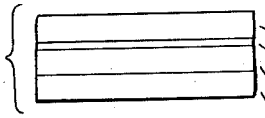
Sept. 18, 1951 H. VON FRAUNHOFER ET AL 2,568,208

COLOR PHOTOGRAPHY

Filed March 28, 1947

1 UNEXPOSED NEGATIVE



BLUE GREEN SENSITIVE EMULSION LAYER CONTAINING BLUE GREEN COLOUR FORMER

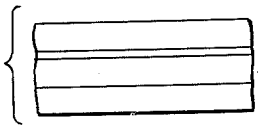
YELLOW FILTER LAYER

RED SENSITIVE EMULSION LAYER CONTAINING MAGENTA COLOUR FORMER

SUPPORT

2 EXPOSE, DEVELOP AND PROCESS

3 FINISHED NEGATIVE



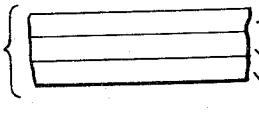
BLUE GREEN IMAGE OF BLUE GREEN COLOUR VALUES

MAGENTA IMAGE OF RED COLOUR VALUES

SUPPORT

4 PRINT THROUGH A GREENISH YELLOW FILTER, WHICH CONVERTS MAGENTA IMAGE TO RED AND BLUE GREEN IMAGE TO GREEN, ONTO A

5 POSITIVE MATERIAL



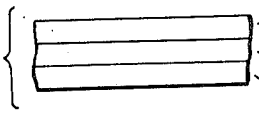
RED SENSITIVE EMULSION LAYER CONTAINING MAGENTA COLOUR FORMER

ORTHOCHROMATIC EMULSION LAYER CONTAINING BLUE GREEN COLOUR FORMER

SUPPORT

6 TREAT WITH COLOUR RECTIFIER SOLUTION TO OBTAIN SELECTIVE DEPOSITS OF YELLOW IN TOP LAYER, DEVELOP AND PROCESS

7 FINISHED POSITIVE



COMBINED MAGENTA AND YELLOW IMAGE

BLUE GREEN IMAGE

SUPPORT

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Patented Sept. 18, 1951

2,568,208

UNITED STATES PATENT OFFICE

2,568,208

COLOR PHOTOGRAPHY

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Application March 28, 1947, Serial No. 737,992
In Great Britain February 17, 1947

2 Claims. (Cl. 95—2)

1

This invention relates to a process of colour photography in which the sensitive materials employed are of the chromogenic integral monopack type.

Processes using such materials have great practical advantages over processes of other types. Only a single exposure in a standard type of camera is required and the subsequent printing and processing operations can be carried out in normally equipped laboratories. However, the processes of this general type which are now in use require highly skilled and costly handling at each step to avoid the many pitfalls inherent in this type of process and the general object of the present invention is to provide a process of the type referred to which is relatively simple and inexpensive to operate in commercial scale production.

All the colour photograph processes using chromogenic integral monopack materials which are now in commercial use employ a three colour analysis and synthesis. Accordingly, the sensitive material employed comprises a Celluloid or other base and five superimposed coating layers, namely three layers of emulsion separated from each other by two filter layers of gelatine. The production of such material requires five separate coating operations and the productive capacity of any given coating plant is correspondingly reduced.

Moreover, great practical difficulties are experienced in practice in providing three properly matched colour formers. The colour balance of the material can be badly affected by small differences in the concentration of the coupling components in the three emulsion layers or by small differences in the temperature at which the various layers are coated. Furthermore, the colour balance of any five layer chromogenic material may easily be so upset as to ruin the negative or print by small variations in the composition, temperature and age of the solutions used in processing the material.

In the process of the present invention, these difficulties and disadvantages are largely avoided or overcome by the use of sensitive material having only two emulsion layers. The particular object of the present invention, therefore, is the provision of a colour photography process, employing material of the chromogenic integral monopack type, which permits the production of truly natural colour prints or positives from a two colour analysis negative.

In the process of the invention, a two emulsion positive material, comprising an emulsion layer

2

containing a magenta colour former superimposed on an emulsion layer containing a blue-green colour former, is printed onto from a two colour analysis negative in such manner that an image corresponding to the red-yellow colour values is formed in the emulsion layer containing the magenta colour former and an image corresponding to the blue-green colour values is formed in the emulsion layer containing the blue-green colour former, and the emulsion layer containing the magenta coloured image is then treated with a colour rectifier solution which selectively deposits yellow in the silver image.

The operation and advantages of the method of the invention will best be understood from the following description of a specific embodiment thereof, the details of which are, of course, given by way of illustration only and not by way of limitation. Reference may be had to the accompanying drawing which indicates the course of the colouring process by means of briefed flow diagram.

In this particular process, we employ a negative material comprising a carrier or base coated successively with a red sensitive emulsion layer containing a magenta colour former, a yellow filter layer and a blue-green sensitive emulsion layer containing a blue-green colour former.

A two emulsion material of this type is far simpler and considerably less expensive to produce than a three emulsion material with two filter layers, nor is its production nearly as critical as the latter material because adjustment in printing and processing for slight differences between the coating weights of the two layers of emulsion is far simpler than is the adjustment of corresponding differences in the case of the three emulsion material. Moreover, while the choice of the three colour forming substances is of critical importance in a five-layer material, we find that we can use any two colours in our negative material so long as they are widely separated from each other, or can be widely separated from each other by the use of a suitable printing filter.

After exposure we develop and process our above described negative film in the following manner: The negative is first passed through a developing solution which is made up as follows:

Sodium Sulphite	9½ ozs.
di-Ethyl-p-phenylenediamine	11 ozs.
Potassium Carbonate	16 lbs. 6 ozs.
Potassium Bromide	2¼ ozs.
Water to	20 gallons

The normal developing time varies between 10 to 15 minutes and, thereafter the film is passed through a stop and clearing bath which is made up as follows:

	Pounds
Sodium Bisulphite	2
Sodium Acetate	7
Water to 20 gallons	

After passing the film through the above solution for two to three minutes, it is passed into a fixing bath made up as follows:

	Pounds
Chrome Alum	2½
Sodium Hydrosulphite	40
Water to 20 gallons	

The fixing of the negative usually requires 7 to 10 minutes and thereafter the film is passed through a cascade washing tank for approximately 15 minutes and, thereafter, the film is passed into a bleaching bath which is made up as follows:

	Pounds
Potassium Ferricyanide	15
Potassium Bromide	5
Water to 20 gallons	

The negative remains in the bleaching solution for approximately 6 to 8 minutes; thereafter it is washed in a cascade washing tank for 5 to 7 minutes, then passed into a fixing bath made up as stated above for 5 to 6 minutes; thereafter it is washed again and then dried.

The finished negative film is printed through a suitable filter of greenish-yellow colour which converts the magenta colour of the one layer into a red colour and the blue-green colour of the other layer into a green colour, in a single exposure on to a special positive material. This positive material comprises a carrier or base coated successively with an orthochromatic layer of emulsion containing a blue-green colour forming substance and a red sensitive layer of emulsion containing a magenta colour forming substance.

The exposed positive film is passed through a colour rectifier solution of aceto-acetanilide or acetacet 2,5 dichloroanilide, made up by dissolving 1½ ozs. of the dye in 60 ozs. of alcohol, and thereafter the film is developed and processed in the same manner and in the same solutions as prescribed for the negative film. Alternatively, the acetoacetanilide rectifier may be mixed into the developing solution or, in the case of a two tank developing procedure, it may be mixed into either the first or the second tank, depending upon the results desired in the final print.

The result of this treatment with the colour rectifier is that the lower layer of the positive film, carrying the blue-green coloured image, is not affected by the rectifier to any extent, whereas the top layer, carrying the magenta coloured image, receives a sufficient selective deposit of yellow in the silver image to produce a range of colours from deep red to yellow which, in combination with the lower blue-green coloured image results in a truly natural colour rendering in the positive or print.

It will be appreciated that the process above described is extremely simple and is easily handled and controlled in commercial scale production. An additional advantage of our above described procedure of making natural colour films or photographs is in the fact that we obtain considerably sharper images than is possible to obtain by a five-layer material because of the fewer separating layers present in our negative and positive films.

We claim:

1. Process for preparing natural colour prints on positive photographic material having only two light sensitive silver halide emulsion layers containing dyestuff components superimposed on a base layer, said dyestuff components being capable of forming a dye in the places of the silver picture upon being contacted with a colour forming developer, said process comprising forming in one layer of an integral bipack colour separation negative a magenta image recording red from a natural subject, forming in the other layer of said negative a blue green image recording blue green from said subject, exposing said positive through the formed negative and through a greenish yellow filter, said positive material having a red sensitive silver halide emulsion layer, containing a magenta dyestuff component coated on a base and an orthochromatic sensitive layer containing a blue green dyestuff component superimposed on said red sensitive layer, developing the exposed positive material and causing colour coupling of the dyestuff components to take place therein whereby a magenta image is formed of the negative record of the natural red and a blue green image is formed of the negative record of the natural blue green, and forming a selective yellow deposit on the silver image in the magenta coloured layer of the exposed positive whereby a range of colours from deep red to yellow is formed in the magenta coloured layer of said positive which in combination with the blue green coloured image in the outer layer of the positive will result in a natural rendition of the colours of the subject.

2. Process for obtaining the effect of a three-colour photographic rendition of a natural subject having red, blue, green, and yellow colours by employing a negative element and a positive element, each of which elements includes only two light-sensitive silver halide emulsion layers, said process comprising exposing the negative element from an emulsion side to light from said subject, said negative element having respectively coated onto a base layer a red-sensitive silver halide emulsion layer containing a magenta dyestuff component, a yellow filter layer, and a blue green-sensitive layer containing a blue green dyestuff component, whereby the red of the subject is recorded in the red-sensitive layer and the blue green of the subject is recorded in the blue green-sensitive layer, accomplishing development and color coupling of the dyestuff components in said negative producing a magenta image of the red record and a blue green image of the blue green record, exposing the positive element through a greenish yellow filter and the developed negative, said positive element having superimposed on a base layer an orthochromatic silver halide emulsion layer containing a blue green dyestuff component and a red-sensitive silver halide emulsion layer containing a magenta dyestuff component, whereby the red record of the subject carried by the magenta image of the negative is recorded as an image in the red-sensitive layer of the positive and the blue green record of the subject carried by the blue green image of the negative is recorded as an image in the orthochromatic layer of the positive, accomplishing development and color coupling of the dyestuff components of and within the exposed positive producing a magenta

image of the red record and a blue green image of the blue green record, and forming a selective yellow deposit on the silver image in the magenta coloured layer of the positive whereby a range of colours from deep red to yellow is formed in the magenta coloured layer of said positive which in combination with the blue green coloured image in the outer layer of the positive will result in a natural rendition of the colours of the subject.

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HARRY EDWARD COOTE.

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