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COLORED PHOTOGRAPHY

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The invention relates to the art of color photography, and is concerned with the production of multi-colored photographs or pictures obtained by blending color images on a single base.

The object of the invention, is to provide an improved process to be used in the production of multicolor photographs as aforesaid, whether still photographs or moving picture photographs, in order that said photographs may be obtained in a simpler manner than heretofore without sacrificing fidelity of color and detail, as compared with photographs produced by known and more elaborate processes.

The process to be herein described, may be said to commence with the treatment of a set of color record prints containing photographic silver images, and made in known manner by any suitable method, the present invention providing a novel and advantageous mode of proceeding from said color record prints to secure final multi-colored photographs or pictures.

The color record prints can be made on any suitably sensitized photopaper, celluloid or other base, capable of receiving any necessary photographic treatment according to known practice, to produce photographic silver images as aforesaid.

The main feature of the invention resides in dye-toning the photographic silver image of a color record print with dye in association with a mordant, whereby the image is brought to a condition such that color can be transferred therefrom to a separate surface by contact with the latter.

A further feature of the invention, is the utilization of the mordant and dye to result in building up or continuation of the image in relief, the color being transferable from said relief to a separate surface.

All of the images can be dyetoned, and color transferred therefrom and blended on a separate surface, or one of said images can be colored so that color will not transfer therefrom, in which case color is transferred from the dye-toned images to the image from which color is non-transferable.

Other features are also involved in the invention, as will be apparent from the description which follows and the claims appended hereto.

The improved process will first be described as proceeding from a set of two positive color record prints made from two color selective negatives, both positive prints being printed to obtain the necessary gradation and weight required to give

the desired effect in the final photograph or picture.

The print produced from the red-yellow record negative is toned blue in an iron bath preferably as follows:—

(a)	Ferric chloride	milligrams	300	10
	Oxalic acid	milligrams	900	
	Nitric acid	cubic centimetres	1.5	
	Water	cubic centimetres	142	
(b)	Potassium ferricyanide	milligrams	300	10
	Water	cubic centimetres	142	

In using, it is preferred to prepare (a) and (b) separately, and mix together, although it is possible to prepare the whole as a single solution.

Instead of using the above iron bath for blue toning the print from the red-yellow record negative, said print may be dyetoned as follows:—

The reduced or developed metallic silver image of the print is first brought to a condition in which it will be receptive to a dye or dyes during subsequent treatment; certain formulae already well known in photographic bleaching being capable of being used for this purpose, a suitable formula comprising cupric chloride or bromide, with or without acids such as acetic, nitric, hydrochloric or the like in the following proportions:—

Cupric chloride	grams	10	30
Acetic acid (optional)			
.....	cubic centimetres	1 to 1.5	
Water	cubic centimetres	284	

The optimum time for treatment in the bath just given is two minutes.

The print is then treated in a bath containing in solution a suitable dye or dyes, and an intermediary agent which will cause the dye to attach sufficiently to the conditioned or receptive image, to build up a colored image for use in the transference process as hereinafter described; the intermediary agent may be what is known in chemistry as a thio-amino compound, especially one in which the sulphur is in a re-active condition, and in which one or more amino or substituted amino groups remain free to enter into chemical reaction. Suitable such intermediary agents are thiocarbamide and thiosinamine, whilst cystein and thioacetamide have also been found capable of acting in the desired manner.

Dyes suitable for this blue bath are those known on the market under the trade names Patent Blue L, or BL, other dyes also being available,

although a satisfactory result is obtained by using a bath compounded as follows:—

Patent Blue L, or BL.....	milligrams.....	150
Thiocarbamide.....	milligrams.....	50 to 150
Water.....	cubic centimetres.....	170

The bleached or conditioned image is allowed to come into contact or association with the dye solution, when the dye or dyes attaches or attach to the image, it being found that contact or association of the latter with the bath for approximately 3 minutes is adequate. The colored or dyed image is then washed until excess dye and other water soluble substances are sufficiently removed.

Alternatively the bleached or conditioned image may first be treated in a bath of thiocarbamide or material that will act in a similar manner, and in such case the next step would be to treat the image in the blue dye bath either containing, or not containing, the thiocarbamide or material that will act in a similar manner.

A thiocarbamide bath without dye, can comprise thiocarbamide 50 to 200 milligrams, and water 170 cubic centimetres.

The silver image of the print from the violet blue green yellow record, is then bleached or conditioned as before described, and is dye-toned red-yellow, in a bath similar to that described for dye toning the print taken from the red-yellow record, except of course that an appropriate dye or dyes is or are used.

In connection with the red-yellow dye-toning, it is known that acid fuchsin among other dyes, if mixed in suitable proportions with a suitable yellow dye (for instance tartrazine) will be replaced in certain parts, thus giving a gradation of color from blue-red, through crimson scarlet, to orange and yellow.

Although only two dyes are mentioned for red-yellow dye toning, other dyes may be used, a satisfactory bath being as follows:—

Acid fuchsin.....	milligrams.....	240
Tartrazine.....	do.....	100 to 200
Thiocarbamide.....	do.....	150
Water.....	cubic centimetres.....	170

The proportions and dilution of the last-mentioned bath or solution, may be varied according to circumstances, and with different dyes more or less thiocarbamide or like substance is desirable.

While for general dye toning purposes the ingredients of this red-yellow dye toning bath, with or without additions, may be considerably altered, the formula as given with the dyes mentioned, besides dye toning in the usual sense, causes the continuation of deposition of color material beyond that actually toning the image itself, so as to form in relief, an image which facilitates transference of color from the image as will be later described.

It is found that the use of certain image bleaching or conditioning agents, for the purpose of bringing the images into condition for dye toning, if followed by the use of certain dyes when dye toning the prints, results in a staining or coloring of the print with a lighter shade of the color used, and said lighter shade is capable of being utilized to extend the color range of the prints. For example, when cupric chloride is used to bleach or condition the images prior to dye toning, and although other bleaching or conditioning agents may be used, those agents containing copper have the advantage that there

results during dye toning, a staining of the gelatine of the emulsion by the acid fuchsin, and although said stain becomes decolorized during washing after dye toning, it may be revived or made apparent as will be later described.

The next step is to combine color from, or of, the colored images of the two positive prints, on the one base, and if an iron blue toned print from which color is not transferable is used, said print is first immersed in a bath containing a suitable salt such as potassium bromide, with or without an acid, the following bath for example, having been found suitable:—

Potassium bromide.....	grams.....	5
Nitric acid (optional).....	cubic centimetre.....	.1 to .3
Water.....	cubic centimetres.....	284

The red yellow print is then brought so that its image registers accurately with the image of the blue toned print, following which the registering images of the prints are caused to make contact with each other, and are squeezed or pressed together, with the result that transference from the dye toned and built up or relief image of the red-yellow print, takes place to the blue toned print. As an aid to quick transference, heat and/or pressure may be applied.

As an alternative, color from the red-yellow print may be transferred to the blue print, after the latter has been immersed in the bromide bath, but before said blue print is toned. After transfer of the red-yellow image, the blue print is then immersed in the blue toning bath, until it is sufficiently colored, this treatment however, only being carried out when the contents of the iron toning bath will not spoil color transferred from the red-yellow print.

A still further alternative is that the blue print image may be blue dye toned as described in connection with the dye toning of the red-yellow print, instead of being iron blue toned, and transference from both the blue and the red-yellow dye toned print images may be made to a separate suitable surface, whether or not the latter has any image, toned or untoned on it, and in such case after the first transference of color has been made, said surface is treated to fix the transferred dye image, and prevent undue running or retransfer to further prints which may subsequently be brought into contact therewith. Such a fixative bath can consist of acetic or other acid, thiocarbamide or other similar compound, with or without such a salt as potassium bromide or chrome alum, any of the following baths being suitable for the purpose:—

Acetic acid.....	cubic centimetres.....	4
Water.....	do.....	285

or

Thiocarbamide.....	gram.....	1
Acetic acid (optional).....	cubic centimetres.....	4
Water.....	grams.....	285

or

Chrome alum.....	grams.....	5
Water.....	cubic centimetres.....	285

Treatment in any of the aforesaid fixative baths, also has the effect of expanding a paper base back to the state it was in upon receiving the first physical color impression, this stretching treatment being desirable where a second transfer or impression is made to or on a print which has already received a transferred image.

The result obtained by carrying out the before

described procedure, is very close in color value to that of a three negative color process, the colors incorrectly reproduced being mainly blue pinks, mauves and the like, and it is here that use is made of the stain previously referred to.

This stain is somewhat transferred to the final print, but being in a decolorized condition, does not degrade the whites or other portions of the latter. Upon those places however, where it is desirable, such as in a pink or mauve flower, it is only necessary to treat the appropriate portions of the print with a suitable agent such as a dilute acid, oxalic acid 1%, or nitric acid being suitable for the purpose indicated, when the stain is immediately revived, thus giving an approximate three color rendition from two negatives.

Where acid fuchsin or the like is used in red-yellow dye toning, agents or reagents such as the above, may also be employed to brighten the reds.

Although a cupric chloride bath, and an acid fuchsin bath have been specified to obtain a pink stain, the same process with other bleaching agents and other dye baths, may be employed to result in the production and utilization of other colors.

Further, should it be desirable to brighten the yellow parts, this may be accomplished by the application of a suitable agent such as dilute ammonia, sodium carbonate or a soluble sulphite, for the purpose of removing degrading matter.

Further, the yellow parts may be lightened or bleached by the use of certain chemicals such as chlorine.

The extra tones or shades before referred to, may be brought up, and the yellows brightened or bleached, before transference of the colors.

Before or after transference, one or more of the prints may be fixed by immersion in any photographic fixing agent, such as hypo, provided it does not injuriously affect the color.

A further finishing effect treatment, may consist in immersion in a dilute acid bath, before or after transference of color from an image.

The prints are then dried and mounted in any suitable manner.

When three or more color separation negatives are employed, prints are made from the negatives, and each printed to obtain the gradation and weight required to suit the particular color it represents, and to which it is to be toned.

The silver images of the positive prints are then bleached or conditioned as described in connection with the prints from the two color selective negatives, after which they are dyetoned, a separate color bath of the requisite color being used for each print.

An iron blue toning bath can be used instead of a blue dye bath if desired.

In transferring colors, if an iron blue toned print is used, the red and yellow, and other colored print images, are transferred to the iron blue toned print which becomes the photograph or picture, or all of the print images, if dye toned, may be transferred to any selected one of said prints, or to any suitable separate surface with or without a toned or untoned image thereon.

The bringing up of the pink or other stain, and the brightening or lightening or bleaching of the yellow, or yellow color, and red or red color, may also be carried out when more than two negatives and prints are employed, while all or such other of the remaining steps used in the two

color or two negative work, are also employed where necessary or desirable.

Should it be found that any one or more of the print images to be transferred, owing to the astringency or softening characteristics of the different baths used for the respective prints, has or have become slightly larger or smaller than the image to which transference is to be made, the print images may be brought to the same state by placing a print or prints in a softening or hardening bath, or even a cold or warm water bath, prior to transfer so as to provide for perfect registration of the images being effected, the stretching baths used in the two color negative work being suitable here for a similar purpose.

Also should it be desirable to form a key image, as well as a multi-colored one, for the purpose of giving body, and to relieve flatness of prints, this may be accomplished in several ways, namely the iron blue toned print may, before or after other images are transferred to it, be placed in a developer, such as acid amidol where the silver ferrocyanide formed during blue toning is converted back to metallic silver, or other suitable agent to form the required color image from the silver ferrocyanide, provided such treatment does not injure the blue toned or other images.

In making final prints or pictures on a base having an emulsion on each side, an image is printed on each side of the base from the different color separation negatives, care being taken to see that the images register, after which they are treated according to any necessary known photographic procedure.

Coloring or/and dyeing of the images is then carried out in the manner and according to the description and directions before given, care being taken to prevent color from one image detrimentally affecting the other image during treatment.

When the final print or picture is made on a base having an emulsion on one side only, a print is made from a color separation negative, developed, washed and colored or dyetoned in an appropriate color in the manner and according to the directions and information before given.

The film can then be treated according to known practice for the purpose of receiving a further image, provided such treatment causes no injury to the previously colored image.

A print is then made from the complementary color separation negative, care being taken to see that registration is exact, following which the newly printed image may be developed, fixed and washed, and following which it is colored or dyetoned as before described.

When separate transparent bases to be combined to produce the final print or picture are used, each separate transparent base has a light sensitive emulsion on one or both sides, each or any emulsion receiving a printed image from a color separation negative, the image if necessary being developed, fixed, washed and being colored or dye-toned as already described, following which the separate transparent bases are combined with their images in register to produce the desired finished effect.

Color separation prints may also be obtained by using a multi-colored screen plate, or other colored negative, and printing therefrom on to separate surfaces, each of which is sensitized to receive a record of selected rays, the prints obtained, if necessary, being treated as before de-

scribed for transference of color to a common base, whereby a multi-color photograph or picture is produced.

It is to be understood that washing and other steps well known in the art of photography, although not specifically mentioned, are used when thought necessary or desirable.

What we do claim and desire to obtain by Letters Patent of the United States of America is:—

10 1. In transferring a second color to an iron blue base, the steps of first bleaching and then building up the photographic silver image of a color record print with dye in the presence of thiocarbamide and transferring the color there-
15 from in the presence of potassium bromide to the base by contact with the latter.

2. In transferring a second color to an iron blue base, the steps of first bleaching and then
0 building up the photographic silver image of a color record print by treating said image with thiocarbamide in solution, and dyetoning said image in a separate color bath and transferring the color

therefrom in the presence of potassium bromide to the base by contact with the latter.

3. Method of making photographic color prints consisting in dyetoning a bleached silver photographic image in a solution containing a dye and thiocarbamide, and, in the presence of potassium bromide, pressing the image onto a surface to which it is to be transferred.

4. Method of making photographic color prints consisting in dyetoning a bleached silver photographic image in a solution containing an iron blue dye, then immersing the image in a bath containing potassium bromide and finally pressing the image onto a surface to which it is to be transferred.

5. Method of making photographic color prints consisting in dyetoning a bleached silver photographic image in a solution containing an iron blue dye, then in the presence of potassium bromide, pressing the image onto a surface to which it is to be transferred.

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