

UNITED STATES PATENT OFFICE.

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PRODUCING COLORED PHOTOGRAPHIC PRINTS IN GRADUATED RELIEF.

980,962.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, FREDERIC E. IVES, a citizen of the United States, residing in Woodcliffe-on-Hudson, Weehawken, New Jersey, have invented certain Improvements in Producing Colored Photographic Prints in Graduated Relief, of which the following is a specification.

My invention is an improvement upon a method which I described in a paper published in the *Journal of the Camera Club*, London, April, 1894, page 63, as follows: "The examples which I shall show were made from photochromoscope negatives. * * * Bichromatized gelatin films on clear celluloid were exposed from the back by electric light, developed as carbon prints, the images cut apart and each dyed to a suitable depth by immersion in a solution of its proper printing color. * * * A great degree of precision is necessary to secure the correct proportionate depth of coloring in the three prints."

The above described process was not as practical as was desired for the following among other reasons: 1. Celluloid films thick enough to be satisfactorily coated with the necessary thickness of gelatin for the process were objectionable because of color and of shrinkage and tendency to buckle through gradual evaporation or solution of contained camphor, and because when the prints were used as lantern slides the effect of heat in the lantern upon the celluloid was liable to destroy or seriously damage the pictures. 2. The bichromated gelatin film must be of such thickness that detail may be retained in the prints from both ends of the scale of gradation from black to white of the negative, and owing to the small percentage of bichromate salt that can be incorporated with gelatin without crystallization in drying, the gelatin film must be so thick as to make the process of development in warm water tediously slow, and the resulting print difficult to color up correctly, since if the color bath proved to have been too strong for the subject, washing to reduce the strength acted relatively too fast upon the thin parts, and strengthening by the use of a stronger dye bath, also acted relatively too fast on the thin parts. 3. The finished color prints were seldom as sharp as is desirable, and the relief was so great that it became necessary, in order to obtain satisfactory results with the lantern slides, to

seal the prints together with Canada balsam. By my improved process these difficulties and defects are greatly reduced, and the quality of the results improved. These improvements have been effected, first, by substituting amyl acetate collodion for celluloid, second, by using a more soluble sensitizer which permits of the incorporation of a much larger percentage of the sensitizing salt in the gelatin without danger of crystallization in drying, thus obtaining prints in lower relief, and, third, by treating the developed low relief prints with chromic acid in order both to sharpen them and to serve as a mordant for the dyes subsequently used, and which would not be sufficiently mordanted by the small amount of chromic oxid remaining in the low relief prints after development in an alkaline developer. I sometimes incorporate a non-actinic dye with the sensitizing solution, to limit the penetration of light, this dye being preferably acid, so that it may be discharged by an alkaline developer.

Either gelatin or fish glue may be used as the coating on the amyl acetate collodion film, said coating being sensitized with bichromate of ammonium. If a gelatin coating is used the sensitizing may be done by immersing the gelatin coated film for a minute or two in a solution of bichromate of ammonium, either with or without the addition of a non-actinic dye, then drying superficially by placing between blotters or by means of a squeegee, before hanging up to dry out in the usual way. The removal of the superfluous sensitizer, as described, is in order to prevent uneven sensitizing and probable crystallization of bichromate salt in or on the surface of the gelatin coating. If fish glue is used, the sensitizer or sensitizer and dye must be incorporated in the fish glue solution before coating, as fish glue is soluble in the cold sensitizing bath.

The gelatin prints are developed in warm or hot water, to which I prefer in any case to add a small amount of ammonia, although it may not always be necessary, since even when the dye is used, it may be discharged by ammonia after the development is completed. Bromid or iodid of silver may also be incorporated in the gelatin or fish glue coating, in which case it should be dissolved out by hyposulfite of soda after the relief print is developed.

When a gelatin relief print is developed

and cleared as above described, it is not, even if dried out, as sharply defined as is usually desirable, and the print will not readily absorb or fix enough dye for the purposes of the process. The next and one of the most important procedures in my improved method is therefore to immerse the print for a minute or two in a solution of chromic acid, which may be of the strength of 30 grains of chromic acid to one pint of water. This treatment contracts, sharpens up and hardens the relief print, and mordants it for the dyes subsequently used, so that very sharply defined and exceedingly low relief prints may be made and dyed to the desired depth of color. The prints may be transferred directly from the chromic acid bath to the respective dye baths, or first washed in water. Three such prints are made for the composite trichromatic print. One print from a negative made with red light is dyed a peacock blue, one from a negative made with green light is dyed a magenta color, and one print from a negative made with blue light is dyed yellow. The three prints superposed make the complete composite trichromatic print. The dyes which I prefer to use, and which are mordanted by chromic acid, are "neptune green", a mixture of acid rhodamine and eosin, and "brilliant yellow".

Another advantage of the chromic acid treatment is that it facilitates the drying of the prints by first pressing them between blotters to absorb the surplus water. Ordinarily such use of blotters is not permissible as the fluff from the same sticks to the prints and cannot afterward be brushed off. When the chromic acid treatment is adopted this objection is overcome.

I claim:

1. The within described improvement in the process of making colored photographic prints in graduated relief, the same consist-

ing in first producing and developing a colloid relief print, then treating said print with a hardening and mordanting agent such as chromic acid, and then dyeing the print thus treated.

2. The within described improvement in the process of making colored photographic prints in graduated relief, the same consisting in incorporating a non-actinic coloring medium in the sensitized colloid coating, exposing said sensitized coating to light, developing the print, discharging the coloring medium, treating the developed relief print with a hardening and mordanting agent such as chromic acid, and then dyeing the print.

3. The within described improvement in the process of making colored photographic prints in graduated relief, the same consisting in incorporating a non-actinic coloring medium in the sensitized colloid coating, exposing the sensitized coating to light, discharging said coloring medium after such exposure by means of an alkaline developer, treating the developed relief print with a hardening and mordanting agent such as chromic acid, and then dyeing the print.

4. The within described improvement in the process of making colored photographic prints in graduated relief, the same consisting in incorporating a non-actinic and water-soluble dye in the sensitized colloid coating, exposing said sensitized coating to light, developing the print, discharging the dye, and then subjecting the print to its appropriate dye bath.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

FREDERIC E. IVES.

Witnesses:

F. C. MARTIN,
FRED TAGLANG.