100,082

PATENT SPECIFICATION

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Complete Accepted, Aug. 10, 1916.

COMPLETE SPECIFICATION.

Improvements in Light Splitting Devices for use in Colour Photography and for other purposes.

I, PERCY DOUGLAS BREWSTER, formerly of 65, Prospect Street, East Orange, New Jersey, but now of 50, Spring Street, Newark, New Jersey, United States of America, Film Manufacturer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in light splitting devices for use in color photography and other arts, of the kind in which part of the light passing through a lens is transmitted in one direction, while another part of the light is reflected in another direction. Heretofore such devices have been made by silvering a transparent plate or prism of glass in bands or stripes, or in other forms, and also by silvering such a plate or prism and then removing suitable areas of the silver coatings, thereby leaving transparent spaces through which incident rays can pass. In color photography in which two or more separate images are produced and, after staining or dyeing, are superposed one on the other, the several images must coincide or register exactly. For this purpose, a device such as mentioned above is markedly disadvantageous, since, being located behind the lens, it alters the focal length of the lens with respect to the transmitted rays, owing to the fact that these transmitted rays must pass through the glass, with the result that the images are not of the same size. Moreover, the transmitted image is distorted by passing through the glass at an angle and hence cannot later be superposed on the other with perfect registration. It has been customary to compensate for the distortion of the transmitted image by interposing a piece of glass of the same thickness in path of the reflected rays, thereby forming what is known as a "compound prism" and with a lens of small actual aperture, such prisms are small and hence not only comparatively inexpensive, but also cause but slight loss of light by absorption. With a lens of large actual aperture, however, for example a "fast" lens of long focal length such as is used for portraiture, the prism must be large. Such a prism is not only exceedingly costly to manufacture in view of the delicate nature of the work which must be executed upon it, but it also results in a loss of light owing to absorption of the light passing through the glass, which loss is practically prohibitive in some cases.

[*Price* 6*d*.]

The object of my invention is to provide a light splitting device which shall be extremely cheap as compared with the former devices and shall also avoid the disadvantages heretofore existing in devices of this character, and to this end, in accordance with my invention, I provide a light splitting device in which the transmitted light passes through apertures between the light reflecting portions of the device, so that no losses or distortion in the transmitted light takes place. Preferably, the light splitting device is made of a plate of metal or glass which is perforated or slotted to form apertures, the front face being silvered to constitute the light reflecting mirror. This device presents the advantage that the spaces between or among the reflecting portions being actually openings in the structure, the light does not pass through a medium which tends to absorb it, but remains in the same medium in which the rays are reflected, thereby avoiding any distortion in the size of the transmitted image as compared with the reflected image and avoiding the need for interposing glass in the path of the reflected rays to compensate for absorption.

Several embodiments of the invention are illustrated diagrammatically in the accompanying drawing, in which

Fig. 1 shows one form of my improved mirror or reflector in section, arranged behind the exposure lens. This figure also shows two sensitive plates or films in position for exposure, and suitable filters in front of the same to screen out undesired rays.

Fig. 2 is a front view of the mirror shown in Fig. 1.

Figs. 2*a* and 2*b* show other forms of the mirror.

Fig. 2*c* is a section on line *c*—*c* of Fig. 2*a*.

Fig. 3 is a diagrammatic view in section illustrating the use of the mirror in color cinematography.

In Fig. 1 the exposure lens is designated by 1, and has its second nodal or principal point in the plane indicated by the broken line 2. Usually the diaphragm (not shown) is at or near this plane, and is assumed to be so located in the present case. The divergent beam of light projected from the lens (rightwardly in the figure) is in the form of innumerable "pencils" each conical in form as indicated by the converging solid lines, with their bases at the lens and their apexes in the focal plane. Behind the lens is a mirror 3, so constructed and arranged that part of the light from the lens will be transmitted through the mirror to a sensitive plate 6 carried by a suitable holder 6*a* and another part reflected to another sensitive plate or film 8 carried by a holder 8*a* at an angle to the first-named; the angle depending upon the inclination of the mirror to the optical axis of the lens, or *vice versa*, as will be readily understood. For the purpose of thus splitting or dividing the light the mirror illustrated in the figure is provided with a plurality of reflecting ribs or bars 4 alternating with transmitting slots or slits 4*a*. To diminish the amount of light impinging on the walls of the transmitting slits or openings the walls of the latter are inclined more or less in correspondence with the inclination of the pencils or the rays proceeding from the lens, as indicated in Fig. 1, the inclination being produced in the present instance by tapering the reflecting ribs or bars 4 backwardly, that is, toward the focal plane 6; and to minimize reflection from such walls they are made "dead black" in any convenient way. The ribs and slots are shown horizontal in Figs. 1 and 2, merely for convenience of illustration, since, as will be readily understood, it is wholly immaterial whether they are horizontal, perpendicular or inclined. In other words the mirror can be turned to any position in its own plane. Nor is it essential that the ribs and slits be straight, as it is clear that they can be curved if desired; and the transmitting openings can be mere holes in the mirror such as the flared elliptical holes 4*a* in Fig. 2*a*, distributed over a suitable area and flaring backwardly. This type is shown in section in Fig. 2*c*.

The mirror can be made of metal or any other suitable material, but of course its front surface should be capable of taking a high polish. Preferably it is

made by die-casting, and its front surface coated with silver. This surface should approach a true plane sufficiently to prevent noticeable distortion of the reflected image, and the polished surface can be coated with a transparent varnish or other substance to protect the same from oxidation or other tarnishing.

In general, the greater the number of reflecting ribs and transmitting slots in a given space, the more evenly will the light be divided. If for any reason it is desirable to have more light reflected than is transmitted, or *vice versa*, the slots can be decreased or increased in area, as the case may be. For instance the ribs can be made 55 *per cent.* and the slots 45 *per cent.* of their combined area, in which case more light will be reflected toward a plate at 8 than will be transmitted toward a plate at 6.

An end view of another form of the mirror is shown in Fig. 2*b* in which the bars 4*b* are fastened in suitable frames (one of which is shown at 3*d*) having inclined front edges provided with spaced notches or recesses to receive the reflecting bars 4*b*, thus providing transmitting slots 4*c*. In any case I prefer to have the mirror as thin as possible, consistent with the necessary rigidity to prevent distortion in grinding or polishing its reflecting surface, and deformation by bending when in use.

To produce the desired "color separation" suitable filters may be interposed between the mirror and the two plates, as for example 5 and 7. Thus the filter 5 can be red, transmitting only rays below green of the spectrum and filter 7 can be green, transmitting only rays above yellow. If either plate is sensitized to only the rays that should affect it, its filter can be dispensed with. So, also, if each plate is sensitive to only its own color-group, as for instance one sensitive only to red, orange and yellow, and the other only to green and blue, both filters can be omitted.

In Fig. 3 I have shown my improved reflecting and transmitting mirror used in a camera for colour cinematography. Here the light from the lens 9, having a diaphragm 10, is in part transmitted by the openings in the mirror 11 and in part reflected by the front surfaces of the bars or ribs 12, the two parts being reflected by reflectors 14, 13 to two sensitive surfaces at the plane 16 through the film gate 17. These sensitive surfaces or emulsions may be on opposite sides of the said film, or on separate films run together through the same film gate. At 19 I have indicated by a dotted line the position which the focal plane of the transmitted rays would occupy if they were not intercepted by the reflector 14. Filters 15 and 18 may be used to screen out the undesired rays.

If either emulsion of a film coated on both sides is sensitive to too great a degree to the rays which should affect only the other, suitable precautions should be taken to prevent the impairment of color-separation that might otherwise result. For example, the appropriate emulsion, or both emulsions, can be made opaque, at least with respect to the rays which should not be passed. In the case of two films run together through the film gate, they may be separated by a strip of paper or other opaque material as in Fig. 4, in which 29 and 31 designate two films having sensitive coatings or emulsions 28, 32, which are separated by a strip of paper 30. It is clear that a camera of the type shown in Fig. 3 can be used for the same purpose as the one shown in Fig. 1, the two sensitive surfaces being parallel to each other instead of at an angle.

Focussing is of course most conveniently effected by moving the lenses 1 and 9.

I have described the invention as for use in color-photography but it can be used for other purposes. In fact the mirror can, in general, be employed wherever it is desired to reflect part and transmit another part of a beam of light.

I have not considered it necessary to illustrate a light-tight box or casing for the camera, Figs. 1 and 3, as the same can readily be supplied by any one skilled in the art.

It is to be understood that the invention is not limited to the constructions herein specifically illustrated and described, but can be embodied in other forms without departure from its spirit.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A device for splitting light projected by a lens having light-reflecting portions and light-transmitting apertures, for the purpose specified.

2. A device for splitting light projected by a lens comprising a plate of metal, glass or other material having a front reflecting face pierced with apertures, for the purpose specified.

3. A device for splitting light projected form a lens having light-transmitting apertures, the walls of which are so inclined to the reflecting surface of the device as not to interfere with the light pencils which it is desired to transmit therethrough when the device is arranged in the beam at an oblique angle to the axis thereof, for the purpose specified.

4. A device for splitting light projected by a lens having a reflecting surface made up of a plurality of separate bars held together, for the purpose specified.

5. A device for splitting light projected by a lens comprising a metallic plate having a reflecting surface pierced by a number of flared elliptical holes, for the purpose specified.

6. The improved light-splitting device constructed and arranged substantially as described and illustrated.

Dated this 2nd day of February, 1916.

For the Applicant:

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Chartered Patent Agents,
55/56, Chancery Lane, London, W.C.,

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1916.

SHEET 1.

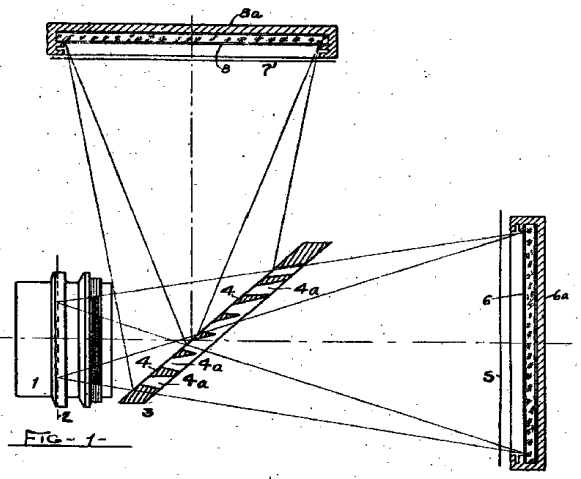

FIG. 1.

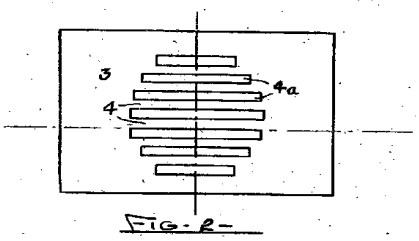

FIG. 2.

SHEET 2.

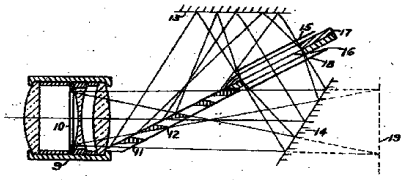

FIG. 3.

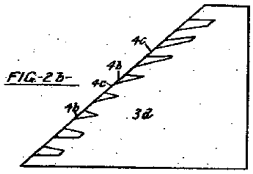

FIG. 2b.

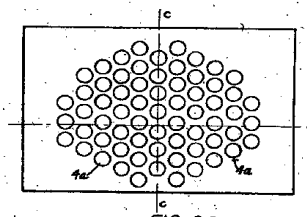

FIG. 2a.

FIG. 4.

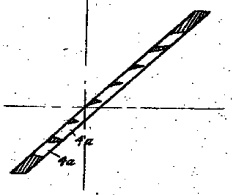

FIG. 2c.

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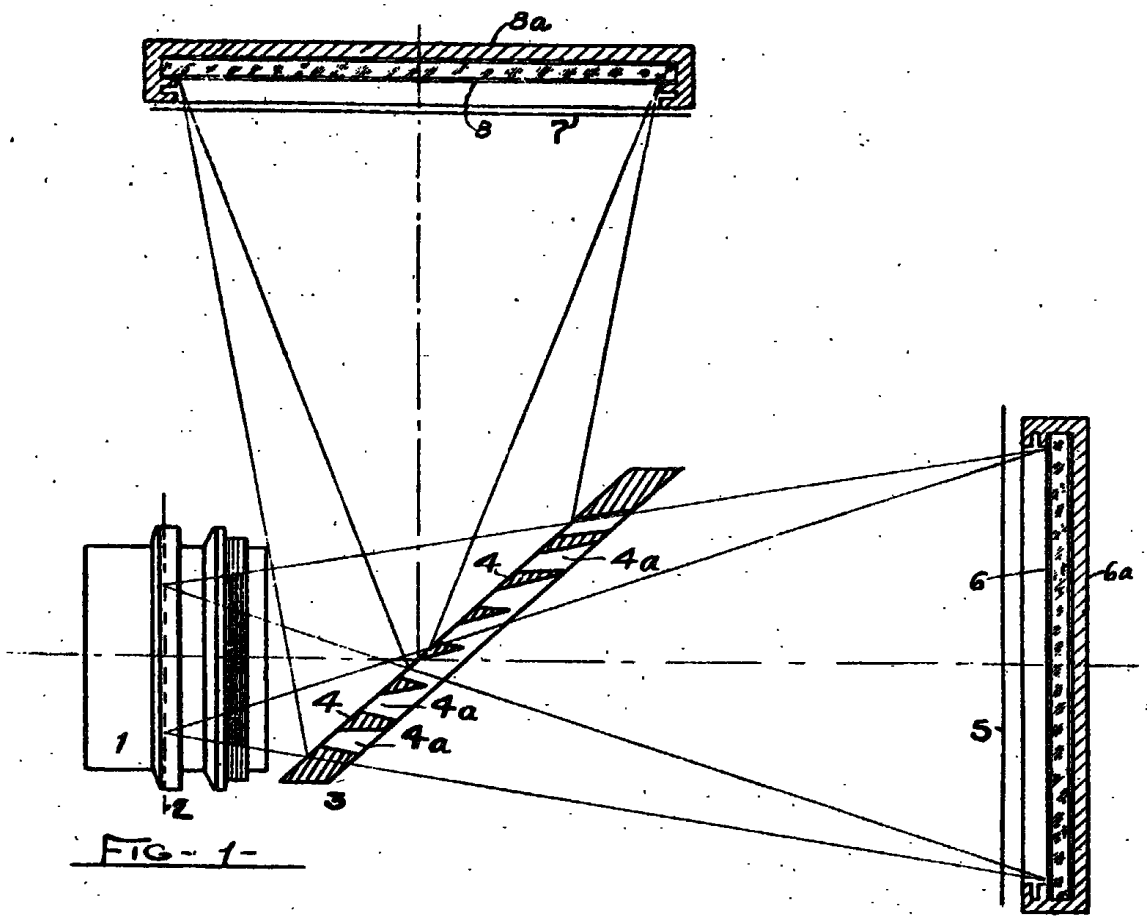

FIG. 1.

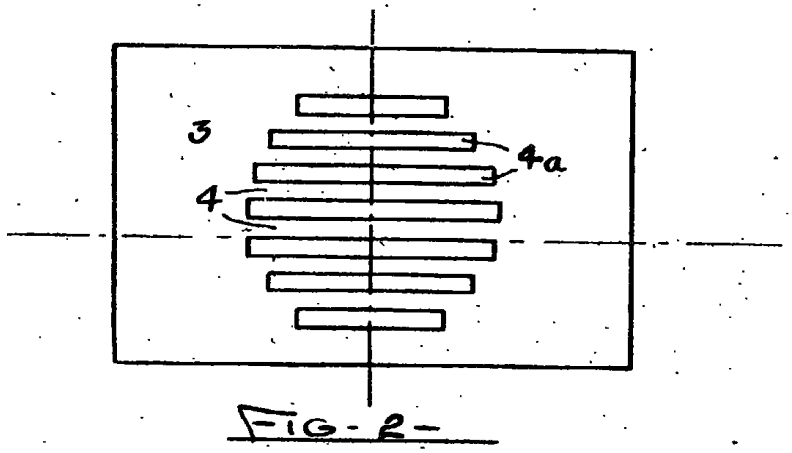

FIG. 2.

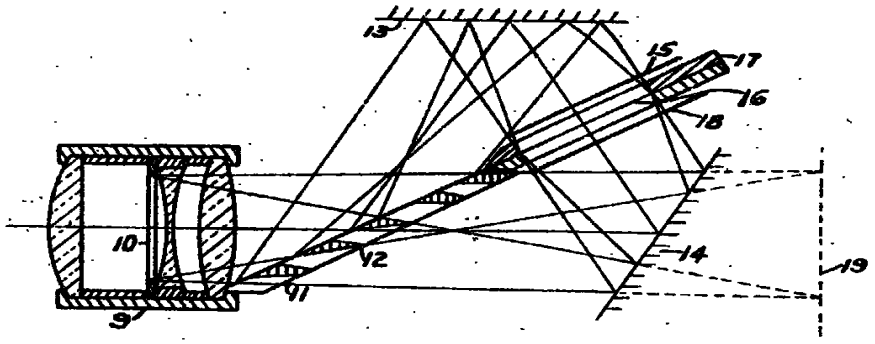

FIG.-3-

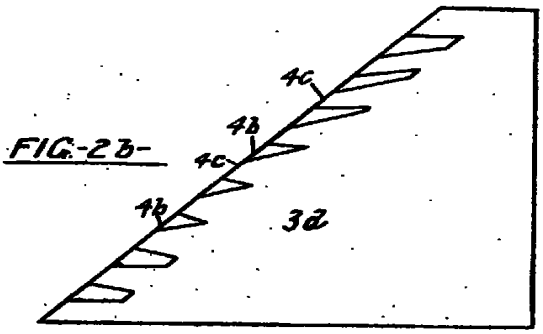

FIG.-2b-

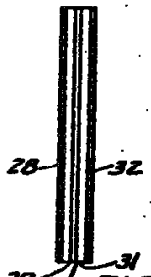

FIG.-4-

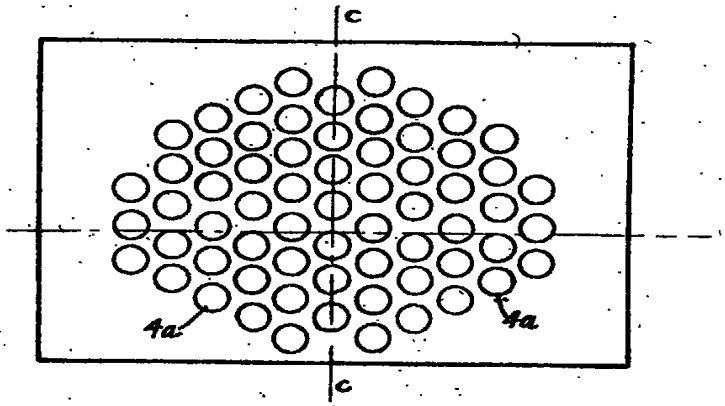

FIG.-2a-

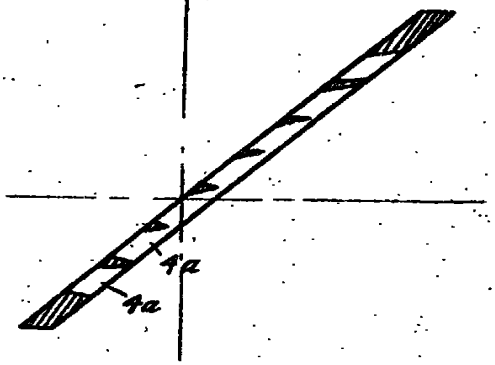

FIG.-2c-

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