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COLOR PHOTOGRAPHY

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This invention relates to a sheet material and method for use in the production of prints and more especially in the production of colored photographic prints.

In my co-pending application filed August 24, 1938, Serial No. 226,469, now Patent No. 2,244,905, I have set forth my discovery that a colloidal relief image such, for example, as a washed gelatin relief image, which has been locally hardened or tanned and had the unhardened soluble gelatin washed away, when combined with a white, opaque, water-resistant backing or support is ideal for hand-coloring, and when subjected to hand-coloring will produce a finished print having the same play of light and shade, i. e., the same tonal effect as the original subject; and the colors when applied will be absorbed by the gelatin or other colloid in such a way as to give an accuracy of tonal reproduction the effect characteristic of a direct color photograph while allowing great latitude in choice and combination of colors used. I also described satisfactory methods of obtaining the desired gelatin relief image on an opaque, water-resistant backing. In the present application I now set forth other ways which I have developed, and which I consider to be improved ways of and material for producing the desired colloidal relief image, especially on a white, opaque, water-resistant surface; and it is an object of my present invention, therefore, to provide an improved material and method for production of color pictures with good portrayal of tonal values especially in the distribution of light and shadow in the subject matter. Another object of my invention is to provide a material capable of forming and supporting a superior relief image in which exposed portions of the base constitute an integral part of the image representing an extreme of tonal value without unnatural contrast of surface texture or gloss. Another object of the invention is to provide a material for producing a relief image on a partially exposed base, the base and the relief image thereon being of different nature, whereby color may be taken up and carried by one which is repelled by the other.

My above mentioned patent teaches methods of making a photographic relief image on an opaque white support and the method of coloring the relief to give a print in which the density or tone is controlled by the thickness of the photographic relief, i. e., is controlled photographically, and the color is controlled manually. I refer to such prints as being manually colored, photographically toned, the term tone

referring to the gradation from highlights to middle tones and shadows rather than to the hues.

The present application teaches primarily an improved embodiment of the invention employing a mat surface between the support and the wash-off relief layer or image. It also relates to two systems alternative to those of my patent for making the required relief image. In one of these systems, a wash-off relief emulsion carried by a transparent base is exposed through the base and the rear surface of the base is provided with an opaque white layer. In the other system, the wash-off relief emulsion is carried permanently by an opaque white base so that the exposure must be from the front and the processing must fasten the required relief image to the support.

The advantages of the two systems are obvious, namely simplicity, convenience and reliability. Which of the two is preferable depends on the use to which they are put, one having the advantage of a permanent base and the other, the advantage of simpler processing.

The advantages of the mat support are perhaps not so obvious. Prior colorable reliefs suitable for my process were on smooth shiny bases so that the highlights were glossy and the rest of the image generally dead mat. This change in texture across a picture is exceedingly objectionable both in appearance and when photomechanical reproductions are desired. The highlights should not be more glossy than the middle tones and shadows. This is the first advantage of the mat support.

Secondly, the mat surface produces a foundation for any surface retouching desired in the highlights. The support must be of a material which repels the dyes used in the sense that it does not absorb them. With prior glossy supports which met this requirement it was practically impossible to get any color into the highlights or "burned out" areas which were not covered by the relief. But with the mat surface there is sufficient tooth to permit adherence of the coloring material without absorption into the base. Thus, the mat surface solves two problems unique to my process for making manually colored, photographically toned, prints.

In order to obtain the desired results I prefer to use a soluble, light-sensitive, gelatin emulsion coated on a white, opaque, water-resistant Celluloid. My invention, however, is not limited to these in its broader aspect as defined by the claims. I use the term "soluble" herein in its

loose sense as commonly used in this art to include colloidal dispersion. Preferably the emulsion has a semi-light-restraining dye incorporated therein to an extent just sufficient to slightly retard the light as it enters the emulsion, thus confining the full exposure to the upper part of the emulsion layer. The purpose of this is to expedite the reversal of the image as more fully described hereafter. Preferably, the base or support has inherently or is provided with a mat surface.

If the base is opaque, exposure must be made on the surface of the emulsion. Obviously however, it is necessary that the final image be in intimate contact with the base. These results I obtain in various ways.

For example, the emulsion can be exposed to a positive of the desired image and the resulting negative image developed with a non-tanning developer. Due to the presence of the light-restraining dye, this produces an image nearer to the surface of the emulsion than to the base. A positive image is then formed adjacent the base by any well known reverse printing method as, for example, by bleaching in ammonium bichromate and sulphuric acid solution, then washing and exposing to a strong light. Preferably, the emulsion is then redeveloped in a tanning developer such, for example, as a tanning pyro to develop a positive image adjacent to the surface of the support and at the same time to harden the image so formed. The relief image on the base is then developed by washing away the remaining soluble emulsion with hot water.

If this relief image is to be used directly for the color print, it may be treated while it is on the surface of the base with any well known bleaching solution to render the image transparent and colorless. It is then dyed with a black or other dark color dye which is not taken by the base, rinsed off in dilute acetic acid and dried. The dark dye renders the image discernible in the manner of an ordinary black and white print and it is then ready to color with any suitable bright color dyes.

The colloidal relief image on a white, opaque, water-resistant base can also be obtained in other ways. For example, it is possible to use a soluble light-sensitive emulsion on a transparent base, the base being preferably mat or frosted. In this case, exposure will be from a negative through the transparent base to form a positive relief image adjacent to the base. The emulsion is then processed in the usual way to develop the image on the base, and the image may be dyed a black or dark shade as above described.

The transparent base with the image is then backed with a white opaque reflecting layer, e. g., by mounting, base down, on a white gelatin-coated paper to provide the desired white background for the relief image. The gelatin-coated paper should first be washed in a solution consisting approximately of the following:

Gelatin	-----grams--	2
Water	-----c. c.--	4
Glacial acetic acid	-----do-----	20
Wood alcohol	-----do-----	400

Such treatment enables the Celluloid base to adhere to the gelatin coating of the white background when the two are pressed firmly together. In pressing the two sheets together care must be exercised to expel all air from between them. Also, the combination must be kept from curling due to shrinking of the paper while drying. This

can be done by expedients used in the drying of other laminated and coated sheets, e. g., by taping the edges thereof down upon a stiff board.

The black or otherwise darkened gelatin relief image, obtained by the above or any other desired process, may then be colored locally in accordance with the invention of my prior Patent No. 2,244,905 by applying suitable dyes directly to the relief image with a brush or the like. The application of dye to the image gradually removes the black or other dark color dye from the image and converts it into a colored print. The amount of color absorbed by different portions of the image varies with the depth of the gelatin relief, with the result that the same play of light as was present in the original subject is obtained automatically in the colored image. The high lights are formed by the dye-resistant surface of the base which, being repellant to the dye, remains clear and free of color. Because of the frosted or mat character of the base there is no contrasting texture or gloss in these highlights notwithstanding the exposure of the base by removal of the gelatin. The half-tones accept the colors in full brilliance, and the deepening shadows, due to the retention of dark dye in the thicker portions of the relief image, render the brilliance of the color less and less saturated until in the thickest portions they appear black. The brilliance of the print as a whole is governed by the amount of black which is removed and this in turn is controlled by the amount of color dye applied to the black image. The more color dye applied, the more black is eliminated and the greater the brilliance of the finished print.

Although the dye may be applied in full strength to the surface of the print, it will be received only in amounts corresponding to the depth of the image, and the play of light and shadow on any given area of local color will therefore practically duplicate that on the original subject.

It will be apparent that a suitably hardened image of other colloids can be employed in place of gelatin, and that ways of obtaining a suitable gelatin relief image on the proper backing other than those described can be employed. Obviously the present invention can be variously modified and adapted within the scope of the appended claims.

I claim:

1. A manually colored, photographically toned print comprising a white opaque support having a mat surface and a relief image on said mat surface, the highlights of said image consisting of areas of said mat surface not covered by said relief and the relief being colored in proportion to its thickness by dyes not absorbable by the support.

2. A print according to claim 1 in which some highlights are slightly colored by coloring material adhering to but not absorbed by said mat support.

3. A sheet material for use in the production of manually colored, photographically toned, prints comprising a white opaque support having a mat surface and a gelatin relief image on said mat surface, the highlights of said image consisting of areas of the mat surface not covered by the gelatin relief, said relief being colorable by dyes in proportion to its thickness, said support being repellant to said dyes and said mat surface highlights being colorable by adhesion without absorption.

4. A sensitive sheet material for use in the production of manually colored photographically toned prints comprising a support which is repellant to the coloring materials used for the manual coloring and which has a mat surface and a sensitive wash-off relief emulsion layer coated on said mat surface.

5. A sheet material according to claim 4 in which said mat surface is colorable by adhesion of said coloring materials without absorption thereof.

6. A sheet material according to claim 4 in which said support is transparent.

7. A sheet material according to claim 4 in which said support is opaque and white.

8. The method of making a manually colored photographically toned print which comprises exposing a wash-off relief emulsion coated on a transparent base through the base, processing it

to a relief image on the front of said base, applying a white opaque layer to the back of said base, dyeing said image throughout with a dark removable dye repelled by said base, and then applying to local areas of said relief, differently colored dyes adapted gradually to replace said dark dye.

9. The method according to claim 8 in which the front surface of the base is mat whereby the highlights of said relief image, whereat the base is uncovered, are mat.

10. The method according to claim 8 in which the front surface of the base is mat whereby the highlights of said relief image, whereat the base is uncovered, are mat and including the additional step of applying coloring materials by adhesion only to said highlight areas.

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