[Second Edition.]

PATENT SPECIFICATION

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Application Date (in United Kingdom): Aug. 13, 1928. No. 23,341 / 28.

Complete Specification Accepted: Aug. 1, 1929.

COMPLETE SPECIFICATION.

Improvements in or relating to Apparatus for use in Colour Photographic Processes.

We, KODAK LIMITED, a Company registered under the Laws of Great Britain, of Kodak House, Kingsway, London, W.C. 2 (assignees of MERRILL WILMER SEYMOUR, Citizen of the United States of America, of Kodak Park, Rochester, New York, United States of America), 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 apparatus for use in colour photographic processes, more particularly the process described in British patent specification No. 10,611 of 1909 and employing a photographic support carrying microscopic lens elements thereon and a polychromatic screen associated with the objective.

In order to obtain uniform illumination in such apparatus it is desirable for the images of the screen to fill the fields of the minute lens elements and consequently it is not always possible to use different stops or diaphragms having the usual circular apertures to compensate for different light conditions, since such stops cut down the screen area imaged by the minute lenses. If the lens elements are of the lineal or convex ridge type, and the screen consequently comprises several colour bands or strips side by side, the use of an iris type of diaphragm would be impracticable, since such a diaphragm would in closing not cover the different colour fields to the same extent and would therefore throw the colour ratio out of balance.

The object of the present invention is to provide means whereby this disadvantage may be obviated.

To this end according to the present invention the apparatus comprises a colour screen having distinct, differently coloured, light-transmitting areas or fields in the form of bands or strips arranged side by side and a light modifying device having a non-rectangular opening so shaped as to expose to light the full width of each band but to vary the amount of light falling on each band if desired independently in accordance with the requirements of the particular emulsion on which an exposure is to be made, by shielding the ends of one or more bands to the desired extent from the light.

The colour screen and the mask aperture may be of any shape which will produce the desired result, but in a preferred arrangement the screen is circular, while those parts of the edges of the mask aperture which determine the amount of light to which the various colour fields are to be exposed are in the form of a portion of a conic section. If desired the mask aperture may be adjustable and in some cases may be covered by a light filter of uniform or variable density.

The invention may be carried out in various ways and a number of arrangements according thereto are illustrated by way of example in the accompanying drawings, in which

Figure 1 is a diagram of part of a motion picture apparatus to which the invention may be applied,

Figure 2 is a view of one form of colour screen,

Figure 3 is a perspective view of one form of mask for use with the screen illustrated in Figure 2,

Figure 4 is an elevation showing the mask and screen together,

Figures 5, 6, 7, 8 and 9 are views of modified forms of mask for use with a colour screen,

Figure 10 illustrates a mask in which the aperture is covered by a filter of uniform density throughout.

Figures 11 and 12 show modified forms of the device illustrated in Figure 10, and

Figure 13 shows an adjustable form of the filter of Figure 10.

In the arrangement illustrated in Figure 1 parts of an apparatus for taking motion pictures are shown diagrammatically, and comprise a film gate 1 having a film-advancing mechanism 2 whereby the film 3 is fed downwards by means of the perforations 4. The film is provided with convex ridges 5 forming the minute lens elements necessary for the colour process with which the apparatus is used. An

[*Price* 1/-]

objective is mounted in a holder 6 having a carrier 7 for a polychromatic screen, and a semi-circular shutter 8 mounted on a shaft 9 is adapted to rotate in properly timed relation to the movement of the film-advancing mechanism.

One form of screen 10 suitable for use with the apparatus described above is illustrated in Figure 2 and comprises three colour fields R, G and B preferably of equal area with straight-bounding lines 11 between them. The cap 7 constitutes a frame serving to hold the screen in position so that the three colour fields or bands lie parallel to the ridges in the film.

In order to compensate for varying light conditions and for variations in the intensity of the colour sensitivity ratio of the emulsion it is necessary to use a mask or stop and in practice a series of masks may be provided to suit the varying conditions. In Figure 3 one such mask is illustrated in the form of a cap 12 having a flange 13 adapted to fit over the screen mount 7 and carrying an opaque mask 14 provided with an aperture 15. This aperture is in the form of an ellipse of which the major axis *a* is equal in length to the diameter of the screen 10 while the length of its minor axis *b* bears a predetermined ratio to the diameter of the screen. This ratio is such that if at any point *o* (Figure 4) on the major axis a perpendicular be drawn to cut the edge of the aperture at A and the edge of the screen at D, then the ratio of the length *o*A to the length *o*D remains constant whatever the position of the point *o* on the major axis. Under these conditions the proportion of the area of each colour field exposed through the aperture 15 to the total area of the field is the same for each of the three colour fields and the colour ratios are therefore unchanged. Further, since the distance *a* is always the full width of the screen and this is transverse of the lenticular ridges 5 and entire fields of these lenses will be filled and the images will be reproduced as colour bands, three for each ridge.

Since different emulsions vary in their colour sensitivity ratio it is desirable to provide masks which will allow less light to fall on cereain colour fields than on others and eramples of such masks are illustrated in Figures 5, 6 and 7.

In the construction of Figure 5 the mask aperture 16 is circular in form where it coincides with the blue and green fields so as to expose their entire area, but is elliptical in outline where it coincides with the red field so that part of this latter field is concealed. Similarly in Figure 6 the shape of the aperture 17 is such as to leave only the blue field fully exposed while in Figure 7 the blue and red fields are unobstructed, the green field being partially concealed by the projections 18 in the mask 19, these projections having straight edges 20.

If desired, the mask aperture may be so formed as to conceal to different extents all of the colour fields. For example, in Figure 8 is shown a mask giving the same colour ratio as that of Figure 6, but less exposure, and of which the aperture area bears the same ratio to that of the mask 14 (Figure 6) as the aperture area of the latter bears to the area of the circular screen.

In this construction the part of the aperture 21 coinciding with the colour fields R and G is in the form of an ellipse of one minor axis while the part coinciding with the field B is in the form of an ellipse of larger minor axis. The ratio between the minor axes of the ellipses is the same as the ratio between the minor axis of the elliptical aperture in Figure 6 and the diameter of the circular screen.

The elliptical form of mask aperture is preferred because its area can be more readily or accurately calculated than that of an aperture of irregular outline. In addition the ellipse preserves the same exposure distribution as that obtained with the circle. In this connection it should be observed that the upper and lower edges of the aperture in Figures 4, 5, 6 and 8 form portions of closed conic sections.

Nevertheless, apertures of any configuration may be used provided that they give the desired colour ratio and exposure. Examples are given in Figures 7 and 9, the aperture in the latter figure being indicated at 22.

If desired, the mask aperture may be covered by a light filter either of uniform density throughout or of varying density which may take any of the forms illustrated in the previous figures. Examples of masks provided with such filters are shown in Figures 10, 11 and 12. In the construction of Figure 10 the filter 41 obstructs the light to a uniform extent over each colour field while in Figure 11 the filter is of such a shape as entirely to conceal a portion of the colour field 42 so as to vary the colour ratio as well as reducing the amount of light reaching all the colour fields.

In the arrangement of Figure 12 the cap 43 carries a circular filter of the same diameter as the screen with which it is to be used and comprising three bands 44, 45 and 46 corresponding to the three colour fields of the screen. These bands differ in density and may also differ in

colour transmission so as to vary both the colour ratio and the exposure as required.

Figure 13 illustrates a camera box 47 from the front of which projects a lens mount 48 carrying a screen cap 7 and screen 10. Mounted above and below the objective are lugs 49 carrying rollers 50 over which passes a band 51 divided into a series of neutral light transmitting areas of different densities. Each roller 50 is provided with a handle 52 and by turning the handles the intensity of the light to which the screen is exposed may be varied at will.

It will be appreciated that in a given instance the mask or filter employed is selected in accordance with the predetermined requirements of the particular case in which it is used and that the invention is not restricted to the examples given.

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:—

1. In an optical system for use in a colour process of the kind described, the combination with a colour screen comprising distinct differently coloured light transmitting areas or fields in the form of bands or strips arranged side by side, of a light modifying device having a non-rectangular opening so shaped as to expose to light the full width of each band but to vary the amount of light falling on each band preferably independently, in accordance with the requirements of the particular emulsion on which an exposure is to be made, by shielding the ends of one or more bands to the desired extent from the light.

2. An optical system as claimed in Claim 1 in which the colour screen is circular while those parts of the edges of the mask aperture which determine the amount of light to which each area or field is to be exposed are in the form of a portion of a conic section.

3. An optical system as claimed in Claim 1 or Claim 2 in which the mask aperture is covered by a light filter preferably of uniform density throughout so as to obstruct the passage of light to a uniform extent over those parts of each colour field which are exposed.

4. An optical system as claimed in Claim 3 in which the light filter is in the form of a band wound on or passing over rollers in such a way that rotation of the rollers causes it to pass across the colour screen, this band being divided into a number of areas of different density.

5. The combination and arrangement of parts constituting the complete apparatus or light-obstructing device for use therewith as described and as illustrated in Figures 1, 2, 3 and 4, or in Figure 5, Figure 6, Figure 7, Figure 8 or Figure 9, or in Figure 10, Figure 11, Figure 12 or Figure 13.

Dated this 13th day of August, 1928.

KILBURN & STRODE,
Agents for the Applicants.

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2nd Edition

Fig. 1.

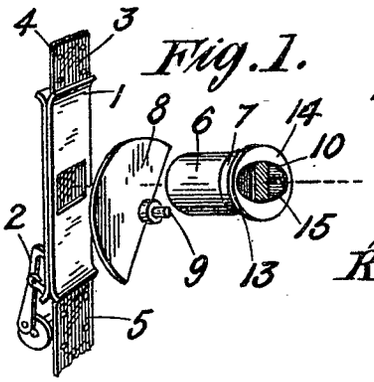


Fig. 2.

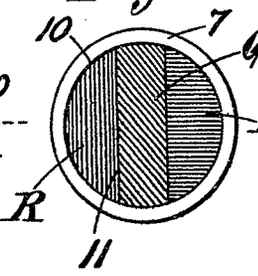


Fig. 3.

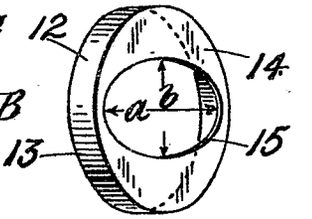


Fig. 4.

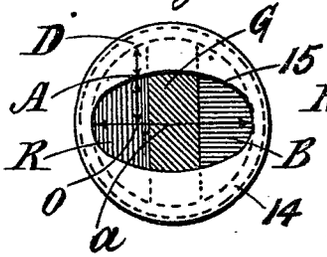


Fig. 5.

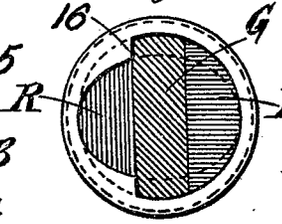
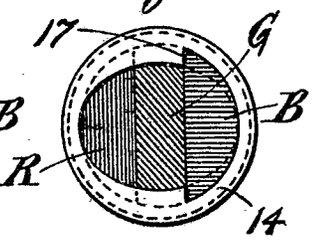


Fig. 6.



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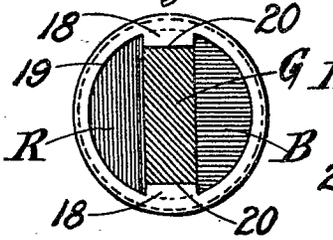


Fig. 8.

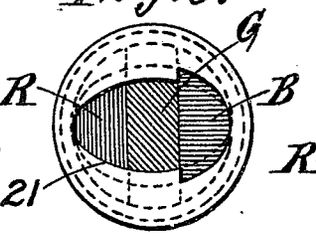


Fig. 9.

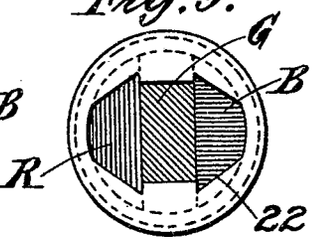


Fig. 11.

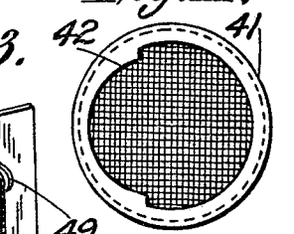


Fig. 13.

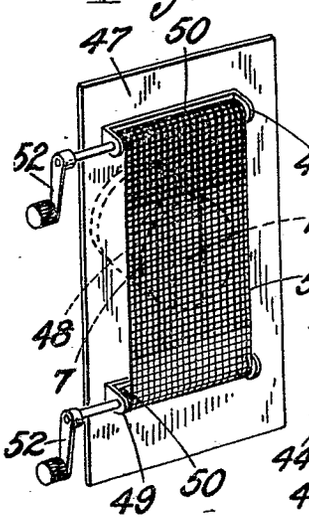


Fig. 10.

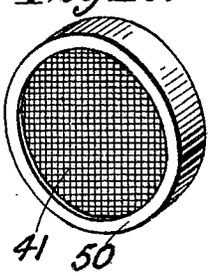
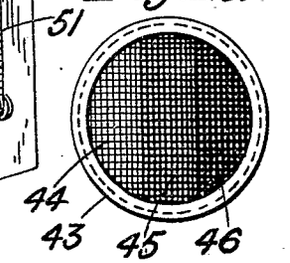


Fig. 12.



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