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PROCESS OF PREPARING COLORED PHOTOGRAPHIC PICTURES

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17 Claims. (Cl. 95—2)

This invention relates to the preparation of colored photographic and cinematographic positives by the superimposition of several photographic images of different colors upon one support.

In this connection it has already been proposed *inter alia* to print positive images in register on both sides of a transparent film coated with emulsion on either face and, according to another process, to superimpose two or three positive images on one side of a film by covering the coat of exposed emulsion in each instance with a new coat of fresh emulsion. The first process above mentioned necessitates special preparation of the film blank to coat in on both sides and special apparatuses to allow the two images to be printed, developed and toned separately. The film thus obtained is very costly and wears rapidly owing to the delicacy of its two faces. The second process referred to suffers from the inconvenience that the film shrinks after each coating with fresh emulsion and that the superimposed images do not remain in perfect register whilst, on the other hand, the aniline dyes used to tint the various images almost invariably disperse among the several coats of emulsion and thus make the images vague or "woolly". It has also been proposed mechanically to print images superimposed on a common base by the discharge of coloring matters by means of relief negatives or the like, but this process, being difficult to perform, is of small commercial use and films so prepared do not always convey the impression of natural colors.

The present invention comprises a process for preparing photographic and cinematographic positives, bearing two superimposed images of different colors upon one same face, by the successive exposures to light, under two complementary negatives prepared in any suitable manner, of any film, plate or sensitized paper known to the trade, without any fresh application of emulsion between the two exposures.

This process is likewise suited to the preparation of colored cinematographic sound-films.

Broadly speaking, such process consists in producing in one same sensitized coat a silver salt image and, after resensitizing by means of another metallic salt, another image which is developed by the precipitation of a colored salt of said metal and through which the first image is subsequently dyed in another color. In order that such dyeing process be effected under favorable conditions, the second image is preferably produced by means of a salt adapted to

render the silver salt of the first image capable of being mordanted previous to dyeing.

In one application of the process, after the silver salt image has been developed by the usual method, I resensitize the coat of emulsion bearing said image by impregnating it with an iron salt sensitive to light and upon said resensitized coat I print a second image which I develop in blue by means of a double cyanide, whereupon I tint the first image, orange-red for example, by treating same with a mordant and dyeing it with aniline through the second image.

The iron salt I preferably use is ferric chloride in solution with an acid adapted to act as reducer and accelerator, for the reason that said iron salt exerts upon the silver salt of the first image an action favorable to mordanting. Other ferric salts might, however, prove suitable, such as oxalate, tartrate and citrate of iron.

The double cyanide used to develop the second image may be a ferrocyanide or a ferricyanide, according whether such image was printed from a positive or from a negative film. In either case, the image developed in blue is insensitive both to the substance, iodide of potassium for example, used to mordant the silver salt of the first image, and to the aniline colorings used to dye the first image.

Two superimposed images of different tints suffice to create an illusion of natural colors but, if desired, a third image of a different color may be superimposed, for example by the mechanical printing of coloring matter, as by the transferring or by the stencilling process, for example.

In order that my invention may be more clearly understood I now shall describe an example of its application to cinematographic films:

I first shall assume that two negative films have been exposed by any suitable process through two screens of different colors, for example, one such film reproducing the orange-red portions of the subject filmed and the other reproducing the blue-green portions of the same subject. With the first negative I print an ordinary positive in the ordinary manner, on a usual commercial silver-salt film. After development, fixing and washing, I obtain a first positive image of reduced silver, in which the orange-red portions of the subject are shown in black.

This film is then immersed, without being toned, in a solution of ferric chloride and oxalic acid, in order to saturate with said solution the gelatine coat bearing the image. After having been dried, said coat, impregnated with ferric chloride and with the acid intended to re-

duce and to accelerate the same, is again sensitive to light. The ferric chloride likewise acts upon the reduced silver of the first image and converts it to a condition suitable for subsequent mordanting, previous to dyeing.

I then again expose the film under the second negative which shows the blue-green portions of the subject, care being taken that the second image thus printed on the resensitized coat is in exact register with the first image. Under the action of light and in the presence of the acid the ferric chloride FeCl_3 is converted into ferrous chloride FeCl_2 .

I develop this second image by immersing it in a solution of potassium ferricyanide which reacts with the ferrous chloride, forming a ferrous ferricyanide precipitate (Turnbull blue) which stains in blue the gelatine portions previously exposed to light through the clear portions of the negative film. The blue tint of this image, more or less marked according to the quantity of light received during exposure under the negative, is indelible to the reagents used during subsequent treatment of the film.

Such further treatment consists in washing the film and immersing the same in a solution of iodide of potassium to mordant the silver of the first image, i. e. to prepare it to take and to retain a suitable aniline dye. This image then is dyed through the second image, merely by passing the film thus prepared through a bath of aniline dye, of orange-red color for example, such as fuchsine or auramine. After having been washed in slightly acidulated water to remove excess dye, the film then bears two sharp and well-defined superimposed images of which one is orange-red and the other is blue and which produce a single image in natural colors when projected upon a screen.

If, instead of printing the second image by exposure to light beneath a negative, it be printed by means of a positive and the film be subsequently treated with ferrocyanide instead of with ferricyanide, then a blue image still results, but in that event the blue tint is assumed by those portions of the image which were sheltered from light during exposure and said blue tint consists of a ferrous ferrocyanide precipitate, or Prussian blue. Such blue image is likewise indelible to subsequent reagents and, as in the former alternative, the first image may be mordanted and dyed through the blue image.

The two-color film obtained as described above may be projected as it is, by existing cine projectors, without any alterations thereto, and its cost price is but slightly higher than that of an ordinary black-and-white film.

As has been explained, it is possible if desired, to superimpose a third image, in yellow for instance, by printing the film mechanically and discharging coloring matter upon it by transfer or by the stencilling process.

In the appended claims the word "photographic positive" is intended to cover cinematographic as well as photographic positives, and it also should be understood that the performance of my improved process may be varied without departing from the scope of my invention as defined in said claims, whatever be the nature of the support used.

I claim:

1. In a process of preparing a colored photographic positive, forming a silver image in a sensitized material, treating said material with an acid solution of an iron salt adapted to re-

sensitize it, forming a second image in said material, developing said second image in one color by precipitating a colored salt of iron and then dyeing the first image in another color through the previously colored second image.

2. In a process of preparing a colored photographic positive, forming a silver image in a sensitized material, resensitizing said material with a solution of a salt of iron and oxalic acid adapted to promote subsequent mordanting of the silver in said image, forming a second image in said material, developing said second image in one color by precipitating a colored salt of iron, mordanting the silver in the first image through said second image, and then dyeing the first image in another color through the previously colored second image.

3. In a process of preparing a colored photographic positive, producing a silver image on a sensitized support, treating said support with a solution of a ferric salt adapted to resensitize it, producing a second image on said support, developing said second image by precipitating a colored salt of iron, and then dyeing the first image in another color through the previously colored second image.

4. In a process of preparing a colored photographic positive, exposing a sensitized support through a selected master picture, producing a silver image on said support, treating said support with a solution of a ferric salt adapted to resensitize it, reexposing said support through another selected master picture, producing a second image on said support, developing said second image by precipitating a colored salt of iron, and then dyeing the first image in another color through the previously colored second image.

5. In a process of preparing a colored photographic positive, forming a silver image in a sensitized material, treating said material with a solution of ferric chloride to resensitize said material, forming in said material a second image registering with the first, treating said material with a solution of a soluble ferricyanide to color in blue the second image by the precipitation of ferrous ferricyanide, and then dyeing the first image in another color through the blue second image.

6. In a process of preparing a colored photographic positive, preparing two selected master pictures through screens of different colors, exposing a sensitized support through one of said master pictures, producing a silver image on said support, immersing said support in a solution of an iron salt, reexposing said support through the other of said master pictures, producing a second image on said support, developing said second image by precipitating a colored salt of iron, and then dyeing the first image in another color through the previously colored second image.

7. In a process of preparing a colored photographic positive, preparing two selected master pictures through screens of different colors, exposing a sensitized support through one of said master pictures, producing a silver image on said support, immersing said support in a solution of ferric chloride, reexposing said support through the other of said master pictures, producing a second image on said support, immersing said support in a solution of potassium ferricyanide, mordanting the silver of the first image and immersing said support in a bath of aniline dye.

8. In a process of preparing a colored photographic positive, exposing a sensitized support

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through a selected master picture, developing the image thus obtained, resensitizing said support by immersion in an acid solution of ferric chloride, reexposing said support through another selected master picture, developing the second image thus obtained by immersion in a solution of potassium ferricyanide, treating said support with potassium iodide and coloring the first image by immersion of the support in a solution of aniline dye.

9. In a process of preparing a colored photographic positive on an ordinary support sensitized with a silver salt, exposing said support through a master picture, developing the image thus formed, resensitizing said support by immersion in a solution of a ferric salt adapted to promote subsequent mordanting of the silver in said image, reexposing said support through another selected master picture, developing the second image thus obtained by immersion in a solution of a double cyanide, mordanting the silver in the first image through said second image and dyeing the first image through said second image.

10. In a process of preparing a colored photographic positive on a support having a silver-sensitized coat on one side thereof, forming a silver image in said coat, resensitizing said coat by treatment with ferric chloride, forming an iron image in said coat by treatment with a soluble ferricyanide, and dyeing said silver image through said iron image.

11. In a process of preparing a colored photographic positive on a support having a silver-sensitized coat on one side thereof, exposing said coat through a master picture, developing the silver image thus formed, resensitizing said coat by impregnating same with an iron salt sensitive to light, reexposing said support through another selected master picture, developing the iron image thus formed by treatment with a soluble double cyanide, mordanting the silver in said first image through said iron image, and dyeing said silver image through said iron image.

12. In a process of preparing a colored photographic positive, exposing a sensitized support through a selected master picture, developing the image thus obtained, resensitizing said support by impregnating same with an iron salt sensitive to light, reexposing said support through another selected master picture, developing the iron image thus formed by treatment with a soluble ferricyanide, dyeing said first image through said second image, and superimposing a third image on the first two images by mechanical printing and discharge of color thereon.

13. In a process of producing a colored photographic positive, producing an image on one side of a silver sensitized support, developing and fixing said image, resensitizing said support by means of an iron salt and simultaneously

rendering said image capable of being mordanted, producing a second image on the same side of said support, developing said second image by precipitating a colored salt of iron, mordanting said first image, and aniline dyeing said first image by interpenetration with said second image.

14. In a process of producing a colored photographic positive, exposing a sensitized support from one side through a selected master picture, developing and fixing the image thus obtained, resensitizing said support by means of a solution of ferric chloride, reexposing said support from the same side through another selected master picture, developing the second image thus obtained by means of a solution of potassium ferricyanide, mordanting said first image by means of a solution of a soluble iodide, and aniline dyeing said first image by interpenetration with said second image.

15. In a process of producing a colored photographic positive on a support having a silver-sensitized coat on one face thereof, printing a silver image on one side of said coat, developing and fixing said silver image, resensitizing said coat by treatment with a solution of ferric chloride, printing an iron image on the same side of said coat, developing said iron image by treatment with a soluble ferricyanide, and dyeing said silver image by interpenetration with said iron image.

16. In a process of producing a colored photographic positive on a support having a silver-sensitized coat on one face thereof, exposing one side of said coat through a selected master picture, developing and fixing the image thus obtained, resensitizing said coat by treatment with an iron salt adapted to discolor said image, reexposing the same side of said coat through another selected master picture, developing the second image thus formed by treatment with a soluble ferricyanide, and aniline dyeing said first image by interpenetration with said second image.

17. In a process of producing a colored photographic positive on a support having a silver-sensitized coat on one face thereof, exposing one side of said coat through a selected master picture, developing and fixing the image thus obtained, resensitizing said coat and simultaneously discoloring said image by treatment with ferric chloride in acid solution, reexposing the same side of said coat through another selected master picture, developing the second image thus formed by treatment with a soluble ferricyanide, mordanting the first image by treatment with a solution of potassium iodide, and aniline dyeing said first image by interpenetration with said second image.

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