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METHOD OF IMBIBITION PRINTING WITH PURE PRIMARY COLORS AND PRODUCT

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This invention relates to cinematographic films and has for an object the improvement of color images produced thereon by imbibition and of the reproduction of the original scene depicted in more exactly appropriate colors and light values than has heretofore been accomplished.

In making films for cinematographic projection purposes, it is now the common and preferred practice to prepare a matrix film corresponding to the red aspect of the original scene and another matrix film corresponding to the green aspect of the scene, and to print the blank film therefrom by dyeing the matrix films with the respective colors and bringing them into contact with the blank film, thus imparting to the blank the composite red and green images respectively from the two matrix films. However, such practice is limited to the reproduction of the various shades and densities of the respective colors, red and green, and of the hues which may be derived by combining them.

In practice, this procedure has been supplemented by treating the matrix with two shades of the dye solution or with two or more dyes, thus modifying the predominant color. For example, a light shade of the red dye has been relied upon for producing flesh tints, and for the production of a blue sky the green dyed matrix film has been given a secondary dip in a blue dye solution (see copending application of Dr. L. T. Troland, Serial No. 280,289, filed May 24, 1928). But such expedients are necessarily limited in their application and in the results which they may be relied upon to produce. And obviously they are wholly inadequate to reproduce pure yellow objects or to contribue a true yellow coloration to those images in which yellow should be a positive component, as for example yellow sand, gold ornamentation, orange shades, etc.

By the present invention these disadvantages may be overcome and a substantially accurate color reproduction of all objects may be produced by imbibition printing of a blank film in the complementary colors red, blue and yellow, (preferably in pure dyes as distinguished from diluted dyes) from complementary matrix films corresponding to the occurrence of these component colors in the original scene.

The procedure is preferably effected by first printing the blank in yellow dye, followd by printing with the blue and red dye in either sequence desired. For special effects, however, the sequence may be rearranged.

A typical and preferred instance of carrying out the invention in actual practice will be described with reference more particularly to colored motion picture or cinematographic films. For this purpose, the following dye compositions have been found especially advantageous and appropriate:—

Yellow

Anthracene yellow GR (400% pure Schultz No. 177 or Sulphon yellow R Zeit. für Farben industrie 1908 Beil. 22	90 grams
Glacial acetic acid	450 "
Water, to make a total volume of	18 liters

Red

Acid magenta 2 B conc (egg-treated 6.0%)	4000 cc.
Acid magenta BN conc (egg-treated 6.0%)	300 cc.
Fast red S conc (egg-treated 3.0%)	1500 cc.
Glacial acetic acid	600 cc.
Water, to make a total volume of	18 liters

Blue-green

Pontacyl green SN extra (egg-treated 4.5%)	5700 cc.
Fast acid green B (egg-treated 3.0%	2800 cc.
Glacial acetic acid	600 cc.
Water, to make a total volume of	18 liters

The matrix films, corresponding to the primary color components of the original scene, are prepared in accordance with the usual practices, care being taken that they severally correspond to the spectral range of the dye

solutions to be employed, as nearly as may be.

To this end an appropriate filter for preparing the matrix films, may, for example, be selected from the A B and C filters of the Wrattan series.

The yellow matrix is now passed through or in surface contact with the yellow dye solution prepared as above, and then rinsed with water. The superficial liquid is blown off by passing the film before an air jet or the like. The blank is wet with water, and the dye-wet film and blank are then brought into firm face contact (preferably while submerged in a bath of cold water to prevent inclusion of air bubbles) and maintained in such contact for a sufficient period of time to effect imbibition transfer of the dye from the matrix to the blank and thus to form the yellow component of the image to be depicted thereon.

The yellow printed film blank is then separated from the matrix film and dried and passed into like contact, while submerged in water, with the red dye-wet matrix film. The contact is maintained for a sufficient time to effect substantially complete transfer of the dye to the blank. The matrix film and film blank are then separated, the printed blank being again dried, and passed into surface contact with the blue dye-wet matrix film. The latter is wet with blue dye solution in the same way as the other matrix films and contacted under water in a like manner to that described above, and the contact is continued for a sufficient time to effect complete transfer of the dye to the blank.

The printed blank is then separated from the blue matrix film and may be subjected to a solution of a mordant such as tannic acid which serves to render the dye images insoluble and fast. At the same time it toughens the hardened gelatine film. Glycerine may also be added, which keeps the film soft and pliable.

The finished blank is dried and is then ready for use in the usual apparatus for projecting motion pictures. The projected images are possessed of the full range of coloration, including each of the pure primary colors red, blue and yellow, as well as composite shades and derivative colors, such as oranges, purples, greens, etc., in purer composition than is obtainable by modification of compound colors such as green or by dilution of such colors, etc.

From the foregoing it will be understood that the colors red and blue are used in the specification and claims merely for illustration, the present invention being particularly concerned with the yellow color; and that any variations of the red and blue colors, such as commonly employed in the art of color photography, may be made without departing from the spirit of the invention. In color cinematography, for example, inasmuch as the so-called red component must also transmit blue light it is usually colored magenta, and inasmuch as the so-called blue component must also transmit green it is ordinarily colored blue-green.

I claim:

1. A method of making colored motion picture films, comprising the steps of preparing matrix films corresponding to the three primary colors in the original scene to be depicted, wetting the same in solutions of corresponding yellow, red and blue dyes respectively, said solutions being characterized by containing their several dyes in true solution only and free from solids of whatever sort, whether dyes or other substances, and successively contacting the dye-wet films in registered superposition upon a film blank, with intermediate drying of the latter.

2. A method of making colored motion picture films, comprising the steps of preparing matrix films corresponding to the three primary colors in the original scene to be depicted; wetting the same in pure colloid treated solutions of corresponding yellow, red and blue dyes respectively, said solutions being characterized by containing their several dyes in true solution only and free from solids of whatever sort, whether dyes or other substances, and successively contacting the dye-wet films in registered superposition upon a film blank, with intermediate drying of the latter, and finally treating the printed blank with a mordanting solution.

3. A method of making colored motion picture films, comprising the steps of preparing a yellow-printing matrix film, wetting the same with a solution of a pure yellow dye, said solution being characterized by containing the dye in true solution only and free from solids of whatever sort, whether of the dye or other substance, and contacting the dye-wet matrix film with the blank film to be printed.

4. A method of making colored motion picture films, comprising the steps of preparing a yellow-printing matrix film, wetting the same with a solution of Acid Anthracene Yellow GR pure dye, said solution being characterized by containing the dye in true solution only and free from solids of whatever sort, whether of the dye or other substance, and contacting the dye-wet matrix film with the blank film to be printed.

5. A colored motion picture film, characterized by having fixed superposed images thereon of pure yellow, red and blue dye solutions, respectively, and free from insoluble matter, whether of dye or other substance.

6. A colored motion picture film, characterized by having an image thereon composed of imbibed Acid Anthracene Yellow GR pure dye solution.

7. A colored motion picture film char-

acterized by having fixed superposed images thereon of yellow, red and blue dye solutions, respectively, and free from insoluble matter, whether of dye or other substance, mordanted thereon.

8. A colored motion picture film characterized by having an image thereon composed of imbibed Acid Anthracene Yellow GR pure dye solution, mordanted with tannic acid.

Signed by me at Boston, Massachusetts this 7th day of March, 1929.

BERTHA SUGDEN TUTTLE.