SEARCH ROOM

P. D. BREWSTER.

LIGHT SPLITTING DEVICE FOR COLOR PHOTOGRAPHY.

APPLICATION FILED FEB. 16, 1915.

1,253,138.

Patented Jan. 8, 1918.

2 SHEETS—SHEET 1.

T2550

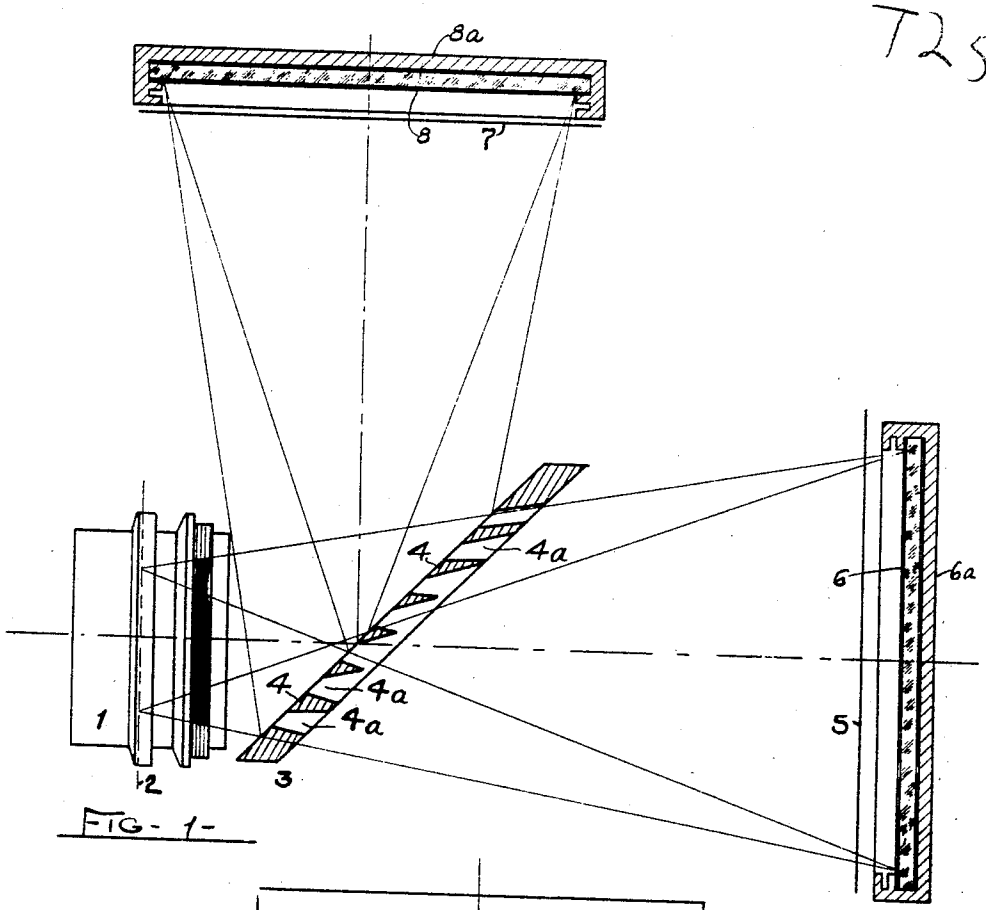


FIG. 1.

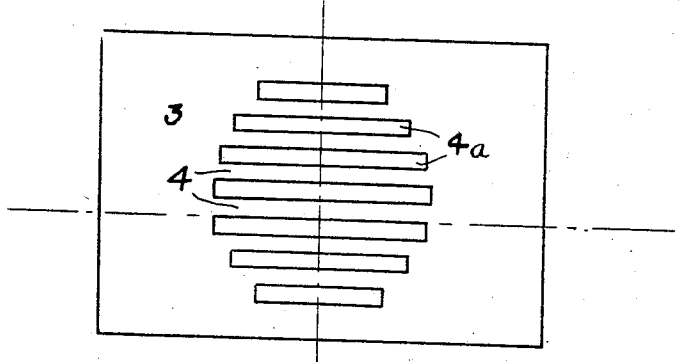


FIG. 2.

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2 SHEETS—SHEET 2.

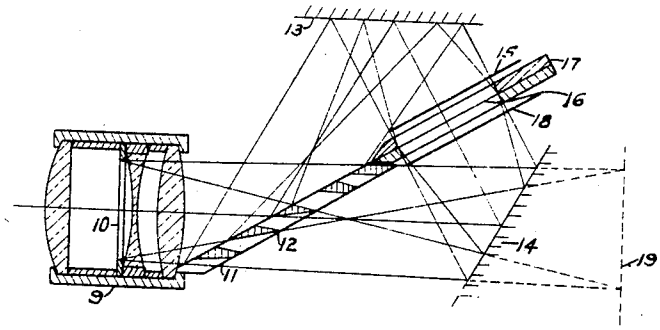


FIG.-3-

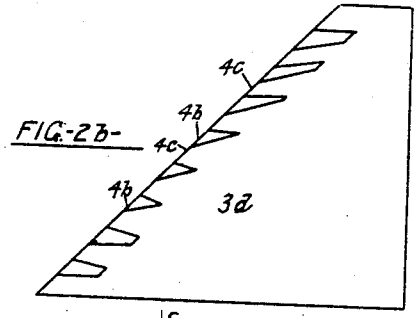


FIG.-2b-

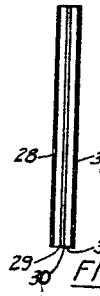


FIG.-4-

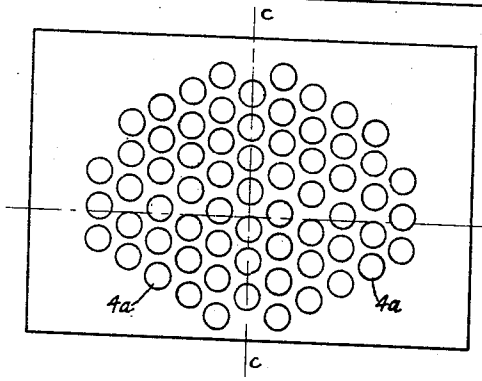


FIG-2a-

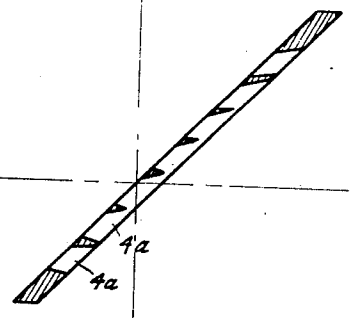


FIG.-2c-

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UNITED STATES PATENT OFFICE.

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LIGHT-SPLITTING DEVICE FOR COLOR PHOTOGRAPHY.

1,253,138. Specification of Letters Patent. Patented Jan. 8, 1918.

Application filed February 16, 1915. Serial No. 8,454.

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 certain new and useful Improvements in Light-Splitting Devices for Color Photography, of which the following is a full, clear, and exact description.

In the art of producing photographs "in natural colors" a method heretofore proposed is to superpose a plurality of single-color or monochome images of the object, for example one produced by the action of light-rays of the green group and one produced by the action of the rays of the red group. The two images can be produced in various ways, as for example "splitting" the light from the photographic lens so that part is projected upon one sensitive surface or plate and another part upon another surface or plate. Suitable "filters" being interposed in the path of one or the other or both parts, or each plate or film being sensitive only to rays of its appropriate group, the exposure is made and the plates or films developed and fixed. The resulting negatives can now be used to print positives, which are developed and fixed and then stained or colored in colors complementary to the color-groups of rays by which the respective negatives are produced, as for example one red and the other green. The staining or coloring of the positive images can be effected in any suitable way, as by the so-called Traube process or by bichromated gelatin methods. The colored or stained positives are then held in suitable register by any convenient means. Instead of producing positives by printing from the negatives the latter can be "reversed". The positives produced by such reversal can be used to print negatives, which can themselves be reversed to make additional positives, as will be readily understood.

My present invention relates to this art, particularly the method in which the light from the lens is split, and its chief object is to produce an inexpensive but effective device to divide or split the light in any camera suitable for the purpose. To this and other ends the invention consists in the novel features of construction and combinations of elements hereinafter described.

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

Figure 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.

Fig. 4 is an edgewise view showing two sensitive films arranged back to back, with a strip of opaque paper between the two.

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 in-

stance 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 as at 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 color 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, 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.

Focusing 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.

I am aware that it has been proposed heretofore to provide a light-reflecting and light-transmitting device by silvering a transparent plate of glass in bands, or stripes, or in other forms, and also by silvering such a plate and then removing suitable areas of the silver coating, 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 of the kind 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, with the result that the images are not of the same size. Moreover, the transmitted image is distorted and hence cannot later be superposed on the other with perfect registry. These effects upon the transmitted image constitute the chief reason why it is customary to use in practice a "compound prism" for splitting the light, so that the reflected rays and the transmitted rays will pass through the same thickness of glass. With lenses of small actual aperture such prisms are small and hence are not only comparatively inexpensive, but also cause but slight loss of light by absorption. With a lens of large actual aperture (for example a "fast" lens of long focal length, for portraiture) the prism must be large. This makes the prism exceedingly costly and causes a loss of light which is practically prohibitive in some cases. On the other hand, my improved light-splitting device has but a single surface that requires to be "figured" and polished to an accurate plane, and, if made of glass, does not require that the same be homogeneous and free from striæ. This makes it markedly inexpensive. Moreover, the transmitting spaces between or among the reflecting spaces are actual openings in the structure, so that the light does not pass through a different medium, but remains in the same medium as the rays which are reflected. Hence it has no effect at all upon the size or position of the transmitted image. It is, however, desirable that the device be placed close to the lens, as indicated in the drawings, for the reason that if the device is too far from the lens "banding" is liable to be produced in the images.

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.

I claim:

1. A device for transmitting a part and reflecting another part of the light projected by a lens, comprising a body having a polished front surface, and provided with a plurality of openings extending through it and having inclined walls.

2. A device for transmitting a part and reflecting another part of the light projected by a lens, comprising a body having a plurality of reflecting ribs or bars and transmitting apertures in alternation, the sides of the ribs or bars being inclined to their reflecting surfaces and constituting the walls of the said apertures.

3. A device of the kind described, provided with a light-reflecting surface and pierced with a plurality of light-transmitting apertures.

4. A device for reflecting a part and transmitting another part of a beam of light made up of divergent pencils, comprising a plate having a reflecting surface and having a plurality of light-transmitting apertures, the walls of the apertures being so inclined to the said reflecting surface as to be more or less parallel to the light pencils when the plate is arranged in the beam at an oblique angle to the axis thereof.

5. In a camera for color-photography, the combination with a lens, of a light-reflecting and transmitting device in rear of the lens, comprising a mirror arranged at an oblique angle to the axis of the lens and having a plurality of light-transmitting apertures the walls of which are inclined to the reflecting surface of the mirror in correspondence with the paths of the rays projected by the lens.

6. In a camera for color-photography, the combination with a lens for receiving and projecting rays of light from an object to be photographed; of a light-reflecting and transmitting device comprising a mirror arranged at an oblique angle to the rays projected by the lens and having a plurality of light-transmitting apertures the walls of which are inclined to the reflecting surface in correspondence with the paths of the said projected rays, and means for holding two sensitive surfaces in position for exposure to the reflected rays and the transmitted rays, respectively.

7. A light-reflecting and transmitting device for the purpose described, comprising a series of bars or ribs spaced apart to provide light-transmitting apertures or spaces between them, the front surfaces of the ribs or bars being highly polished and arranged in the same plane, and the sides of the ribs or bars being inclined toward each other backwardly from the polished surfaces.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

PERCY D. BREWSTER.

Witnesses:

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S. S. DUNHAM.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."