P. D. BREWSTER.

FILM FOR COLOR CINEMATOGRAPHY.

APPLICATION FILED JUNE 24, 1914.

1,222,925. Patented Apr. 17, 1917.

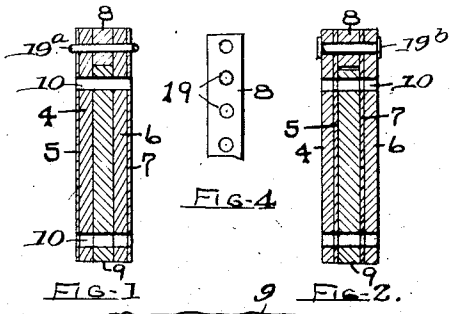


FIG-1

FIG-4

FIG-2.

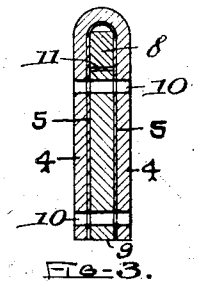


FIG-3.

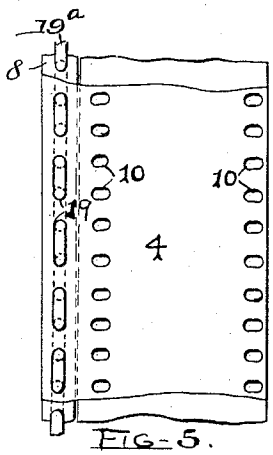


FIG-5.

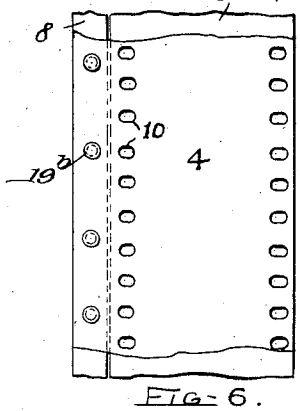


FIG-6.

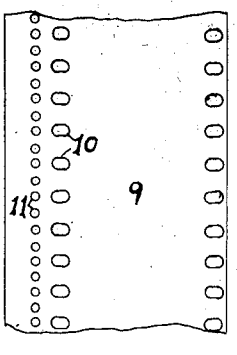


FIG-7.

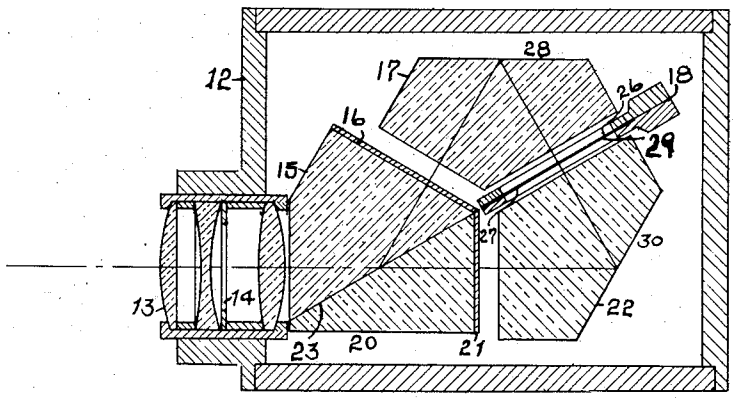


FIG-8.

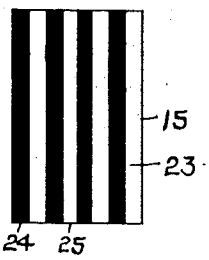


FIG-9.

Witnesses:
A. S. Brewster
[illegible]

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UNITED STATES PATENT OFFICE.

PERCY D. BREWSTER, OF EAST ORANGE, NEW JERSEY.

FILM FOR COLOR CINEMATOGRAPHY.

1,222,925. Specification of Letters Patent. Patented Apr. 17, 1917.

Application filed June 24, 1914. Serial No. 846,966.

To all whom it may concern:

Be it known that I, PERCY D. BREWSTER, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Films for Color Cinematography, of which the following is a specification.

This invention relates to color photography, particularly cinematography in colors, and its chief object is to provide film which may be used in the process described in my copending application Serial No. 841,797, filed May 29, 1914, for the production of two negative films, each having a separate color record, from which a positive film sensitized on both sides can be printed to record one color or group of colors on one side and another color or group of colors on the other side, thereby producing a final result like that described in my co-pending applications Serial No. 747,712, filed February 11, 1913, and Serial No. 843,351, filed June 6, 1914; that is, a two-color film with a different color on each side.

Several convenient and effective forms of the invention are illustrated in the accompanying drawings, in which—

Figures 1, 2 and 3 show three embodiments in cross section. Fig. 4 is a detail plan view of a spacer used to separate the two strips of film. Figs. 5 and 6 are plan views of the film shown in Figs. 1 and 2, respectively. Fig. 7 is a plan view of a separator that may be used in Fig. 3. Fig. 8 is a sectional plan view of a camera suitable for utilizing film of the types contemplated by the present invention. Fig. 9 is a plan view of the reflecting and transmitting surface of one of the prisms used in the camera.

My improved film comprises two transparent supports or films 4, 6, superposed one on the other and having color-sensitive emulsions 5, 7, with a "spacer" 8 and a "separator" 9 between the two films. The two emulsions may both be panchromatic; but I prefer to have one sensitized chiefly for light of one or more colors above, say, yellow-green of the spectrum, and the other for colors below yellow-green. Of course the dividing line in color-sensitiveness can be at any other desired point in the spectrum. The emulsions may be color sensitive when coated or they may be treated with dye baths of well known compositions after coating,—such as eosine or erythrosine for the green sensitiveness, and a derivative of cyanine for the red. It is usually necessary to filter out the ultra-violet, violet and part of the blue from the light before it reaches the red-sensitized film, as even specially dye-treated emulsions are more or less sensitive to these colors. The same system of color sensitiveness may be applied to any of the film described herein.

The emulsions may be on the outside, as in Fig. 1, or on the inside facing each other, as in Fig. 2. The two films and the spacer are attached to each other in any preferred manner; for example, they may be laced together through the holes 19, 19, by the lacing 19^a, Figs. 1 and 5. The separator 9 may be integral with the spacer, as in Fig. 7, or it may be separate, as in Figs. 1 and 2, but it should be made of a material sufficiently opaque or colored to prevent the passage of material amount of light.

The function of the spacer between the two films is to maintain a separation between the films equal to the thickness of the positive film upon which the pictures are made from the negative; and the function of the separator is to prevent the passage of any light through one film against the other and to maintain the films, during exposure, flat and in the same relative positions that they will occupy when the positive is being printed, so that proper registration of the image will be secured.

In cinematographic work, for which the film is primarily intended, great accuracy must be attained, as the small picture (an inch by three-fourths of an inch in size) is enlarged a hundred and twenty to a hundred and fifty diameters, or fourteen thousand to twenty-two thousand times. Hence an error of a thousandth of an inch on the film amounts to from an eighth to a sixth of an inch on the screen, which causes lack of sharpness and "banding" of colors. It is therefore important to make the spacer of a thickness as nearly as possible equal to

that of the positive film, so that the negatives will not bend or buckle in either direction when the positive is between the two for printing, but will lie flat along the two sides. Bending or buckling of the negatives displaces the negative images in relation to each other and causes images out of register on the positive. In short, the separator simply acts as a dummy for the positive film while the exposure of the two negative films is being effected.

After exposure, the two films are separated, as by removing the lacing 19[a], and are developed and fixed, and (if desired) stained. The films are then reassembled with the spacer between as before, but without the separator. (If the separator and spacer were originally in one piece they must be cut apart.) The positive film, coated on both sides with light-sensitive emulsions, is now placed between the negative films in place of the separator and is printed on both sides through the negative films.

The two films and the spacer can be inseparably fastened together along one edge (as by gluing or cementing, or by pinning as at 19[b], Figs. 2 and 6) in which case the two films can be held open along the opposite edge during development and such other treatment (fixing and staining) as may be desired; the separator being first removed, especially if the emulsions are on the inner surfaces of the films. In printing, the two films, fastened together along one edge, are opened or spread apart along the other to receive the positive film.

A plan view of a combined spacer and separator is shown in Fig. 7. Like the separators in Figs. 1, 2, 5 and 6, it is perforated with standard sprocket holes (10, 10) used in cinematographic film, and, also provided with a series of holes 11, 11, along which the separator may be torn from the spacer. The standard holes 10, 10 are preferably punched in the films and separator simultaneously, so as to insure an even feed of film through the film gate, as will be readily understood.

Fig. 3 illustrates in cross section a single film of about double the standard width, bent to form a double film with a separator 9 between. A spacer 8 may be also incorporated between the films and held in place by any convenient means. If celluloid be used for the film support, it can readily be bent by the local application of heat along the line on which the bend is to be made. If the film be placed in contact with a tube containing steam or hot water the celluloid may be readily bent and if this heat be applied carefully, the emulsions on the portions where the pictures are to be taken will not be affected as there will ordinarily be a margin of about an inch between the two series of pictures. This form of double film is developed, etc., and is used in printing, in the same manner as the double film shown in Fig. 2.

A type of camera that may be used for exposing the negative film is shown in Fig. 8, and comprises a casing 12, provided with lens 13 and diaphragm 14. The light from the lens passes into the prism 15, and part of it is reflected from the surface 23 through filter 16 (adapted to permit the passage of light of the red group of colors) in prism 17 and is reflected by surface 28 of prism 17 against the red sensitized emulsion 26 on film 29 in the film gate 18; while the other portion of the light passes through prism 20 and filter 21 (adapted to permit the passage of light of the green group of colors), into prism 22 and is reflected from surface 30 upon the green sensitive emulsion 27 on film 29. The surface 23 of the prism 15 is preferably provided with alternating clear bands 25 and silvered bands 24, and the two prisms 15 and 20 should be cemented together with Canada balsam, so as to transmit all of the light impinging upon the clear spaces or bands. If the angle of the surface 23 is such as to produce total reflection, the silvering of the prism may be dispensed with and the balsam put on in strips or spots, so that where the prism is uncemented the light will be reflected while the portions cemented together with the balsam will transmit the light. Any desired proportion of reflected and transmitted light may be secured in this way.

As methods of intermittently feeding the film through the film gate are well known in the art, it is not necessary to illustrate or describe the same herein. I do not claim the apparatus described, such as the camera, prism and reflecting systems.

If panchromatic film be used, suitable light filters, as 16, 21, should be interposed in the paths of the rays, so as to permit light of only the desired colors from reaching the respective emulsions.

The line of perforations 11, 11 (Fig. 7) in the spacer or separator may be omitted and the spacer otherwise weakened along that line in any manner, so that the spacer may be readily torn along the line of weakness.

Inasmuch as any detachment of the two films from each other for the purpose of development and other treatment is merely temporary, the films and the spacer being re-assembled and re-fastened together for printing, the films and the spacer may be described as permanently fastened together, to distinguish from prior schemes in which two films are attached to an intermediate fugitive element. In such schemes (as for example in Ives Patent No. 927,244, dated July 6, 1909), the negatives are not reas-

sembled after development and fixing, as they were before, but are used separately for printing separate positives which are then combined.

It is to be understood that the invention is not limited to the procedure and apparatus herein specifically described but may be practised in other ways without departure from its spirit.

I claim:

1. As a new article of manufacture in the art of color photography, photographic film for the purpose described, comprising two color-sensitive films superposed one on the other and provided with means for holding the two in the same relative positions during exposure in a camera and during subsequent printing operations, and capable of opening along one edge for the insertion of another film between the two for printing purposes.

2. As a new article of manufacture in the art of color photography, photographic film for the purpose described, comprising two films, one sensitized for one or more colors and the second for one or more colors different from the first, the two films being superposed on each other and provided with means to hold the two in the same relative positions during exposure in a camera and during subsequent printing operations, and capable of opening along one edge to permit the insertion of another film between the two for printing purposes.

3. As a new article of manufacture in the art of color photography, photographic film for the purpose described, comprising two color-sensitive films superposed one on the other and spaced apart, and provided with means for holding the films in the same relative positions during exposure in a camera and during subsequent printing operations, but permitting the two films to open along one edge for the insertion of another film between the two for printing purposes.

4. As a new article of manufacture in the art of color photography, photographic film comprising two superposed color-sensitive films, a spacer between the two films, and means fastening the spacer and the two films together along one edge of the latter and permitting the films to open along the other edge for the insertion of a third film between the other two.

5. As a new article of manufacture in the art of color photography, photographic film comprising two superposed color-sensitive films, a permanent spacer between the two films along one edge thereof, the films and the spacer being fastened together, and a removable separator arranged between the two films and extending over the areas thereof that are to be exposed to light.

6. As a new article of manufacture in the art of color photography, photographic film comprising two superposed color-sensitive films, a spacer arranged between the two films along one edge and permanently secured thereto, and a separator detachably connected to the spacer and extending therefrom toward the opposite edge of the film.

7. As a new article of manufacture in the art of color-cinematography, cinematographic film comprising two long and relative narrow color-sensitive films superposed on each other, and a spacer between the two films along one edge thereof, the films and the spacer being permanently fastened together but permitting the films to open along the opposite edge to receive a third film for printing purposes.

8. As a new article of manufacture in the art of color-cinematography, cinematographic film comprising two long and relatively narrow color-sensitive films superposed on each other, a spacer between the films along one edge thereof, the two films and the spacer being permanently fastened together, and a removable separator between the two films and extending over the areas thereof that are to be exposed to light.

9. As a new article of manufacture in the art of color-cinematography, cinematographic film comprising two color-sensitive films superposed on each other, a permanent spacer between the films along one edge thereof, and a removable separator arranged between the two films and extending over the areas thereof that are to be exposed to light.

10. As a new article of manufacture in the art of color-cinematography, cinematographic film comprising two color-sensitive films superposed on each other, a spacer arranged between the films along one edge thereof and permanently fastened thereto, and a separator between the films, detachably connected to the spacer and extending toward the opposite edge.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 23rd day of June, 1914.

PERCY D. BREWSTER.

Witnesses:
A. S. BREWSTER,
C. O'DONOGHUE.