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COLOR PHOTOGRAPHY

Filed March 8, 1929

Fig. 1.



Fig. 2.



Fig. 3.

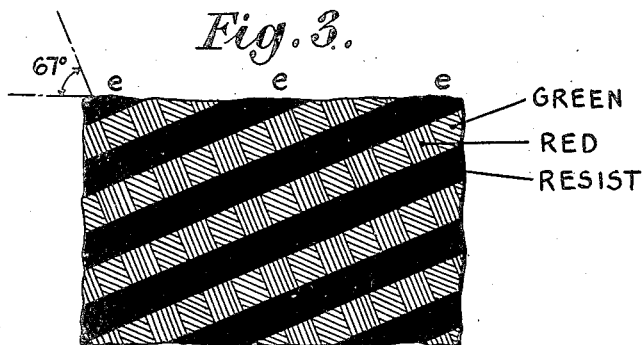
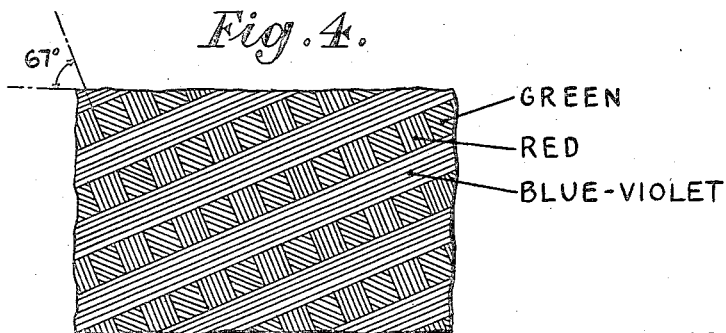


Fig. 4.



INVENTOR

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By Watson, Post, Morse & Criddle
1931

UNITED STATES PATENT OFFICE

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COLOR PHOTOGRAPHY

Application filed March 8, 1929, Serial No. 345,604, and in Great Britain August 3, 1928.

This invention consists of improvements in or relating to color photography. One object is to enable photographs in natural colors to be taken or reproduced on non-inflammable films, viz. films made from cellulose acetate or similar cellulose ester of an organic acid. Another object is to enable photography in natural colors to be applied successfully to the cinematograph.

Hitherto, suggestions have been made for the application to films of celluloid, or of gelatine, of dots, lines or geometrical patterns made up of two, three or more colors. The film thus prepared was coated with a light-sensitized layer after a suitable varnishing.

According to this invention, a process of making a multi-color screen for color photography or cinematography includes the step of applying to a film of cellulose acetate, or similar cellulose ester of an organic acid, a solution of collodion, or similar solution of cellulose nitrate, alone, or in admixture with softening or plasticizing agents, before applying the dyes or colors. Alternatively, said solution may itself contain a dye.

Further, according to this invention, the said solution may form an effective bond with the film, and dyes applied to the film treated with such solution may penetrate into the film.

This invention also includes a support for a multicolor screen comprising in combination a layer of cellulose acetate, or similar cellulose ester of an organic acid and a deposited layer thereon of cellulose nitrate alone or in admixture with softening or plasticizing agents.

This invention also includes a process of making a multi-colour screen for color photography, or cinematography, in which there is applied to a dyed support, as above described, fatty resists enabling the portions of the support which are not protected by the resists to be decoloured and dyed with another color.

The said resists may be removed and a fresh application of resists made to enable the portions of the support which are not

protected to be again decoloured and dyed with another color.

The invention relates to the manufacture and use of multicolor screens and sensitized films for color photography and cinematography, whether the films be master films (e. g. negatives) or reproduced films (e. g. positives).

Further features of the invention will appear from the following description with reference to the accompanying drawings Figures 1-4, which it should be understood, are diagrammatic only, of one method of carrying the invention into effect in the production of cinematograph films in natural colors:—

A cellulose acetate film is produced in any known way, but preferably, according to the methods described in United States applications of H. J. Hands, Ser. No. 300,932 and Ser. No. 238,150. The thickness of the film may be about 0.0055 inch, and the film is conveniently cut to a width of about 10 inches. The clean film, from a bobbin, is led through a coating apparatus, preferably of the type described in the U. S. application of Charles Bonamico, Serial No. 345,568, filed March 8, 1929. The object is to apply on one side of the film a fine layer of collodion of a definite and uniform thickness (Figure 1), and in the present example the collodion embodies a green dye. It is this collodion coating which is to receive the various dyes, and in determining the composition of the collodion and the thickness of the layer the determining factor is that the ultimate coloured portions shall give the correct spectrum absorption. A 2% solution of industrial collodion, and a 5% solution of industrial collodion, are mixed together in such quantities as to afford the required viscosity. The proportions have to be varied to suit the temperature, humidity, and similar conditions. The collodion mixture is dyed green with an alcoholic solution of malachite green and of auramine. The composition of the dye may be, for example, alcohol 100 parts, malachite green 4 parts, auramine 6.7 parts. The composition of the collodion mixture may be, for example, collo-

dion mixture 30 c. c., dye solution 2 c. c. For instance, in practice it has been found convenient to apply this solution in such a thickness that an area of 100 c. long, by 26 c. wide, takes 22 to 25 c. c. Thus, the thickness of the layer is about .01 millimetre wet, i. e. .0002 to .0005 millimetre when dry. The collodion layer could be put on uncoloured and thereafter dyed.

The film dyed uniformly green all over is then led through a printing machine by means of which extremely fine parallel lines of greasy ink (intended to act subsequently as fatty resists) are printed upon it. The printing is effected by means of a small engraved steel roller having (in one case) 15 lines and 15 intervening grooves per millimetre. In the example, the lines were at 23° to the axis of the cylinder. The film at this stage exhibits 15 clear green lines *c* and 15 opaque greasy lines *d* (green underneath) per millimetre, both kinds of line being of about the same width (Figure 2). After an interval of about an hour, to let the ink dry, the film is led in succession (*a*) over a bath which bleaches and dissolves out the green dye from only the clear spaces, leaving unattacked the green lines protected by the ink. The composition of this bath is—alcohol 100 parts, potassium hydrate (10% aqueous solution) 2 parts, acetone 4 parts, (*b*) over an inking roller which applies a red dye to the spaces between the ink line. In this example the red dye is basic red N Extra (Kühlmann) 8% solution in alcohol. The film is thoroughly washed with water to remove the excess of dye. (*c*) The film is passed through a solvent cleansing bath of benzene and is brushed by roller brushes within the benzene to remove the ink lines, leaving exposed the clear green lines.

The film is again led (when dry) through the printing machine which produces parallel lines of greasy ink *e* (Figure 3), as before, but this time at right angles to those formerly made. In other words, the lines are at 67° to the axis of the cylinder and at right angles to the red and green lines. After an interval for the ink to dry, the film is led in succession (*a*) over a bath which bleaches and dissolves out the red and green dye from only the clear spaces between the greasy lines, (*b*) over an inking roller which applies a violet dye which dyes the interlined spaces. The violet dye contains—crystal violet (4% solution in alcohol) 80 parts, and malachite green (8% solution in alcohol) 20 parts. (*c*) The film is again led through a solvent cleansing bath of benzene and is brushed by roller-brushes within the benzene to remove the ink lines (Figure 4). The film is then dried, is coated with a suitable substratum (such as a thin layer of gelatine and a thin layer of varnish) and is thereafter coated with a layer of sensitized emulsion (a panchromatic emulsion).

The bath referred to above under (*a*) conveniently comprises: alcohol 100 parts, potassium hydrate (10% aqueous solution) 1 part, acetone 10 parts, water 6 parts.

I claim:

1. A method of making a multicolour photographic screen consisting in applying to a film of a cellulose ester of an organic acid a coating of cellulose nitrate in solution, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
2. A method of making a multicolour photographic screen consisting in applying to a film of cellulose acetate a coating of cellulose nitrate in solution, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
3. A method of making a multicolour photographic screen consisting in applying to a film of a cellulose ester of an organic acid a coating of cellulose nitrate in solution in admixture with a plasticizing agent, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
4. A method of making a multicolour photographic screen consisting in applying to a film of cellulose acetate a coating of cellulose nitrate in solution in admixture with a plasticizing agent, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
5. A method of making a multicolour photographic screen consisting in applying to a film of a cellulose ester of an organic acid a coating of cellulose nitrate in solution in admixture with a dye, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
6. A method of making a multicolour photographic screen consisting in applying to a film of cellulose acetate a coating of cellulose nitrate in solution in admixture with a dye, drying the coating and thereafter treating said coating to produce therein a multiplicity of differently-coloured regions.
7. A method of making a multicolor photographic screen consisting in applying to a film of a cellulose ester of an organic acid a coating of cellulose nitrate in solution in admixture with a dye, drying the coating, applying thereto a fatty resist, decolouring those parts not protected by said resist, dyeing said parts with another color and removing the resist.
8. A method of making a multicolour photographic screen consisting in applying to a film of a cellulose ester of an organic acid a coating of cellulose nitrate in solution in admixture with a dye, drying the coating, applying thereto a fatty resist in a pattern of

parallel strips, decolouring those parts not protected by said resist, dyeing said parts with another color, removing the resist, applying further resist in a pattern of parallel strips transverse to the direction of those
5 formerly applied, decolouring the portions not protected by the resist, dyeing them with a third color, and removing the resist.

9. A method of making a multicolour photographic screen consisting in applying to a
10 film of cellulose acetate a coating of cellulose nitrate in solution in admixture with a dye, drying the coating, applying thereto a fatty resist, decolouring those parts not pro-
15 tected by said resist, dyeing said parts with another color and removing the resist.

10. A method of making a multicolour photographic screen consisting in applying to a film of cellulose acetate a coating of cel-
20 lulose nitrate in solution in admixture with a plasticizing agent and with a dye, drying the coating, applying thereto a fatty resist, decolouring those parts not protected by said resist, dyeing said parts with another color
25 and removing the resist.

11. A multicolour photographic screen comprising a film of a cellulose ester of an organic acid having a deposited coating thereon of cellulose nitrate which is dyed
30 in different colors in different parts thereof.

12. A multicolour photographic screen comprising a film of cellulose acetate having a deposited coating thereon of cellulose ni-
35 trate which is dyed in different colors in different parts thereof.

13. A multicolour photographic screen comprising a film of cellulose acetate having a deposited coating thereon of cellulose ni-
40 trate in admixture with a plasticizing agent which is dyed in different colors in different parts thereof.

In testimony whereof I affix my signature.
LOUIS DUFAY.

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