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PROVISIONAL SPECIFICATION.

**Improvements in and relating to Cameras for Colour
Photography.**

We, ALEXANDER EUGEN CONRADY, of 23, Flanchford Road, London, W., Optical Computer, and ARON HAMBURGER, of The Dover Street Studios, Limited, 38, Dover Street, Mayfair, London, W., Managing Director, do hereby declare the nature of this invention to be as follows:—

5 This invention relates to improvements in connection with colour photography cameras of the kind in which a reflector filter is inserted in the path of the rays from the lens.

The insertion of the reflector filter in such cameras leads to a distortion in the image produced by the transmitted rays. This distortion which is due to the
10 inclination of the filter to the axis of the cone of rays and the appreciable thickness of the glass is sufficient to affect the registration of the separate colour prints obtained from the different negatives.

It is the object of the present invention to provide means whereby the defect may be readily and completely removed. Again in cameras of this type as the
15 focus of the lens is increased it becomes necessary to diminish the tilt of the focussing screen, (the latter having been tilted to compensate for the bulk of the distortion already referred to), and according to this invention we provide for effecting this automatically as required.

Further objects of the invention are to provide for increasing the size of the
20 images obtained beyond the size normally obtainable with any particular filter and to provide for an improved distribution of the rays by reflection from and transmission through the reflector filter.

This invention consists in correcting for the distortion produced by reflector filters in cameras of the type described by distortion of the reflector filter as by
25 application of different pressures at various points around its edges.

This invention further consists in automatically effecting correction of inclination of the focussing screen with alteration in focus as by pivotally mounting the focussing screen and connecting it by links or the like with the focussing means.

30 This invention also consists in the improvements in and relating to cameras for colour photography hereinafter indicated.

In carrying this invention into effect in the preferred form, we provide means for applying spring pressure to the reflector at suitable points in order to bend the same and introduce distortions of the same sense and magnitude into the
35 reflected image as are inevitably present in the transmitted image.

Where the reflector in its natural, unstrained condition is perfectly flat the correction can be effected by supporting it from the side of the focussing screen in four points, a pair at its upper edge and a pair at its lower edge, and by application of spring pressure to the other edges and opposite side of the
40 reflector, but with an average reflector, pressure may be needed at almost any point and in either direction, and we accordingly preferably provide for each reflector a rigid frame of U section with a number of threaded holes all around

[Price 8d.]



Improvements in and relating to Cameras for Colour Photography.

and on both faces at distances say of 1 inch from each other, into which spring faced pressure screws may be inserted where required. Three rigid but adjustable supporting points with strong springs opposite to them are further provided in suitable widely separated positions, so as to fix the distance of the reflector from the faces of the frame, and by adjusting these three points reflectors of varying thickness may be so adjusted as to act correctly when their frames are placed against the same fixed supports in the cameras, thus providing for interchangeability of reflectors. 5

In order to provide for diminution of the tilt of the focussing screen when the focus of the lens is increased, we provide in the preferred form a long lever bearing with its long arm on an inclined guiding bar adjustably attached to the sliding part of the focussing adjustment, whilst the short arm of the lever acts on the tilting movement of the focussing screen. 10

As the difficulties of correcting for distortion increase rapidly with increase in size of the reflector filter, it is always desirable to keep the size of the reflector filter at a minimum, and we accordingly provide attachments with plate holding devices so that these may be applied in place of the normal plate holding devices, and by increasing the distance between the plate holder and the reflector to increase the size of the image without changing the size of the filter. As the effective length of the camera is thus lengthened, a diminution of tilt is required in the focussing frame of plate receiving the transmitted image; this we provide for by making the extension box for the transmitted image slightly wedge-shaped. If the extension boxes effect a large extension, an alteration of the bearing of the reflector also becomes necessary, which we effect by fitting the extension-box for the reflected image with projecting points acting on springs applied to suitable points of the reflector, in a similar manner to those provided in the reflector-frame. 15 20 25

Moreover, in order to equalise the distribution of reflected and transmitted light and to increase the proportion reflected, we find it preferable to employ a reflector filter which is sufficiently silvered to increase the proportion of reflected light without substantially diminishing the amount of transmitted light. 30

Dated this 13th day of December, 1912.

MARKS & CLERK,
57 & 58, Lincoln's Inn Fields, London, W.C., 35
13, Temple Street, Birmingham, and
25, Market Street, Manchester,
Agents.

COMPLETE SPECIFICATION.**Improvements in and relating to Cameras for Colour Photography.** 40

We, ALEXANDER EUGEN CONRADY, of 23, Flanchford Road, London, W., Optical Computer, and ARON HAMBURGER, of The Dover Street Studios, Limited, 38, Dover Street, Mayfair, London, W., Managing Director, 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:— 45

This invention relates to improvements in connection with colour photography cameras of the kind in which a reflector filter is inserted in the path of the rays from the lens.

The introduction of the glass reflector in these cameras causes a displacement of the rays passing through the reflector in the manner indicated in Figure 1, 50

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of the accompanying diagrams, which shows how those rays passing straight from the lens to the focussing screen, that is those transmitted by the reflector-filter are lowered by introduction of the reflector, this effect being greater at the top than at the bottom of the reflector: but the diagram also shows that by
 5 moving the focussing screen further away from the lens and by tilting it in the same sense as the reflector, the distortion resulting from this displacement of the rays can be compensated, and calculation shows that this compensation is more than sufficiently accurate in the vertical centre line of the plate; but when
 10 the calculation is extended to the remaining parts of the plate, it is found that these are affected by a secondary distortion, the sense of which is shown in Figure 1^a which indicates in front view the plate of Figure 1, and where CDEF represents the ideal image of a square object, while C¹D¹E¹F¹ shows greatly exaggerated the corresponding distorted image.

With the largest practicable field for this type of camera—namely, about 32°
 15 in the direction CD and 25° in the direction DE, calculation shows the distance apart of the vertical lines CF C¹F¹ to amount to about $\frac{1}{25}$ th of the thickness of the transparent reflector; whilst the curvature of the horizontal lines is such as to bring the point C¹ about $\frac{1}{60}$ th of the thickness of the reflector lower than the corresponding ideal point C. As a reflector-filter may often require to be
 20 a quarter of an inch in thickness the errors of registration between the images obtained by the transmitted and reflected rays respectively become very serious.

It is the object of the present invention to provide means whereby these disadvantages may be readily and completely removed. Again in cameras of this
 25 type as the focus of the lens is increased it becomes necessary to diminish the tilt of the focussing screen, (the latter having been tilted to compensate for the bulk of the distortion already referred to), and according to this invention we provide for effecting this automatically as required.

This invention consists in correcting for the distortion produced by reflector
 30 filters in cameras of the type described by appropriate distortion of the reflector filter as by application of different pressures at various points around its edges as hereinafter indicated.

This invention further consists in automatically effecting correction of inclination of the focussing screen with alteration in focus as by pivotally mounting the
 focussing screen and connecting it by links or the like with the focussing means.

35 We are aware that it has been proposed in a reflector filter camera to bend the reflector filter arch-like but as the result was stated to be the production of grotesque pictures the actual deformation was evidently so extremely large or of such an unsuitable character that the considerations applying to the correction for the defect already referred to in no sense applied.

40 In carrying the invention into effect in the preferred form we provide means for applying spring pressure to the reflector at suitable points in order to bend the same and introduce distortions of the same sense and magnitude into the reflected image as are inevitably present in the transmitted image.

Where the reflector in its natural, unstrained condition is perfectly flat the
 45 correction can be effected by supporting it from the side of the focussing screen in four points, a pair G, H, at its upper edge and a pair IJ at its lower edge, either the upper or lower pair of these supporting points being on a horizontal bar so as to equalise the pressure on them and ensure steadiness, while from the front spring pressure is applied to the other edges at points K, L, M, N.

50 It is desirable to use spring pressed supports as the actual travel required to effect correction is in most cases minute.

The theoretical form of a perfectly plane and optical uniform mirror when corrected is that of a portion of the surface of a cone of extremely large base diameter and height.

55 The difficulties of producing optically perfect reflectors especially when these have to be provided with deposited films on one or both sides, are, however, so great that it is found in practice that the residual distortion of the image is

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likely to be very much greater than the calculated amount, and is not infrequently actually in the reverse direction. The preferred way of correcting these residual distortions consists in bending the reflector by spring pressure applied in suitable points, in such a way as to introduce distortions of the same sense and magnitude into the reflected image as are inevitably present in the transmitted image. 5

With an average reflector, therefore, pressure may be needed at almost any point and in either direction, and we accordingly preferably provide for the reflector a rigid frame of U section O (Figures 3 and 3^a) with a number of screw threaded holes P all around and on both faces at distances say of 1 inch from each other, into which spring faced pressure screws may be inserted where required. Three rigid but adjustable supporting points with strong springs opposite to them are further provided in suitable widely separated positions, so as to fix the distance of the reflector from the faces of the frame, and by adjusting these three points reflectors of varying thickness may be so adjusted as to act correctly when their frames are placed against the same fixed supports in the cameras, thus provided for interchangeability of reflectors. The correction may be effected by adjusting the pressure at different points until the transmitted and reflected images are of the same size. 10 15

In order to provide for diminution of the tilt of the focussing screen when the focus of the lens is increased we provide in the preferred form a long lever bearing with its long arm on an inclined guiding bar adjustably attached to the sliding part of the focussing adjustment, whilst the short arm of the lever acts on the tilting movement of the focussing screen. This is indicated in Figure 4 in which the adjustable portion of the camera S has upon it an inclined surface T upon which bears a bell-crank lever U adapted to alter the inclination of the pivotally mounted screen V under the influence of the spring W. 20 25

As the difficulties of correcting for distortion increase rapidly with increase in size of the reflector filter, it is always desirable to keep the size of the reflector filter at a minimum, and we accordingly provide attachments with plate holding devices as have already been proposed in cameras of this class so that these may be applied in place of the normal plate holding devices, and by increasing the distance between the plate holder and the reflector to increase the size of the image without changing the size of the filter. As the effective length of the camera is thus lengthened, a diminution of tilt is required in the focussing frame of plate receiving the transmitted image; this we can provide for by suitably sloping the plate holder with relation to the plane of attachment to the camera. If the extension boxes effect a large extension, an alteration of the bending of the reflector also becomes necessary, which we effect by fitting the extension-box for the reflected image with projecting points acting on springs applied to suitable points of the reflector in a similar manner to those provided in the reflector-frame. 30 35 40

Moreover, in order to equalise the distribution of reflected and transmitted light and to increase the proportion reflected, we find it preferable to employ a reflector filter of the known kind which is sufficiently silvered or otherwise caused to have increased reflecting power to increase the proportion of reflected light so as to make the exposure value of the reflected rays more nearly equal to that of the transmitted rays. This distribution of rays may also be improved by inserting in the path of the rays a colour screen adapted to modify the proportion of the transmitted and reflected rays reaching their respective sensitive media. 45 50

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:— 55

1. A method of obtaining colour photographs by means of a camera with a

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reflector filter in which the reflector filter is subjected to slight but appropriate distortion as by the application of pressure at different points around its edge for the purpose hereinbefore described.

2. A camera constructed and adapted to operate in accordance with the method
5 of Claim 1.

3. A reflector filter for colour photography which is provided with means for applying to it pressure at different points near to or around its edge or with other means adapted to subject it to distortion, substantially as and for the purposes described.

10 4. A camera for the purpose hereinbefore referred to, having means adapted automatically to correct for the inclination of the focussing screen upon alteration of the focus for example, a pivotal mounting for the focussing screen connected by links or the like with the focussing means, substantially as described.

15 5. A colour photography camera constructed & adapted to operate substantially as hereinbefore described with reference to the accompanying diagrammatic drawings.

Dated this 26th day of March, 1913.

MARKS & CLERK,

57 & 58, Lincoln's Inn Fields, London, W.C.,
13, Temple Street, Birmingham, and
25, Market Street, Manchester,
Agents.

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[This Drawing is a reproduction of the Original on a reduced scale.]

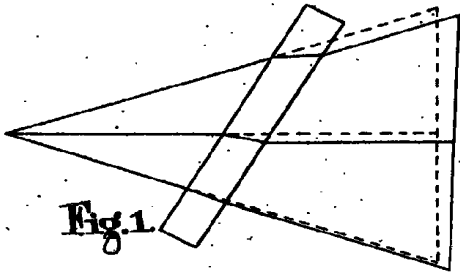


Fig. 1.

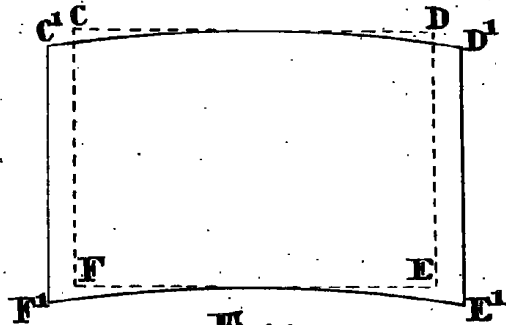


Fig. 1a.

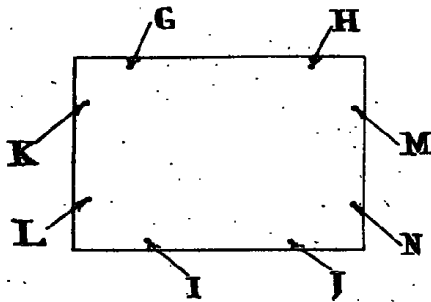


Fig. 2.

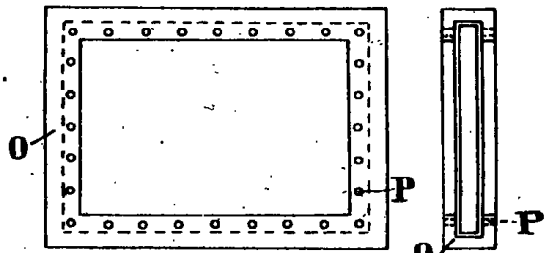


Fig. 3.

Fig. 3a.

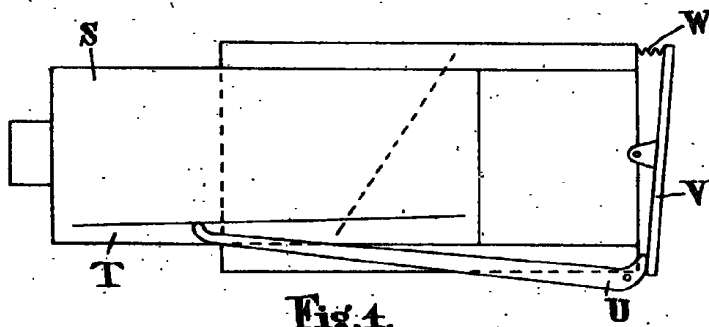


Fig. 4.