

P. D. BREWSTER.
 COLOR CINEMATOGRAPHY.
 APPLICATION FILED MAY 29, 1914.

1,228,877.

Patented June 5, 1917.
 2 SHEETS—SHEET 1.

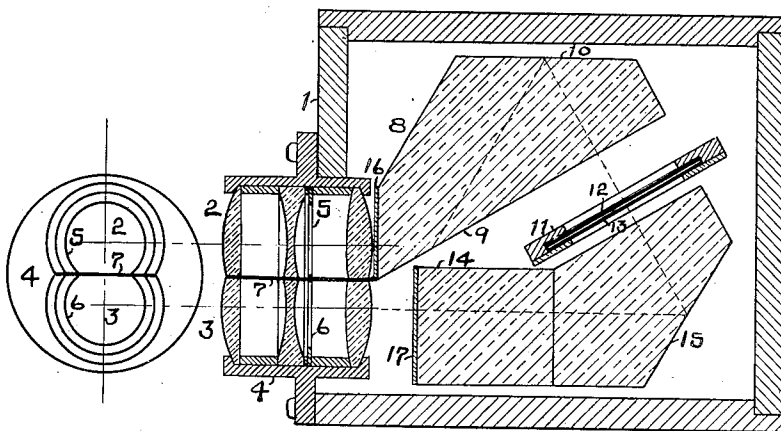


FIG-2-

FIG-1-

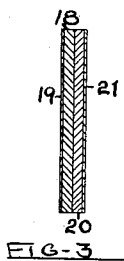


FIG-3-

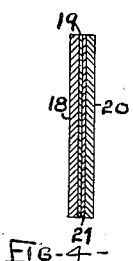


FIG-4-

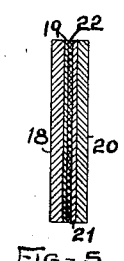


FIG-5-

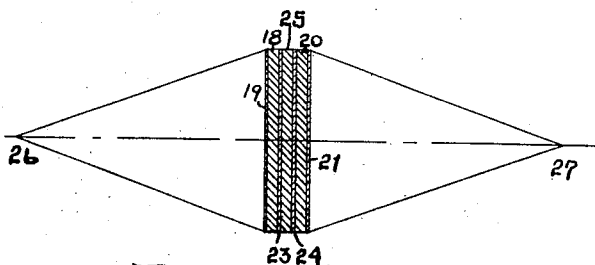


FIG-6-

WITNESSES:

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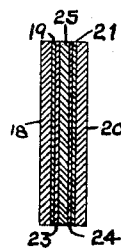


FIG-7-

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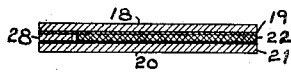


FIG-8

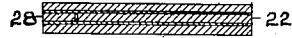


FIG-12

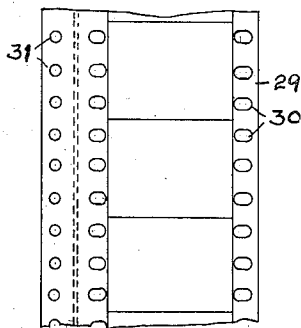


FIG-9-

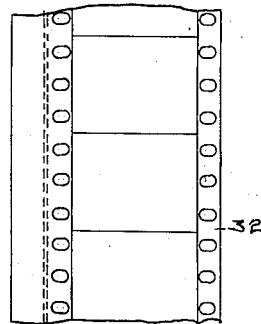


FIG-11

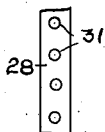


FIG-10

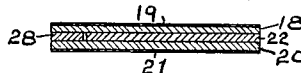


FIG-13-

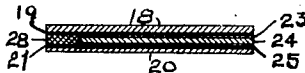


FIG-14-

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COLOR CINEMATOGRAPHY.

1,228,877.

Specification of Letters Patent.

Patented June 5, 1917.

Application filed May 29, 1914. Serial No. 841,797.

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 Color Cinematography, of which the following is a specification.

This invention relates to color photography, particularly cinematography in colors and its object is to provide a new method of producing negative films from which a positive film sensitized on both sides can be printed to record one color on one side and another color on the other side, producing a final result similar to that described in my co-pending application Ser. No. 747,712, filed Feb. 11, 1913, now Patent No. 1,191,941, dated July 25, 1916, namely a two color film with one color on each side.

In the accompanying drawings Figure 1 is a sectional plan view of a suitable camera; Fig. 2 is an end elevation of the lenses; Figs. 3, 4 and 5 are sections through different modifications of the film; Figs. 6 and 7 illustrate methods of printing from the double negative upon the positive film; Fig. 8 is a sectional view of a modified type of film; Fig. 9 is a plan view of the special film; Fig. 10 is a plan view of the spacing device or spacer; Fig. 11 is a plan view of one form of the film; Figs. 12 and 13 are sectional views of modified forms of the film; Fig. 14 is a section illustrating a method of printing.

The camera 1, shown in Fig. 1, is equipped with two lens systems 2 and 3 (shown as triplets) and provided with diaphragms 5 and 6 respectively and mounted in the housing 4. The two lenses are preferably mounted as close to each other as possible in order to reduce the parallax and the two edges of the lenses may be clipped, as shown in Fig. 2, to reduce the distance between their axes. A strip of preferably opaque material 7, such as heavy paper is placed between the two lens systems and extends out to the prism 8 to prevent the interference of light from the two lens systems.

All the light passing through the lens 2 continues into the glass prism 8 where it is reflected by the surfaces 9 and 10 against a sensitive emulsion 12 on a film in the film gate 11, while the light from the lens 3 passes through prism 14, and is reflected from the surface 15 against the sensitive

emulsion 13 in the film gate 11. Surfaces 9, 10 and 15 may be silvered if their reflecting angle does not produce total reflection. My copending patent application Serial Number 815,153 filed Jan. 29, 1914, illustrates a construction whereby the light from a single lens is split into two color groups, one group being reflected to one side of the film and the other group to the other side, and illustrates also a double lens construction with two and three reflections respectively using adjustable mirrors in place of prisms, which apply equally well to the present construction.

The film gate 11 is designed to hold the film or films in a plane substantially parallel with the first reflecting face 9 of the prism 8, thereby very greatly shortening the focal distance, and permitting the use of a short focus lens which combines speed and depth of field which is of extreme importance in cinematographic work. In the twin lens construction unless the film gate were in this plane (parallel to the first reflecting surface) it would be necessary to use two and three reflections thereby greatly increasing the focal distance.

If the sensitized surfaces of the film or films mounted in the film gate are panchromatic the light filters 16 and 17 in the light paths of lenses 2 and 3 respectively should permit the passage of light of only the colors desired to the emulsions 12 and 13 respectively. For example, filter 16 should pass violet, indigo, blue, green and yellow-green light to the film surface 12; while filter 17 should pass red, orange and yellow light to the film surface 13. In both cases the filters should be balanced to produce an orthochromatic rendering of the color values and should be substantially balanced in speed. The speed balance may be aided by using diaphragm stops 5 and 6 of different size to compensate for difference in speed of the emulsions to the different colored light as well as to compensate for pictures taken near noon, which exceed in blue, and those taken near sunset which exceed in yellow and red.

It is apparent that the emulsions are intended to be affected by light of different color or groups of colors, for example one emulsion by the yellow-green to blue or violet group, and the other by the red to yellow group. For this purpose each emulsion may be made, by well understood methods,

sensitive to light of its own color group and relatively insensitive or "blind" to light of other colors. This is particularly the case with the "green" sensitive emulsion which can readily be made "blind" to red and orange and therefore could be used without a filter with resulting great increase in speed if the film were orthochromatic to its own color group, but the "red" sensitive emulsion would probably retain a portion at least of its sensitiveness for blue and violet and would have to be used with a light filter to reduce these colors but that filter would be far "faster" or less dense than a filter that had to absorb the yellow-green and green light rays as well as the blue and violet.

This camera could be used with a single film coated on both sides with color sensitive emulsions as described in my copending applications Ser. No. 747,712, filed Feb. 11, 1913, and Ser. No. 776,782, filed July 1, 1913, or with two films, each of which is coated on one side with a color sensitive emulsion.

Fig. 3 illustrates two film supports 18 and 20 in contact with each other and with the sensitized surfaces 19 and 21 respectively on the outside ready to pass through the film gate together and be exposed.

In order to secure perfect registration in printing it is very desirable that the two films should be perforated simultaneously before exposure. After exposure the films are developed and fixed in the ordinary way and both turned over (so the images on the sides of the negatives will be face to face) and a positive film coated on both sides with light sensitive emulsions placed between the two negative films, the negative films being placed in register by pins fitting in the perforations which were simultaneously made and the positive printed by light passing through the negative film from both sides. After printing the positive is developed and fixed and the images on the two sides stained colors best adapted to reproduce the object photographed.

To prevent the possibility of the printing light from one negative from passing through the positive film support and acting on the other emulsion and thereby impairing the sharpness of the color separations, the positive film may be sensitized on one side primarily for one color, say "green," and on the other side for another color, say "red" and one of the negative films stained "red" and the other "green" in the high lights and the "green" negative placed in contact with the "green" sensitized side of the film and the "red" negative in contact with the "red" sensitized side of the film and printed with white light from both sides, so that each negative could only effect one side of the positive.

A modification of this method is to sensitize the positive film for "red" on one side

and "green" on the other, place in contact with the black and white negatives and print through the negative on one side with "red" light on the "red" sensitized side of the film and with "green" light on the "green" sensitized side.

It is apparent that any of these printing processes may be applied to any of the types of negative film to be described hereafter.

Fig. 4 illustrates a construction where the negative film passes through the film gate with sensitive surfaces in contact and consequently can be printed without being turned over, both films being in exactly the same position as when they were perforated. A material advantage in registration is secured, at the expense of a slight reduction in speed and sharpness of the negative, due to the light of the image having to pass through the support.

Fig. 5 shows a strip of opaque material 22, such as paper between the film to prevent any light from passing through one film and acting on the other and also to prevent scratching of the sensitized surfaces.

Fig. 6 shows the positive film 25 with the sensitized surfaces 23 and 24 being printed between two negative films with the emulsions on the outside by constantly diverging light rays, such as would be projected through a lens. If prints are made with negative images on the outside the printing light should be either in parallel rays or constantly diverging rays as illustrated to secure sharp prints.

A type of negative film is illustrated in Figs. 8 and 9 comprising four separable parts, the films 18 and 20 with the sensitized surfaces 19 and 21 on the inside, a spacer 28 and separator 22. The film 29 is perforated for the standard holes 30, 30 on both sides but is cut with an additional margin in which the holes 31, 31 are punched, preferably simultaneously, through both films and the spacer 28. After exposure the films are separated, developed and fixed and stained (if desired) and are then reassembled with the spacer between exactly as they were before exposure with the pins or lacings in place and the positive films placed between and printed as shown in Fig. 14 by light from both sides.

A modification of this film is illustrated in Figs. 11, 12 in which the spacer 28 is secured permanently between the two films by sewing, lacing, pinning, gluing, or cementing the two films after exposure, the process is continued by removing the separator 22, spreading the film apart by a series of pins (if the sensitive surfaces are facing each other), developing the two films, fixing the two films and slipping the

positive film between the negative films and printing as shown in Fig. 14.

Perfect registration of the images on the positive film is secured by either joining the two negative films together, or, at least, in perforating them simultaneously and passing them through the same film gate and using the same claws to feed the two films through the film gate. The registration of the images on the negative films may be secured by slightly shifting the prisms or mirrors in any direction or by turning the two lenses on a center located midway between the axis of each of the lenses.

It is to be understood that the invention is not limited to the specific apparatus and process and method herein specifically described, but may be practised in other ways without departure from its proper spirit and scope.

I claim:

1. The process of making color cinematographic films, which consists in passing a pair of color-sensitive negative films simultaneously and in unison through the same film gate, reflecting the light received from the object to be photographed to the opposite sides of the pair of films in the film gate for the production of separate optical images of the object thereon, chemically

treating the exposed films to produce photographic images of the object, arranging the two films on opposite sides of and in contact with a positive film sensitized on both sides and exposing the same to light, chemically treating the exposed positive film to produce photographic images of the object thereon, and coloring the two sides of the treated positive in two different colors.

2. In a process of making color-cinematographic films, the steps comprising passing simultaneously and in unison through the same film gate a pair of color-sensitive negative films arranged face to face and permanently connected together along one edge, directing light from the object to be photographed to the opposite sides of the pair of films for the production of optical images of the object thereon, and chemically treating the two films to produce separate photographic images of the object.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 28th day of May 1914.

PERCY D. BREWSTER.

Witnesses:

J. J. MOORE,

A. S. BREWSTER.