000 cc. of water

Solution II: 21 grams of ammonium iron alum
1000 cc. of water

Solution III: 25 grams of oxalic acid
1000 cc. of water,

for 8 minutes. Then the film is washed, bathed for 3 minutes in a solution of sodium sulfite of 5 per cent strength and dried. Hereafter the film is exposed behind the blue part-color negative either from the layer side or through the support, developed in an acid developer, fixed and washed. The silver picture is then transformed into a color picture by dye toning, for instance, the silver

picture is transformed into a silver iodide picture by treatment with the following solution:

100 cc. of a solution of potassium iodide of 10 per cent strength
0.4 grams of iodine
5 cc. of acetic acid of 30 per cent strength
100 cc of water

The picture thus obtained is dyed by means of solution of auramine and fuchsine of 1 per cent strength.

Example 2:—On a film coated with an emulsion layer on both sides of the support the red part-color negative is printed on the layer sensitized for green, for instance with erythrosine, and provided with a red filter dye, for instance Rapid Filter Red, and simultaneously the green part-color negative is printed on the other layer which is not specially sensitized and is provided with a yellow filter dye, for instance, tatrazine. The exposed film is developed and without fixing, the print of the red partial negative is toned iron blue with a mixture of equal parts of the following three solutions:

Solution I: 10 grams of potassium ferricyanide
1.3 cc. of a sodium bichromate solution of 1 per cent strength
1000 cc. of water

Solution II: 21 grams of ammonium iron alum
1000 cc. of water

Solution III: 25 grams of oxalic acid
1000 cc. of water

This treatment lasts about 8 to 10 minutes at a temperature of 18° C. and may consist in letting the film swim on the toning solution. After washing the film for about 10 minutes, the remaining silver bromide is resensitized by a treatment with a solution of potassium metabisulfite of 5 per cent strength, then the film is washed and dried. All these operations are carried out in the dark. Now the blue part-color negative is printed through the formed blue picture, preferably by means of green blue light into the part next the support of the emulsion layer sensitized for green. Hereafter the film is developed with an acid developer which does not attack the blue picture produced by the above chemical toning, for instance, amidol of the following composition

5 grams of amidol
60 grams of sodium sulfite (cryst.)
1000 cc. of water
3 cc. of acetic acid

fixed, washed and dried. The silver pictures are now bleached by means of a copper bleacher consisting of equal parts of the following solutions:

Solution I: 240 grams of copper sulfate
2360 grams of water
180 cc. of glacial acetic acid

Solution II: 112 grams of potassium rhodanate
500 grams of potassium nitrate
2340 cc. of water

The treatment lasts about 8 minutes, whereupon the film is washed with water and dried. The two sides of the film are now dyed separately: the side on which the blue part-color negative has been printed being dyed with a solution of auramine and the other side on which the green part-color negative has been printed being dyed with a solution of fuchsine either by letting the film swim on the dyestuff solution or by applying the dyestuff solution with coating rollers. After drying the film is ready for projection.

Example 3:—On a film coated with an emulsion layer on both sides of the support the red part-color negative is printed by means of green light through the blue-sensitive layer provided with a yellow filter dye, for instance tartrazine, and through the support, on to the layer sensitized for green, for instance, with erythrosine, and provided with a red filter dye, for instance Rapid Filter Red or Rose Bengale, and the green part-color negative is printed by means of blue light directly on the blue-sensitive layer dyed yellow. The exposed film is developed, washed and dried without being fixed, whereby the filter dyes are removed. The print of the red part-color negative is then toned blue as described in Example 2 and after washing the unchanged silver bromide is resensitized by means of a solution of

5 grams of hydrazine sulfate
1000 cc. of water
3 grams of citric acid

and washed. All these operations are carried out in the dark. The blue partial negative is printed on the emulsion sensitized for green by means of green light, and the film is developed in an acid developer as described in Example 2, fixed, washed and dried. The black silver images are bleached and transformed into color pictures as described in Example 2.

Example 4:—A film is coated on both sides with an emulsion layer one of which layers is sensitized for red, for instance, by means of pinacyanole and provided with a water soluble filter dye, for instance, Filter Green, and the other is sensitized for green, for instance by means of erythrosine and provided with a red filter dye, for instance, Rapid Filter Red or Rose Bengale. The green part-color negative is printed by means of green light through the emulsion layer sensitized for red and through the support on the emulsion layer sensitized for green and the red sensation is printed by means of red light through the emulsion sensitized for green and through the support on the emulsion layer sensitized for red. The two part-color negatives may be printed simultaneously or in succession. After development and washing the film is dried in the dark. Now, the print of the red partial picture is toned iron blue, and the print of the green partial picture is bleached by means of the copper bleacher described in Example 2 care being taken that only the side of the film which is to be treated is wetted by the treating liquid. The film is then washed and the unchanged silver bromide resensitized by means of a solution of potassium metabisulfite of 5 per cent strength washed again and dried, still in the dark. The blue part-color negative is then printed by means of red light directly on the emulsion layer in which the iron blue toned picture has been produced, which layer is sensitive towards red, and on the other emulsion layer provided with the bleached strata next the support, which layer is sensitive towards green, there is printed directly by means of green light a black and white picture in the correct tonal values from a negative having the correct tonal values. The film is developed in an acid developer, fixed and washed. The print of the blue partial negative is treated with the copper bleacher as described in Example 2 and dyed

yellow with a solution of auramine of 1 per cent strength so that only this side of the film comes in touch with the treating liquids. The other emulsion is then dyed in the same manner with a solution of fuchsine of 1 per cent strength, whereby only the bleached picture is dyed while the black and white picture contained in the surface strata of the film remains unchanged. After washing and drying the film is ready for use.

In the accompanying drawing there is shown a film suitable for my invention. The support 1 which has been manufactured from any material known in the art, for instance, from cellulose or cellulose derivatives, is coated with the emulsion layers 2 and 3 arranged on its two sides. The emulsion layer 2 is sensitized for green and provided with a red filter dye, and the emulsion layer 2 is not specially sensitized and dyed with a yellow filter dye.

My process is applicable, for instance, for the production of cinematographic pictures in colors or color pictures which are viewed by transmitted light or by reflected light. In the latter case the film must be provided with a base which reflects the light.

My invention is not limited to the foregoing examples or to the specific details given therein and I contemplate as included within my invention all such modifications as are included within the scope of the appended claims.

What I claim is:

1. A film for three or four color photography comprising a support provided on each side with a light sensitive emulsion layer said emulsion layers being sensitive for different spectral colors and dyed with a filter dye of a color complementary to that for which the emulsion layer is sensitive said filter dye being capable of decolorizing.

2. A film for three or four color photography comprising a support provided on one side with an emulsion sensitized for green and provided with a red filter dye capable of decolorizing and on the other side with an emulsion layer having its initial sensitiveness to blue and dyed with a yellow filter dye capable of being decolorized.

3. A film for three or four color photography comprising a support provided on one side with an emulsion sensitized for green and dyed with a red filter dye capable of being decolorized, and the other side with an emulsion layer sensitized for red and dyed with a green filter dye capable of being decolorized.

ARPAD v. BIEHLER.