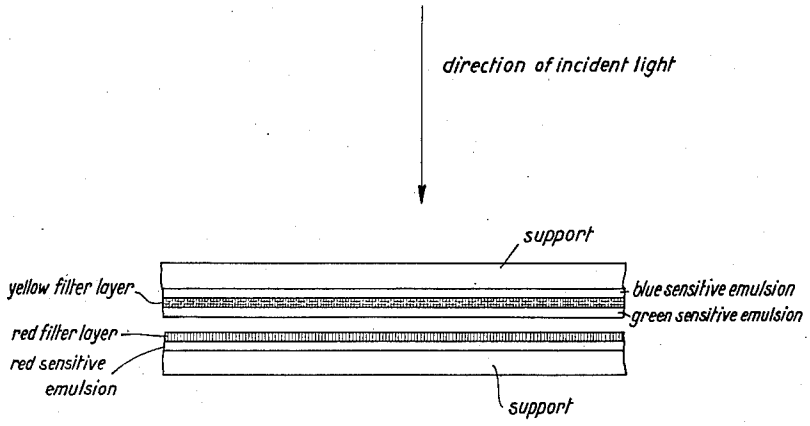
May 6, 1941. J. EGGERT ET AL 2,240,692

COLOR PHOTOGRAPH

Filed June 13, 1938



Inventors
John Eggert
Bruno Wendt

By Their Attorneys
Hutz and Joslin

Patented May 6, 1941 2,240,692

UNITED STATES PATENT OFFICE

2,240,692

COLOR PHOTOGRAPH

John Eggert, Leipzig-Gohlis, and Bruno Wendt, Dessau, Germany, assignors, by mesne assignments, to General Aniline & Film Corporation, New York, N. Y., a corporation of Delaware

Application June 13, 1938, Serial No. 213,426
In Germany June 22, 1935

7 Claims. (Cl. 95—2)

Our present invention relates to the production of color photographs.

In application Ser. No. 85,848 filed June 18, 1936, now Patent No. 2,153,617 of April 11, 1939, of which the present application is a continuation in part, we have disclosed a method of producing color pictures by the employment of a color photographic multi-layer material, in which the individual light-sensitive silver halide emulsion layers are separated by filter layers the dyestuffs of which are stable against the normal photographic treating baths, i. e. the developers, fixing baths and silver-removing-baths.

The method described in our parent application consists in taking a picture on said photographic material, developing and fixing, reducing the silver formed to undevelopable silver halide, differentially exposing the individual layers to mono-chromatic light by means of the colored filter layers, whereby a color separation capable of development is formed in each of the individual layers. The further treatment consists in developing the color separations one after the other in color or otherwise imparting color thereto, and removing the dyestuffs in the filter layers after the formation of at least one color picture.

The present invention has for an object an improvement of the above described process, which will simplify the procedure and ensure that the desired result is obtained.

A further object is the provision of a novel kind of bipack-material for color photography.

Further objects will become apparent from the detailed specification following hereinafter.

Reference is made to the accompanying self-explanatory drawing, the single figure of which shows a bipack with the preferred arrangement of layers.

We have found that it is advantageous to use a bipack for the exposure, which has on one support two differently sensitive silver halide emulsion layers separated by a colored-filter layer resistant to photographic baths and on the other support a single silver halide emulsion layer sensitive to the rest of the visible spectrum. The original silver component images in the superimposed layers which have been converted, after developing and fixing, into undevelopable silver halide images, are converted into dyestuff images by again exposing them separately with the aid of the filter layer, the filter dyestuff being bleached only after the production of at least one dyestuff component image.

The use of a bipack has the advantages that for the production of three color images only two emulsion layers of the exposure material need be converted into dyestuff images, that one filter layer can be dispensed with, and that the color-separation of two color images in the copying process can be more easily and effectively carried out than that of three color images. For example, the blue and green sensitive layers are arranged on one side of a support with a color filter layer as described in the parent application Ser. No. 85,848 and containing as filter dye the dyestuff from diazotized aniline and 1-(para - sulfophenyl) - 5 - pyrazolone - 3 - carboxylic acid-ethyl ester (with calcium lactate as fixing agent) while the red-sensitive layer is on the other support and during the exposure runs through the camera in contact with the two other light-sensitive layers.

The material is worked up as described in the parent application Ser. No. 85,848. Thus, for example, the double layer is developed and fixed in the normal way and the silver images produced are converted into silver bromide, for example by a bath of ammonium persulfate and ammonium bromide of the following composition:

Water	cc.	1000
Ammonium persulfate	grams	100
Potassium bromide	do	50

The layer with the blue component is then exposed to blue light and developed in a developer as described in U. S. Patent application Ser. No. 82,930 filed June 1, 1936, to a yellow picture. After bleaching the color filter layer with a sodium hydrosulfite solution, which does not affect the yellow picture dyestuff or the unexposed silver bromide of the second layer, the green component in the second layer is developed after exposure to blue light with diethyl-para-phenylenediamine and phenyl-iso-oxazolone to a magenta image. Finally the silver produced in the color development is removed in a known manner, for example by potassium ferricyanide and thiosulfate. The single red-sensitive layer on the other support is developed in a usual developer to the negative. These exposures on the bipack can be printed on any desired multicolor photographic material.

The silver pictures of the double-layer film can also be converted into silver chloride by persulfate and hydrochloric acid. The development to the yellow image is then more reliable if potassium bromide is added. The subsequent working up can be the same as that described above.

The silver pictures of the double-layer film

can alternatively be converted into silver iodide. After the exposure of the first layer to blue light it is again developed in alkaline amidol developer (registered trade-mark), converted into silver chloride or bromide and developed by a color developer to yellow. After bleaching the colored filter layer the silver iodide can be colored purple in the known manner by a mordant dyeing process. It is also possible to develop in purple by a color developer (for example diethyl-para-phenylenediamine and phenyl-iso-oxazolone in alkaline solution) if the superfluous iodine ions still adhering to the silver iodide from its formation have first been removed by a dilute silver nitrate solution.

The invention is not limited to the arrangement of the emulsion layers and their distribution on the supports as described with reference to the drawing and the example described above. Other possible modifications of arranging a bi-pack are known in the art, some of which have certain advantages over the others, and we avail ourselves of all such modifications and alterations as are within the scope of the claims hereunto attached.

What we claim is:

1. A bi-pack comprising the support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow dyestuff from diazotized aniline and 1-(para-sulfophenyl)-5-pyrazolone-3-carboxylic acid-ethyl ester, with calcium lactate as fixing agent, said dyestuff being resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion layer and superposed thereon a red filter layer, said red filter layer being brought into contact with said green-sensitive silver halide emulsion layer.

2. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow azo-dyestuff from a diazotized arylamine and a pyrazolone resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion.

3. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow azo-dyestuff from a diazotized arylamine and a pyrazolone resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion layer and superposed thereon a red filter layer, said red filter layer being brought into contact with said green-sensitive silver halide emulsion.

4. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow azo-dyestuff from diazotized aniline and 1-(para-sulfophenyl)-5-pyrazolone-3-carboxylic acid-ethyl ester, resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion.

5. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow dyestuff from diazotized aniline and 1-(para-sulfophenyl)-5-pyrazolone-3-carboxylic acid-ethyl ester, said dyestuff being resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion layer and superposed thereon a red filter layer, said red filter layer being brought into contact with said green-sensitive silver halide emulsion layer.

6. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow dyestuff from diazotized aniline and 1-(para-sulfophenyl)-5-pyrazolone-3-carboxylic acid-ethyl ester, with a fixing agent, said dyestuff being resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion layer and superposed thereon a red filter layer, said red filter layer being brought into contact with said green-sensitive silver halide emulsion layer.

7. A bi-pack comprising a support having cast thereon a blue-sensitive silver halide emulsion layer, a filter layer superposed on said layer and containing a yellow azo-dyestuff derived from a diazotized arylamine and a pyrazolone having a carboxylic acid-ester group in 3-position, said dyestuff being resistant to the photographic treating baths necessary for converting a metallic silver image into a dyestuff image but capable of being decolorized by hydrosulfite, a green-sensitive silver halide emulsion layer on said filter layer and a second support having cast thereon a red-sensitive silver halide emulsion.

JOHN EGGERT.
BRUNO WENDT.