

# UNITED STATES PATENT OFFICE.

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## COLORED PHOTOGRAPHIC IMAGE AND METHOD OF PRODUCING SAME.

1,300,616.

Specification of Letters Patent.

Patented Apr. 15, 1919.

No Drawing. Continuation in part of application Serial No. 149,743, filed February 20, 1917. This application filed October 9, 1917. Serial No. 195,508.

To all whom it may concern:

Be it known that I, FREDERIC E. IVES, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Colored Photographic Images and Methods of Producing Same, of which the following is a specification.

This invention is a colored photographic image and method of producing same. This case forms a continuation in part of my application Serial No. 149,743, filed February 20, 1917, patented Sept. 10, 1918, Patent No. 1,278,667, entitled Color photography and relating to the making of a multi-color photograph or picture compounded of blended multi-color images. The features of the present invention are included or employed in carrying out the invention of the parent application. The features of the present invention, however, are useful in other ways than as described in the parent application and may be of value in photography generally, as well as the so-called "color photography." The present invention indeed may refer to any photographic image whether negative, positive, or diapositive, and the method of producing the same, whether for the purposes of color photography, monochrome photography, motion picture photography, or other branches of the art.

As an instance or embodiment of the principles of the present invention, I will describe the production of a red positive or a diapositive image; and we may presuppose a suitable negative such as the ordinary black or silver haloid negative, which in the case of color photography may be one of set of color-selection negatives representing, for example, the green elements of the subject.

The method may commence by printing an ordinary black diapositive or other positive which may be done in a well known manner, for example by merely exposing a silver haloid sensitive plate or film beneath the negative and developing in the usual way. Next, this black positive is to be converted into a colored positive in accordance with my invention.

This may be effected by a copper-toning process by which the silver image is converted into a copper-red image which, however, is not always desirable in depth and

hue of color, and, as will subsequently be explained, is preferably further treated to afford a satisfactory and permanent colored photographic image of the proper depth and hue.

The silver or black positive is first soaked one or more hours in a copper-toning solution made up of the following solutions:

### Solution A.

Potassium ferricyanid	3.2 grams.
Potassium citrate	15.5 grams.
Water	570 c. c.

### Solution B.

Cupric sulfate	4 grams.
Potassium citrate	15.5 grams.
Water	570 c. c.

A mixture of equal parts of solutions A and B gives the desired toning solution, and, when the diapositive has been soaked for the requisite time, it will be found to have been converted into a copper red colored image. This image is somewhat degraded by the presence of silver ferricyanid, and I, therefore, usually prefer to dissolve out this silver salt by the use of sodium thiosulfate ("hypo").

I have now produced a copper-toned image which, however, is usually insufficiently deep or bright, or not of the desired hue, for color photography or other photographic purposes. I have discovered that the copper-toned image is capable of acting as an extremely efficient mordant for basic dyes, and the principle of the present invention is the production of the colored image by a combined copper-toning and mordant-dye process. I believe it to be new with me to produce a copper-toned image and then utilize the same for the mordanting of suitable dyes so as to strengthen or modify the photographic image to the desired depth and hue. The final image consists of the copper-red image combined with the mordant-dyed image.

In its broader aspect the invention may be carried out by subjecting the copper-toned image having a reddish color, to a bath of any soluble dye capable of being selectively mordanted by the copper image. Not only red but blue or yellow or other dyes might be so employed. Specifically, I will describe the case of increasing the depth or brightness of the copper-red image by means of a red dye; and it should be understood that the

mordant dyeing step can be carried out at any stage of the complete process, although I prefer to effect the dyeing after the dissolving out of the silver salt so to permit the exercise of the judgment by inspection and the stopping of the dyeing process at the most satisfactory point.

Having the copper-red positive free of the silver salt, this may be soaked in the selected dye bath, for example an aqueous solution of fuchsin dye containing a small quantity of acetic acid. Owing to the fact that copper is an effective mordant for certain alkali or basic dyes including the one mentioned, the positive is caused to take up selectively a substantial amount of the fuchsin dye. After this treatment the positive should be washed out in water containing weak acetic acid so as to remove the unmordanted part of the dye from the colloid or gelatin containing the image. When dry the positive is completed.

The copper-toned and mordant-dyed image of this invention I find easy to produce and easily controllable during the process; and the image is particularly advantageous for color photography as no interference is caused with the successful blending of the image with images of other colors, for example a cyanotype blue image produced either before or after the mordant dyeing of the present invention.

The present process is very elastic since the finished print may be tried out in the projection lantern or otherwise, and if it is found that the color is not exactly as desired it may be further modified either by adding or subtracting color almost as readily as in initially carrying out the process. The color may be enhanced by further mordant dyeing or may be reduced by soaking in acidified water.

In one aspect it will be seen that this invention consists in first forming an insoluble or pigment image of material having strong capacity for mordanting and then reinforcing the image by dye bath treatment, the dye being mordanted selectively so as to strengthen or modify the original image.

The fuchsin dye mentioned will give a purplish red result, whereas an orange red may be obtained by the use of auramine dye; and a mixture of the two or other dyes may be employed so as to secure the results which are dictated by experience and the character of the subjects. An example of a satisfactory mixed bath is as follows:

Fuchsin	0.13	grams.
Auramin	0.26	"
Water	5,000	c. c.
Acetic acid	8	"

The dyes may be first dissolved in a little alcohol and then added to the water, and the dyeing process may be continued sufficiently to reach the limit of mordanting action, which may be one or more hours. The unmordanted dye in the gelatin may be subsequently dissolved out by soaking in water preferably made slightly acid.

The mordant dyeing of the copper-red image may be performed either before or after the dissolving out of the silver salt and sometimes when the silver image is thin the fixing thereof may be entirely omitted.

It will thus be seen that I have described a color photographic image and method of producing the same, embodying the principles and attaining the advantages of the present invention. Since many matters of order of procedure, particular ingredients and colors, and other features may be variously modified without departing from the underlying principle, I do not intend to limit the invention except in so far as specified in the pending claims.

What is claimed is:

1. For multi-color photography a red image comprising a colloid layer containing a copper-toned image of a reddish color, the same reinforced by a red dye image selectively mordanted by the copper-toned image.

2. The process of producing a color photographic image consisting in copper-toning a silver image, thereafter dissolving out the opaque silver salt, and thereafter subjecting the image to a bath of soluble dye capable of being selectively mordanted by the copper image.

3. The process of producing a red photographic image consisting in copper-toning a silver image so as to produce a copper-toned image of a reddish color, thereafter dissolving out the opaque silver salt, and thereafter subjecting the reddish copper-toned image to a bath of soluble red dye capable of being selectively mordanted by the reddish copper-toned image.

4. The process of producing a red positive consisting in first producing a black silver positive and then copper-toning it to a red color and dissolving out the silver, and finally subjecting it to a bath of red dye capable of being selectively mordanted by the copper.

5. The process of converting a silver image into a red image consisting in copper-toning it, and subsequently subjecting it to a bath of soluble red dye capable of being selectively mordanted by the copper.

In testimony whereof, I have affixed my signature hereto.

FREDERIC E. IVES.