F. W. DONISTHORPE.

COLOR CINEMATOGRAPHY.

APPLICATION FILED JAN. 15, 1917.

1,350,143.

Patented Aug. 17, 1920.

3 SHEETS—SHEET 1.

Fig. 1.

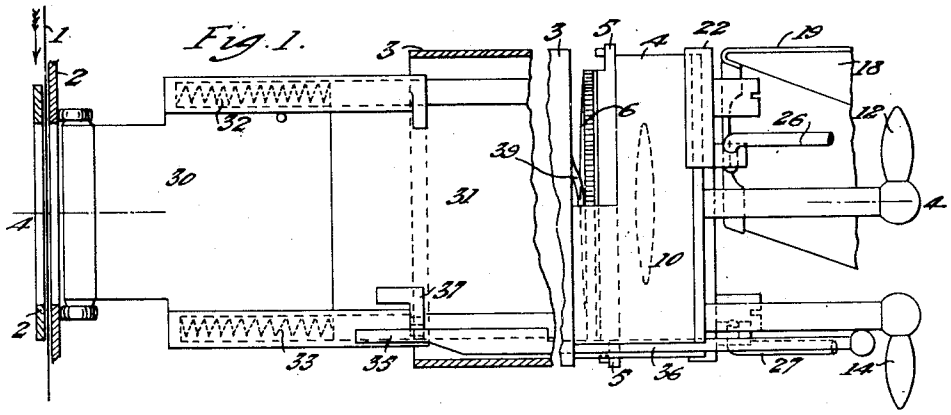


Fig. 4.

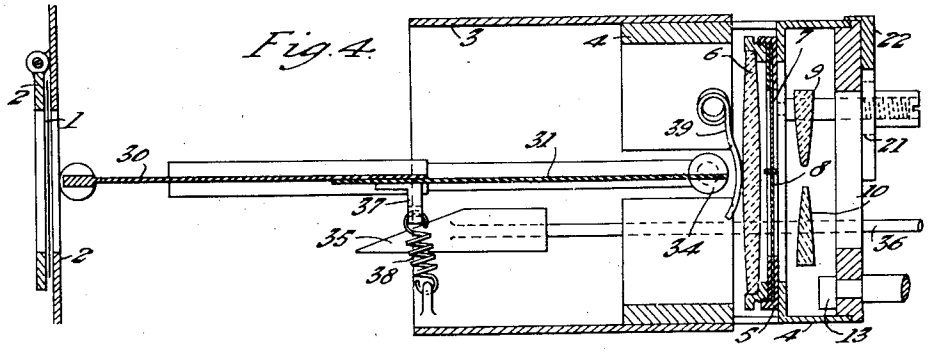


Fig. 2.

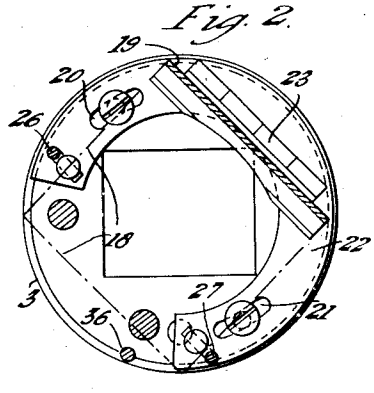
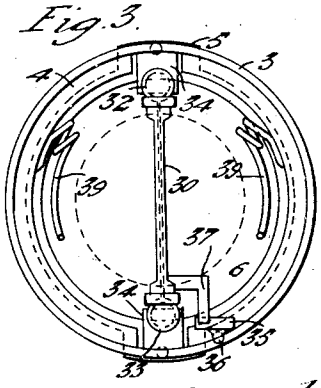


Fig. 3.



Witnesses:

M. E. McHale.

C. L. Hosler

Inventor

Frank W. Donisthorpe

by James L. Norris

Attorney

F. W. DONISTHORPE.

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3 SHEETS—SHEET 2.

Fig. 5.

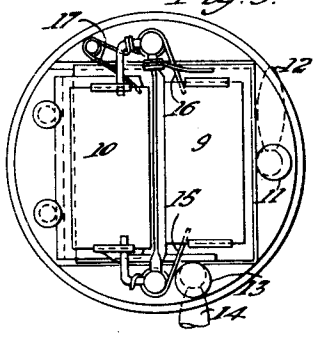


Fig. 9.

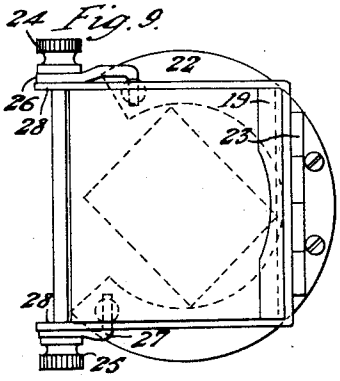


Fig. 6.

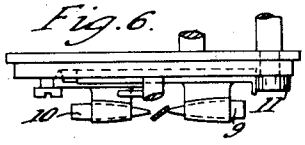


Fig. 7.

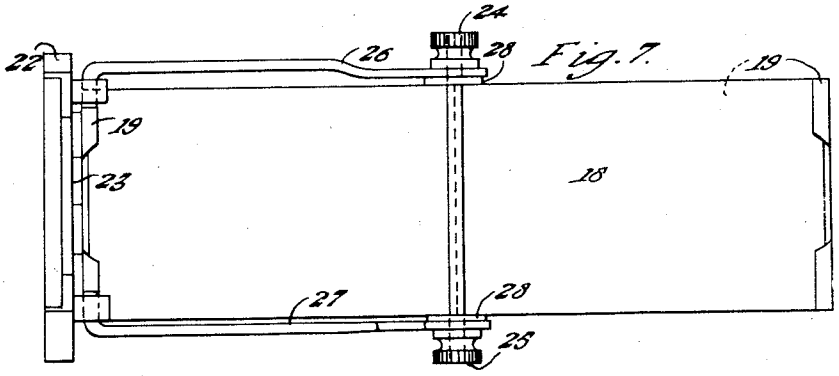
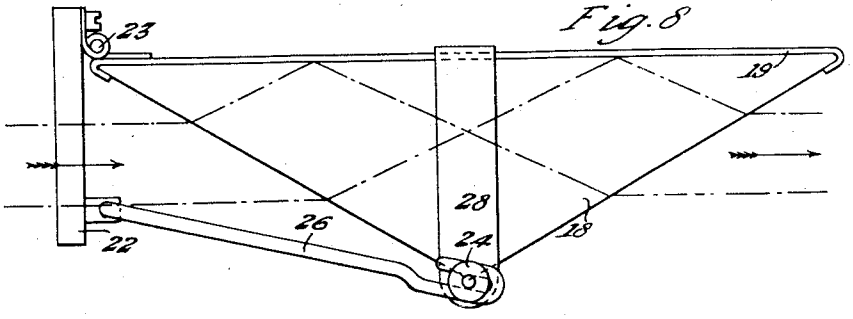


Fig. 8.



Witnesses:

M. E. McDade.

C. E. Kresler

Inventor

Frank W. Donisthorpe

by James L. Norris

Attorney

F. W. DONISTHORPE.

COLOR CINEMATOGRAPHY.

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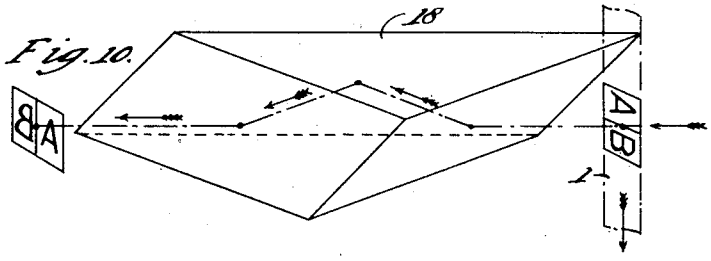
3 SHEETS—SHEET 3.

Fig. 10.



Witnesses:
M. E. McDade.
C. L. Keller

Inventor
Frank W. Donisthorpe
by Munn & Norris
Attorney

UNITED STATES PATENT OFFICE.

FRANK WORDSWORTH DONISTHORPE, OF BARNES, ENGLAND.

COLOR CINEMATOGRAPHY.

1,350,143. Specification of Letters Patent. Patented Aug. 17, 1920.

Application filed January 15, 1917. Serial No. 142,803.

To all whom it may concern:

Be it known that I, FRANK WORDSWORTH DONISTHORPE, a subject of the King of Great Britain, residing in Barnes, England, have invented certain new and useful Improvements in and Relating to Color Cinematography, of which the following is a specification.

The present invention relates to color cinematography and more particularly to the projection on the screen of two color images taken on standard films. For the results to be most pleasing to the eye, the vertical dimension of a picture should be to the horizontal dimension in the ratio of three to four and the usual standard projectors are arranged to obtain this result. In some processes of two color cinematography two images taken through color filters of complementary shades are obtained side by side, so that the breadth of the picture is halved while its vertical dimension is unaltered, with the result that the vertical and horizontal dimensions are in the ratio of three to two instead of three to four. Various methods have been proposed to overcome this drawback. In other processes of color cinematography in the area allotted to a single picture four images are formed, but this results in abnormally small images requiring very large magnification.

In another arrangement, the pictures are taken on the film, so that the horizontal lines of the objects are parallel to the length of the film, and the film is passed horizontally instead of vertically through the projector. The picture is consequently projected on the screen correctly and with the usual satisfactory relation between its vertical and horizontal dimensions. This arrangement, however, necessitates a special projector to enable the film to pass through the gate horizontally and in many theaters the expense of providing an additional projector with its accessories for the projection of pictures which may be only occasionally shown is practically prohibitive.

The present invention enables the required result to be obtained without the drawbacks attending the projection of abnormally small images and without the necessity for providing a special projector. According to the invention, a film, on which, as in the last mentioned method, the images are formed so that the horizontal lines of the objects are parallel to the length of the film, is passed vertically through an ordinary projector and the picture is rotated optically through an angle of 90°. The arrangement for effecting this rotation can be inserted in the ordinary projector at any time and the adjustments necessary for changing from black and white to color pictures can be made in a few seconds. Several different optical methods can be employed for this purpose.

The optical rotation by prisms or mirrors of images taken obliquely on a film and combined for color work, so that the pictures on the screen have substantially the normal position, has been previously proposed, and the present invention relates to arrangements by which the images arranged as previously described on the film are optically rotated through 90°.

A preferred method according to the invention is illustrated in the accompanying drawing, in which Figure 1 is a side elevation of the projecting apparatus with certain parts removed. Figs. 2 and 3 are respectively front and rear views. Fig. 4 is a section on line 4—4 of Fig. 1. Figs. 5 and 6 are respectively an elevation and plan of a divided lens and its means of adjustment. Figs. 7, 8 and 9 are respectively a side elevation, plan and end view of an erecting prism. Fig. 10 is a perspective view of the erecting prism showing the path of a ray of light.

The film 1 is drawn vertically through the gate 2 in the usual manner.

An external cylindrical tube 3 is adapted to fit in the ordinary projector in place of the usual projection tube, and to it is connected an inner tube 4 in which can be inserted a slide 5 containing a lens 6 and colored filters 7 and 8. In the usual methods for the projection of two color films, each set of images is projected through a separate lens system and the accurate combination of the images on the screen is obtained by moving one or both of the tubes containing the lens systems either laterally or about fixed pivots. This adjustment is not easily effected and difficulty is experienced due to differences in the optical properties of the two lenses. These difficulties are obviated by the plan according to the invention of cutting the front glass of a standard projector lens in two across its center and placing the parts together with their curved edges adjacent, or with the flat

edge of one half adjacent to the curved edge of the other half. The curved edges may be flattened where the two parts of the lens are adjacent. In Fig. 4, the references 9 and 10 represent the two halves of a divided lens fitted in the tube 4 in front of the colored filter screens 7 and 8. The distance apart of the half lenses 9 and 10 is adjusted by a cam 11 operated by a lever 12; the half lens 9 is adjusted vertically by a cam 13 operated by a lever 14.

Springs 15, 16 and 17 serve to hold the parts of the lens in contact with the cams. These adjustments enable the two sets of colored images to be readily and accurately brought into registration on the screen.

In order to rotate the picture as seen on the screen through 90°, in the example shown, an erecting prism 18 (Figs. 2, 7, 8, 9 and 10) is mounted in a support 19 so that the plane of the base of the prism is inclined at an angle of 45° to the horizontal plane passing through the axis of the projector. Adjustments for slightly altering this inclination can be effected by means of slots 20 and 21 (Fig. 2) provided in an arc-shaped member 22 rotatable on the end of the tube 4.

In Fig. 2, the prism 18 is shown in dotted lines, the support 19 is hinged at 23 and can be secured in the required position by nuts 24 and 25 (Figs. 2, 7 and 8) which clamp links 26 and 27 pivoted to the arc-shaped member 22 to projecting arms 28 of the support 19.

As shown in Figs. 8 and 10, the rays of light coming from an object placed behind the prism suffer refraction at the rear and front surfaces of the prism and reflection at the base, so that the emergent beam is parallel to the incident beam, but the picture has been rotated through 90°, as illustrated by the letters A B in Fig. 10.

In the arrangement so far described, images would be projected through each half lens of each of the two complementary images on the film. Of these images the green color value of the film projected through the green filter and the red color value of the film projected through the red filter can be combined on the screen so as to give a picture in approximately true colors. The other images would be one below this picture, showing green only, and one above the true picture showing red only. These outside images are prevented from being formed in the arrangement described by means of a thin vertical partition 30, 31 of dead black material extending from the divided lens to the film, where it coincides with the central part of the film separating the corresponding images on either side. This partition restricts the light through the images on each half of the film to their respective half lenses and thereby cuts off the outside pictures formed in one color only which would otherwise be produced on the screen.

In the example shown, in order to allow for varying distances between the lens and the gate, the end 30 of the partition slides over the fixed part 31 and is pressed by springs 32, 33 against the gate. Also, in order that the partition may be accurately centered relatively to the film, the part 31 is pivoted at 34, so as to be adjusted laterally by a wedge shaped member 35 operated by a spindle 36 and engaging with a projection 37 of the partition, against the action of a spring 38.

The slide 5 containing the lens 6 and colored filters 7 and 8, is shown in the example as circular and held in position by light springs 39.

It is obvious that many changes may be made in the optical devices and in the mechanical arrangements without departing from the main features of the invention.

Having thus described the nature of the said invention and the best means I know of carrying the same into practical effect, I claim:—

A cinematographic projector, comprising a film of standard width in which there are pairs of images side by side with the horizontal lines of the objects parallel to the length of the film, a pair of focusing lenses in the projector, a gate in the projector through which the film passes vertically, a partition between the focusing lenses extending to the film, the said partition comprising a sliding portion and a pivoted portion which is laterally adjustable, and means by which the image of the film is optically rotated through 90°.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANK WORDSWORTH DONISTHORPE.

Witnesses:

WALTER J. SKERTEN,

J. PHILLIPS CRAWLEY.