

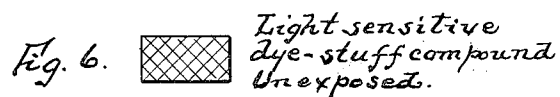
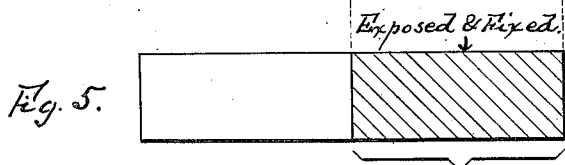
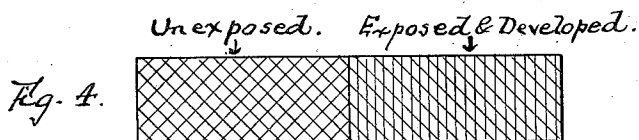
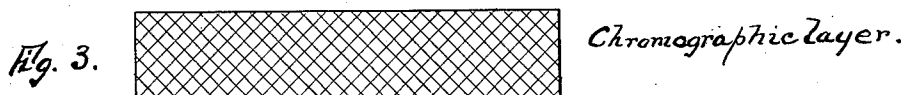
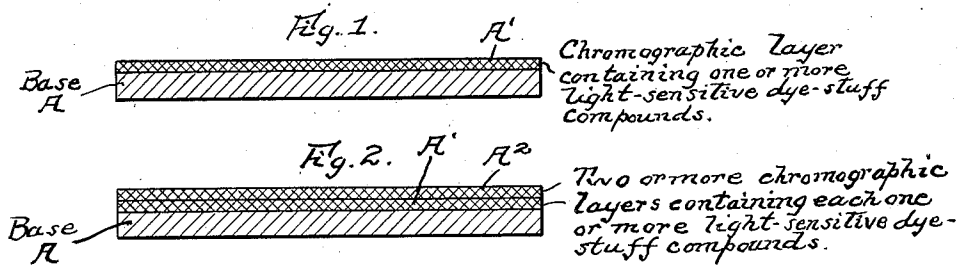
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MULTICOLOR LAYER FOR COLOR PHOTOGRAPHY AND PROCESS OF MANUFACTURING THE SAME

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MULTICOLOR LAYER FOR COLOR-PHOTOGRAPHY AND PROCESS OF MANUFACTURING THE SAME

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9 Claims. (Cl. 95—2)

My invention relates to improvements in multi-color layers for color-photography and the process of manufacturing the same, and the object of the improvements is to provide a sensitized layer the active part of which comprises dye-stuffs which by themselves are fast to light, and which have been sensitized for the purpose of color-photography. My invention is based on the discovery that certain dye-stuffs, including such dye-stuffs which are fast to light, or the salts of such dye-stuffs are capable of entering into combination with comparatively small amounts of components of salts which are sensitive to light. For example, solutions of substantially equal amounts of the said dye-stuffs, and salts of silver and of bromide, form compounds, which compounds are not only loose accumulations of the components or a dyeing of the silver bromide, but true chemical compounds, which is proved by the fact that the said dye-stuff compounds are readily dissolved without decomposition in solvents such as highly diluted ammonia in which silver bromide is insoluble, and that in the said compounds the silver bromide has lost its characteristic blue-violet sensitiveness.

The aforesaid dye-stuff compounds have the dark color inherent in the dye-stuff forming a component thereof. They are sensitive to light, but only to such light rays which are absorbed thereby according to the color of the dye-stuff. Thus they are sensitive to colors, which means that by the action of the said absorbed light rays the combination of the dye-stuff and the components of the sensitive salts is either directly disturbed or changed so as to be disturbed by a subsequent chemical treatment or development, while the dye-stuff itself is not affected in any way.

In the processes heretofore used in the manufacture of sensitized layers it was necessary to make the precipitate of the sensitive salts within the solution of the carrier such as gelatine, in order to obtain minutely divided particles or emulsions. In my improved process the precipitation of the salts need not be made within the carrier, but by reason of the aforesaid solubility of the dye-stuff compounds it is possible to dissolve the previously made and washed precipitate of the said dye-stuff compounds within the solution of the carrier.

By proceeding in this way I obtain a layer which is not in any way granular, and which is transparent in the same way as colored glass. Thus in the said layer there is not a sensitized precipitate of a dye-stuff, but the carrier is dyed

by means of sensitized dye-stuffs acting as a photo-chemical filter.

I combine a series of such dye-stuff compounds which as to their property of absorbing different light rays supplement each other in a known or preferred carrier such as gelatine and on a suitable support such as glass, and I obtain a chromographic plate, film or the like which is sensitive to all the colors of the light rays.

By means of such layers color exposures or copies can be made without using a colored screen. If however the layer contains dye-stuffs which are also sensitive to non-visible rays such as infra-red or ultra-violet I use a screen which is capable of absorbing the said non-visible rays.

When exposing and developing my chromographic layer the dye-stuff compounds which have absorbed light rays are decomposed by the separation of silver. The dye-stuffs which have thus been acted upon are fixed, the separated silver and the dye-stuff compounds which have not been affected by light, and which heretofore have not been altered are removed, whereupon a negative image is formed exclusively by dye-stuffs, which image is complementary as to light and color to the original object. The said negative can be used in a similar process for producing positives on glass, paper, celluloid, and the like having a similar chromographic layer, which positives may be made of even size or of different sizes and which consist exclusively of dye-stuffs which correspond as to their light and color to the original object.

By my improved process I am also able to manufacture a positive image directly from the original negative, for which purpose the original layer is developed in such a way that the dye-stuff compounds which have not been acted upon by the light, and which therefore are unaltered are fixed, and the dye-stuff compounds which have been altered by the action of the light are removed. However as far as I am now aware my improved process is particularly suitable for manufacturing negatives, in which those parts are fixed which have been acted upon by the light, and in which those parts which have not been acted upon by the light are removed. Only by making a negative of this kind I am enabled safely to obtain in each case an image corresponding to the action of the light in quantity and quality, without the thickness of the layer having any influence. If however a positive image is directly developed from the exposed layer by fixing those parts which have not been acted upon by the light all the parts of the chromographic layer must

be exactly equal in strength, and their strength must correspond to the intensity of the exposure, because otherwise the residue of the dye-stuff compounds which have not been acted upon by the light are either too large or too small and are correct only in exceptional cases, the result being, ordinarily, an image which is not absolutely correct as to light and color.

The chromographic layers made by my improved process can be used also for making exposures of special limited sensitiveness, such as are used for example for making printing plates for color printing.

In the following I shall describe preferred methods of making my improved chromographic layers. But I wish it to be understood that my invention is not limited to the examples described hereinafter.

In the accompanying drawing,—

Fig. 1 is a sectional view on an enlarged scale through a plate provided with a chromographic layer made in accordance with my invention.

Fig. 2 is a similar view of a plate provided with a plurality of chromographic layers.

Fig. 3 is a view of a block symbol representing a chromographic layer.

Fig. 4 is a similar view showing representations of exposed and unexposed portions.

Fig. 5 is a similar view showing a representation of an exposed and fixed portion.

Figs. 6, 7 and 8 are block symbols illustrative of components.

In Fig. 1 A is a carrier base or foundation bearing a single chromographic layer A' containing one or more light-sensitive dyestuff compounds.

In Fig. 2 the base A is provided with two chromographic layers A'—A² each containing one or more light-sensitive dyestuff compounds.

There are various dye-stuffs in the trade which have the properties necessary in my process. In the manufacture of the gelatine dry-plate process I prefer to use acid dye-stuffs. In order to have as far as possible pure colors I prefer such dye-stuffs which have limited and intense absorption spectra, and I combine a suitable number of such dye-stuffs which are adapted to absorb the whole spectrum. In my improved process any number of dye-stuffs may be used without complicating the manufacture of the layer. Therefore I prefer the aforesaid selection of the dye-stuffs to the use of a limited number of dye-stuffs having broad spectra or a plurality of absorption areas. The following is an example of such a set of dye-stuffs, the color index numbers being those given in the color index of Rowe except where otherwise noted:

Neptune green (B) No. 667; brilliant blue, violamin B (M L B) No. 760; violamin R (M L B) No. 758; azo yellow R M C (M C) No. 146; Ponceau 3 R (B) No. 80.

The said dye-stuffs and also the sensitizing salts such as potassium bromide and silver nitrate, are used in diluted solutions, in order to prevent precipitation of two components before adding the third component. Otherwise the homogeneous formation of sensitive dye-stuff compounds would not be safely obtained. Suitable solutions are the following:

1 part of dye-stuff (as, for instance violamin R) diluted in 300 parts of distilled water, 1 part of silver nitrate dissolved in 100 parts of distilled water, 1 part of potassium bromide dissolved in 100 parts of distilled water.

After manufacturing the said solutions the manufacture must be continued at non-actinic

light, that is each dye-stuff must be treated at the light of its own color. I mix 20 ccm of dye-stuff with 58 ccm of silver nitrate, and I add 16 ccm of potassium bromide while stirring the solution. The proportions must be varied within certain limits according to the molecular weight of the dye-stuff used. In the aforesaid example it is assumed that a dye-stuff having a molecular weight of 590 is used. Now the precipitate is separated from the liquid which also contains an excess of silver nitrate, and it is washed while adding a little acetic acid. To form the light-sensitive layer the precipitate of the light-sensitive dye-stuff compound is mixed with a solution of 1.5 grammes of gelatine in 30 ccm of water, 5 ccm of ammonia solution 4 : 100 are added, and the matter is heated from ½ to 1 hour at a temperature of 33° C., whereupon the solution is poured on glass plates. The aforesaid amount is sufficient for making about seven plates of 9×12 cm.

In the aforesaid operation a single dye-stuff was used. If a plurality of dye-stuffs is to be used, the dye-stuff compounds are separately made in the manner described, and they are combined in a corresponding amount of gelatine solution, that is for each dye-stuff compound the aforesaid amount of gelatine solution is needed. The subsequent treatment is the same as in case of a single dye-stuff.

In a modification of the process the dye-stuff compounds are separately added to gelatine solutions, whereupon the said solutions are mixed with each other. Preferably the dye-stuff solutions are mixed with one another at the beginning of the process, and the process is carried out in the manner described above. But in this case the process must be carried out in the dark.

In another modification of the process the chromographic layer is made by disposing layers sensitive with reference to definite light rays one above the other, or such layers are applied to separate plates. Further, the precipitate of the dye-stuff compound may be produced in the presence of the solution of its carrier (gelatine) or on the glass plate having the said solution applied thereto. However in this case washing is more difficult, and the precipitate may dissolve itself more or less in flowing water.

For developing the sensitized layers I use any of the known developing media, but I prefer the use of acid developing media.

I claim:

1. A non-granular and transparent layer adapted for use in direct color-photography consisting of gelatinous material containing a coloring of dye-stuff-silver-halide chemical compounds, soluble without decomposition in highly dilute ammonia and of specific color-sensitiveness, wherein the action of complementary light and the subsequent treatment leave the dye-stuff of the compound affected by light in place, the separated silver of this compound and the unaltered compounds being removed.

2. A process of producing a non-granular and transparent layer for use in direct color-photography which consists in precipitating a light-sensitive dye-stuff-silver-halide chemical compound, soluble without decomposition in highly dilute ammonia, by mixing the solution of a dye-stuff selected from the group of acid dye-stuffs with the solutions of a silver salt and of a halide, the molecular proportions of the three constituents being such that the silver salt is in excess, mixing the precipitate with a solution

of gelatinous material and with highly dilute ammonia thus dissolving the precipitate without decomposition and forming a clear, colored, photosensitive solution, and coating such solution on a support.

5 3. In a process of producing a non-granular and transparent layer adapted for use in direct color-photography the manufacture of light-sensitive dye-stuff-silver-halide chemical compounds, soluble without decomposition in highly dilute ammonia, which consists in mixing the solution of a dye-stuff, selected from the group consisting of Neptune green, violamin B, violamin R, brilliant blue, azo yellow and ponceau, with the solutions of a silver salt and of a halide, the molecular proportions of the three constituents being such that the silver salt is in excess, and separating the precipitate of the resulting compound from the liquid.

20 4. A non-granular and transparent layer adapted for use in direct color-photography consisting of gelatinous material containing a coloring of dissolved dye-stuff-silver-halide chemical compounds of specific color sensitiveness, wherein the action of complementary light and the subsequent treatment leave the dye-stuff of the compound affected by light in place, the separated silver of this compound and the unaltered compounds being removed.

30 5. A process of producing a non-granular and transparent layer adapted for use in direct color-photography which consists in mixing a light-sensitive dye-stuff-silver-halide chemical compound with a solution of gelatinous material and with highly dilute ammonia thus dissolving the compound without decomposition and forming a clear, colored, photosensitive solution, and coating such solution on a support.

40 6. A process of producing a non-granular and transparent layer adapted for use in direct color-photography which consists in mixing a plurality

of light-sensitive dye-stuff-silver-halide chemical compounds with a solution of gelatinous material and with highly dilute ammonia thus dissolving the compounds without decomposition and forming a clear, colored, photosensitive solution, and coating such solution on a support. 80

7. A process of producing a non-granular and transparent layer adapted for use in direct color-photography which consists in mixing a plurality of light-sensitive dye-stuff-silver-halide chemical compounds separately each with solutions of gelatinous material and with highly dilute ammonia thus dissolving the compounds without decomposition mixing these solutions and forming a clear, colored, photosensitive solution, and coating such solution on a support. 90

8. In a process of producing a non-granular and transparent layer adapted for use in direct color-photography the manufacture of light-sensitive dye-stuff-silver-halide chemical compounds, soluble without decomposition in highly dilute ammonia, which consists in mixing the solution of a dye-stuff, selected from the group of acid dye-stuffs, with the solutions of a silver salt and of a halide, the molecular proportions of the three constituents being such that the silver salt is in excess, and separating the precipitate of the resulting compound from the liquid. 95

9. In a process of producing a non-granular and transparent layer adapted for use in direct color-photography the manufacture of light-sensitive dye-stuff-silver-halide chemical compounds, soluble without decomposition in highly dilute ammonia, which consists in mixing the solution of a plurality of dye-stuffs, selected from the group of acid dye-stuffs, with the solutions of a silver salt and of a halide, the molecular proportions of the three constituents being such that the silver salt is in excess, and separating the precipitate of the resulting compounds from the liquid. 100

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