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Complete Specification Left, 22nd Nov., 1915—Accepted, 22nd May, 1916

PROVISIONAL SPECIFICATION.

Improvements in or relating to Colour Cinematography.

I, HAROLD WORKMAN, of 12, University Gardens, Kelvinside, Glasgow, Engineer, do hereby declare the nature of this invention to be as follows:—

This invention relates to projecting lanterns and more particularly to cinematograph projectors for projecting two or three colour picture records, produced from negatives taken through suitable colour filters and preferably simultaneously in groups of two or three at each exposure on one film, such pictures being projected simultaneously in groups of two or three through separate projection lenses and suitable colour filters, which may be stationary or moving or embodied in the film; and the invention has for its object the provision of new or improved means and appliances for more efficiently and satisfactorily illuminating the separate two or three gate apertures used in such apparatus, from one arc or other suitable single light source.

The object to be aimed at in such apparatus is that each gate aperture should be evenly illuminated with a condensed cone or pyramid of light rays (hereinafter for shortness included in the word cone) the axis of which passes through the centre of the gate aperture and the axis of the corresponding projecting lens; that the light should be so divided and distributed between the gate apertures that each gate aperture should receive any desired proportion of light and preferably a proportion corresponding to the colour of the projecting colour filter used for each gate, so that a satisfactorily balanced coloured picture may be produced on the screen without undue loss of light; and that the gates should be so illuminated in each case that a slight movement of the arc or other single light source does not unduly disturb the colour balance of the projected picture.

These requirements can be to a large extent fulfilled by the present invention, which broadly described consists in providing means for condensing a cone of light emanating from one arc or other single light source in two or three subsidiary cones and separately deflecting each such condensed subsidiary cone as may be necessary, in such a way that each such condensed subsidiary cone covers one suitably placed gate aperture and a reasonable margin all round it; and straightening prisms are provided close to each gate, preferably on the lantern side of them, which again bend the condensed rays so that the centre of each condensed subsidiary cone of rays passes through the centre of one gate aperture and the axis of the corresponding projecting lens.

These straightening prisms may if desired have a spherical curvature on one or both faces so that in addition to bending the cone of rays generally they may converge or diverge the rays passing through them, as may be desired.

In the case of two colour projection the two gate apertures so illuminated with their condensed deflected and straightened subsidiary cones of light rays may be placed close together or be separated to any reasonable desired extent and may be arranged one above the other either directly or at an angle with

[*Price 6d.*]

each other or side by side at the same or different levels. For three colour projection two of the three gates may be illuminated by separately deflected and straightened subsidiary cones of condensed light rays as explained, and these two gates may be separated to permit a direct condensed subsidiary cone of light rays to illuminate a third gate aperture situated directly between them; or the condensed subsidiary cone of light for the third gate may also be deflected and straightened, in cases where the third gate aperture is disposed otherwise than directly between the other two gates. By these means for three colour work, the gates may be arranged one above the other vertically or obliquely side by side at the same or different levels, and the gates may either be arranged close together or spaced out to any desired extent.

The deflecting prisms for deflecting the subsidiary condensed cones or portions of light are in all cases arranged or adapted to cause the subsidiary cones of light rays to cover their respective gate apertures and a small margin all round them so that a slight movement of the arc or other single light source in any direction produces a similar effect on the illumination of each gate aperture and does not unduly disturb the colour balance of the projected picture.

The prisms for deflecting and straightening the subsidiary condensed light cones may in some cases be formed with a cylindrical or approximately cylindrical curvature in one direction on one or both faces or in one direction on one face and another direction on the other face in such manner as to distribute the light over the gate areas as desired and direct on to the gates light rays from parts of the condenser area which would otherwise be ineffective, thus obtaining a higher illumination of the gates. For example by this means a more or less square shaped area at the gate may be illuminated from a long narrow area of the condenser face.

The means described may be employed for the purpose of producing a greater illumination of one gate than of another, or for the purpose of dividing and distributing the light available over the two or three gate apertures as the case may be in the desired proportions corresponding to the colour of the projection colour filters used at each gate, so that a satisfactorily balanced coloured picture may be produced on the screen without undue loss of light.

The subsidiary cones of rays for the different gates may be condensed by portions of condensers so cut and set that they condense and deflect the subsidiary cones of rays to the desired extent, but a moderately large double condenser of the ordinary type is preferably used in all cases, the necessary deflecting prisms being preferably placed close to and in front of it, *i.e.* between the condenser and the projector gates.

In applying this invention for example to a two colour projector in which the two gate apertures are arranged close together and one above the other an arrangement such as the following may be employed:—

Two portions of the area of a single condenser may be used to condense the two cones of light rays, two slightly deflecting glass prisms fitted close up to the condenser on the opposite side from the arc being used to cause the two subsidiary light cones to converge slightly, so that when they reach the two gate apertures placed close to each other in the gate of the projector they cover the gate apertures and a small margin all round them, overlapping to a small extent. Two straightening prisms, which may be attached to the hinged portion of the gate, again bend the cones of rays so that they pass normally through the gate apertures and axes of the two projection lenses.

I am aware that a similar arrangement has been suggested before, without the slightly deflecting prisms at the condenser, but unless these are fitted or provided, causing the two subsidiary light cones to cover their respective gate apertures with some margin all round them, a small movement of the arc in the line of the gate apertures disturbs the colour balance on the projecting screen to a marked degree rendering the system quite impractical for general use.

In the event of the gate apertures being arranged side by side and separated to a slight extent, so that ordinarily only the light from a long narrow area of the condenser face would fall upon these gates, a positive cylindrical or approximately cylindrical curvature may be given to one or both faces of the deflecting prisms at the condenser, and a corresponding negative cylindrical or approximately cylindrical curvature may be given to one or both faces of the straightening prisms at the two corresponding gate apertures, the effect of the positive curvature on the prisms at the condenser being to converge the light rays from portions of the condenser face lying outside the area which would otherwise illuminate the gate, so that much more of the effective condenser area available is utilised, and the effect of the negative curvature on the prisms at the gate enables such rays to focus again at or about the common focus.

By means such as just described it is possible to illuminate a long narrow strip at the gate from a more or less square shaped area of the condenser face, and conversely by adding a negative cylindrical or approximately cylindrical curvature to one or both faces of a prism at the condenser and a positive cylindrical or approximately cylindrical curvature to one or both faces of a prism at the gate, it is possible to illuminate a more or less square shaped area at the gate from a long narrow strip at the condenser face.

Further, these two effects may be combined by applying suitable separate cylindrical or approximately cylindrical curvatures to each face of a deflecting prism at the condenser face and to each face of a straightening prism at the gate to the desired extent, so that a strip more or less narrow in one direction at the gate may be illuminated by a strip more or less narrow in another direction at the condenser face.

Further as the angle of the deflecting prism determines the amount and direction of the displacement of the illuminated gate area from a centre line drawn through the axis of the condenser and the centre of the arc or other light source it is possible by the means described to illuminate two or three gate apertures arranged at any reasonable separation and relative angle to each other, and dividing up the area at the condenser face and causing the light rays emitted by each portion to illuminate the desired gate area and by curving one or both faces of the deflecting prisms as described to the necessary extent, it is possible to illuminate each gate with the desired percentage of light emitted from the condenser area used.

In the case of three colour projection the middle or intermediate image may be illuminated from a condenser area of a different shape to the gate, and in such case flat prisms with the desired cylindrical curvature on one or both faces may require to be placed both at or near the gate and at or near the condenser face. In the event of the intermediate gate not being placed directly between the other two, either at one level or at different levels, it may be desirable to deflect to some extent the subsidiary cone or portion of light used to illuminate the intermediate gate, and in that event a deflecting prism may be used at the condenser and a straightening prism at the gate, of the character already described. A dividing plate is preferably fitted between the gate apertures and the projection lenses in a two colour projector, to prevent the formation of secondary images, and in three colour projectors two such dividing plates are preferably fitted.

To illustrate the invention I will describe with reference to the accompanying diagrams some examples of its application.

Figs. 1 and 2 indicate in face view and sectional side elevation one form of apparatus for two colour projection in which the two gates are disposed one above the other, for the projection of two colour records in superimposition on the screen. The two colour filters are not shown in the figure.

c is a condenser and *g g* the two projection gate apertures. *d d* represent two deflecting prisms disposed in front of the condenser and each serving to deflect a subsidiary cone of the light rays from the condenser face, so that each

such cone covers one of the gate apertures g g and a reasonable margin all round it, the rays of the respective cones overlapping each other at the gate as shown. s s are straightening prisms placed near the gate apertures and serving to bend the deflected rays again so that the centre of each condensed subsidiary cone passes through the centre of the gate aperture and the axis of the corresponding projecting lens l l. p is a dividing plate disposed between the two lenses and the gate apertures as before mentioned.

In the form shown by Figs. 3 and 4 which are a face view and a sectional side elevation respectively, there are two gate apertures g g disposed side by side, at a slight separation. d^1 d^1 are two deflecting prisms placed in front of the condenser c to deflect the rays of the right and left hand portions of the light from the condenser so that these portions each cover one of the gate apertures and a margin all round it. Straightening prisms s^1 are placed close to each gate aperture g g to bend the deflected rays back so that the centre of each portion passes through the axis of the corresponding projection lens. The deflecting prisms d^1 d^1 are formed with a positive cylindrical curvature so as to converge and direct on to the desired areas at the gates light from the outlying upper and lower portions of the condenser, so that the light from an approximately square area A B C D of the condenser face (Fig. 3) is converged into the form of a long narrow area A^1 B^1 C^1 D^1 at the gate, thus obtaining a higher illumination of the gate apertures and effecting a gain of illumination represented for example by the hatched strips in Fig. 3. The straightening prisms s^1 are formed with a negative cylindrical curvature to enable the converged and deflected rays to focus again at or about the common focus.

Diagrams 5 and 6 are a face view and a sectional plan view of another arrangement having two projection gates disposed side by side and adapted to give more light to one gate than to the other, the deflecting prism d^2 at one side being cylindrically curved on both faces as shown in Fig. 6 and by the separate detail views Fig. 6^a which show these prisms in vertical section so as to illuminate a more or less wide shaped area at the gate and a reasonable margin round same from a narrower shaped area A^2 B^2 C^2 D^2 of the condenser face, and the other deflecting prism d^3 cylindrically curved on one face only serving to illuminate the corresponding gate aperture g^2 and a reasonable margin round same from the condenser area A^2 E F D^2. The straightening prisms bend back the cones of light rays so that the centres of these pass through the centres of the lenses l l, and at the same time by means of the cylindrical curvature given to both faces of prism s^2 and the single cylindrical curvature on s^3 bring the condensed rays more or less to a common focus. Fig. 6^b shows a detail vertical section through the prisms s^2 s^3.

Figs. 7 and 8 show diagrammatically arrangements of three colour gates which can be illuminated by means such as described from the different areas of condenser face shown. In these figures three gate areas A B C disposed side by side at the same level (Fig. 7) or at different levels (Fig. 8) are respectively illuminated from the areas A^1 B^1 C^1 of the condenser c by the employment of suitable deflecting prisms adapted to converge the rays of the respective horizontally narrow condenser face areas A^1 B^1 C^1 on to vertically narrow areas A B C at the gate, straightening prisms or divices being used in combination with the deflecting prisms for the purpose above mentioned. Similar results could of course be obtained by turning the entire system round 90° so that the gates were vertical instead of horizontal.

It is to be understood that in two colour projectors the gates may be arranged alongside each other at different levels.

Dated this 18th day of May, 1915.

MEWBURN, ELLIS & PRYOR,
70 & 72, Chancery Lane, London, W.C.,
Chartered Patent Agents.

COMPLETE SPECIFICATION.

Improvements in or relating to Colour Cinematography.

I, HAROLD WORKMAN, of 12, University Gardens, Kelvinside, Glasgow, Engineer, 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 projecting lanterns and more particularly to cinematograph projectors for projecting two or three colour picture records, produced from negatives taken through suitable colour filters and preferably simultaneously in groups of two or three at each exposure on one film, such pictures being projected simultaneously in groups of two or three through separate projection lenses and suitable colour filters, which may be stationary or moving or embodied in the film; and the invention has for its object the provision of new or improved means and appliances for more efficiently and satisfactorily illuminating the separate two or three gate apertures used in such apparatus, from one arc or other suitable single light source, the type of projector being essentially one in which each gate aperture has a corresponding projection lens.

The object to be aimed at in such apparatus is that each gate aperture should be evenly illuminated with a condensed cone or pyramid of light rays (hereinafter for shortness included in the word cone) which passes normally through the gate aperture and the centre of the corresponding projecting lens; that the light should be so divided and distributed between the gate apertures that each gate aperture should receive any desired proportion of light and preferably a proportion corresponding to the colour of the projecting colour filter used for each gate, so that a satisfactorily balanced coloured picture may be produced on the screen without undue loss of light; and that the gates should be so illuminated in each case that a slight movement of the arc or other single light source does not unduly disturb the colour balance of the projected picture.

These requirements can be to a large extent fulfilled by the present invention, which broadly described consists in providing means for condensing a cone of light emanating from one arc or other single light source in two or three subsidiary cones and separately deflecting each such condensed subsidiary cone as may be necessary, in such a way that each such condensed subsidiary cone covers one suitably placed gate aperture and a reasonable margin all round it; and in providing straightening prisms close to each gate, preferably on the lantern side of them, which again bend the condensed rays so that each condensed subsidiary cone of rays passes normally through one gate aperture and the centre of the corresponding projecting lens.

In other words the invention comprises a colour cinematograph projector having two or more gate apertures and corresponding projection lenses, in which, by a prismatic element provided in, at, or near to the condenser, a portion of the condensing light is deflected towards a gate aperture so as to illuminate that gate aperture and a margin round it, and in which, by a prism at the gate, the deflected beam is redirected to pass normally through the gate aperture and through the centre of the corresponding projection lens.

In the case of two colour projection the two gate apertures so illuminated with their condensed deflected and straightened subsidiary cones of light rays may be placed close together or be separated to any reasonable desired extent and may be arranged one above the other either directly or at an angle with

each other or side by side at the same or different levels. For three colour projection two of the three gates may be illuminated by separately deflected and straightened subsidiary cones of condensed light rays as explained, and these two gates may be separated to permit a direct condensed subsidiary cone of light rays to illuminate a third gate aperture situated directly between them; or the condensed subsidiary cone of light for the third gate may also be deflected and straightened, in cases where the third gate aperture is disposed otherwise than directly between the other two gates. By these means for three colour work, the gates may be arranged one above the other vertically or obliquely or side by side at the same or different levels, and the gates may either be arranged close together or spaced out to any desired extent.

The deflecting prisms for deflecting the subsidiary condensed cones or portions of light are in all cases arranged or adapted to cause the subsidiary cones of light rays to cover their respective gate apertures and a margin all round them so that a slight movement of the arc or other single light source in any direction produces a similar effect on the illumination of each gate aperture and does not unduly disturb the colour balance of the projected picture.

The prisms for deflecting and straightening the subsidiary condensed light cones may in some cases be formed with a cylindrical or approximately cylindrical curvature in one direction on one or both faces or in one direction on one face and another direction on the other face in such manner as to distribute the light over the gate areas as desired and direct on to the gates light rays from parts of the condenser area which would otherwise be ineffective, thus obtaining a higher illumination of the gates. For example by this means a more or less square shaped area at the gate may be illuminated from a more or less rectangular area of the condenser face.

The means described may be employed for the purpose of producing a greater illumination of one gate than of another, or for the purpose of dividing and distributing the light available over the two or three gate apertures as the case may be in the desired proportions corresponding to the colour of the projection colour filters used at each gate, so that a satisfactorily balanced coloured picture may be produced on the screen without undue loss of light.

The subsidiary cones of rays for the different gates may be condensed by portions of condensers so cut and set that they condense and deflect the subsidiary cones of rays to the desired extent, but a moderately large double condenser of the ordinary type is preferably used in all cases, the necessary deflecting prisms being preferably placed close to and in front of it, *i.e.* between the condenser and the projector gates.

In applying this invention for example to a two colour projector in which the two gate apertures are arranged close together and one above the other an arrangement such as the following may be employed:—

Two portions of the area of a single condenser are used to condense the two cones of light rays, two slightly deflecting glass prisms fitted close up to the condenser on the opposite side from the arc being used to cause the two subsidiary light cones to converge slightly, so that when they reach the two gate apertures placed close to each other in the gate of the projector they cover the gate apertures and a margin all round them, the illuminated areas overlapping to some extent. Two straightening prisms, which may be attached to the hinged portion of the gate, again bend the cones of rays so that they pass normally through the gate apertures and the centres of the two projection lenses.

I am aware that a similar arrangement has been suggested before, without the slightly deflecting prisms at the condenser, but unless these are fitted or provided, causing the two subsidiary light cones to cover their respective gate apertures with some margin all round them, a small movement of the arc in the line of the gate apertures disturbs the colour balance on the projecting

screen to a marked degree rendering the system quite impractical for general use.

In the event of the gate apertures being arranged side by side and separated to a slight extent, so that ordinarily only the light from the long narrow area of the condenser face would fall upon these gates, a positive cylindrical or approximately cylindrical curvature may be given to one or both faces of the deflecting prisms at the condenser, and a corresponding negative cylindrical or approximately cylindrical curvature may be given to one or both faces of the straightening prisms at the two corresponding gate apertures, the effect of the positive curvature on the prisms at the condenser being to converge the light rays from portions of the condenser face lying outside the area which would otherwise illuminate the gate, so that much more of the effective condenser area available is utilised, and the effect of the negative curvature on the prisms at the gate enables such rays to focus again at or about the common focus. A similar effect may be produced by using suitable prisms at the condenser with suitable negative cylindrical curvature upon them in the vertical direction and suitable positive curvatures on the prisms at the gate apertures.

By means such as just described it is possible to illuminate a comparatively long narrow strip at the gate from a more or less square shaped area of the condenser face, and conversely by adding a negative cylindrical or approximately cylindrical curvature to one or both faces of a prism at the condenser and a positive cylindrical or approximately cylindrical curvature to one or both faces of a prism at the gate, it is possible to illuminate a more or less square shaped area at the gate from a comparatively long narrow strip at the condenser face.

Further, these two effects may be combined by applying suitable separate cylindrical or approximately cylindrical curvatures to each face of a deflecting prism at the condenser face and to each face of a straightening prism at the gate to the desired extent, so that a strip more or less narrow in one direction at the gate may be illuminated by a strip more or less narrow in another direction at the condenser face.

In other words the invention also comprises a projector in which a cylindrically curved element is combined with the prismatic element in, at, or near the condenser to distort the condensing light passing through it so as to more effectively illuminate the gate aperture and a margin round it, and in which a cylindrically curved element is combined with the prismatic element at the gate to more or less correct the distortion introduced by the curved element at the condenser whilst preserving the functioning of the prismatic element at the gate.

Further as the angle of the deflecting prism determines the amount and direction of the displacement of the illuminated gate area from a centre line drawn through the axis of the condenser and the centre of the arc or other light source it is possible by the means described to illuminate two or three gate apertures arranged at any expedient separation and relative angle to each other, and by dividing up the area at the condenser face and causing the light rays emitted by each portion to illuminate the desired gate area and by curving one or both faces of the deflecting prisms as described to the necessary extent, it is possible to illuminate each gate with the desired percentage of light emitted from the condenser area used.

In the case of three colour projection the middle or intermediate image may be illuminated from a condenser area of a different shape to the gate, and in such case flat prisms, hereinafter included by the term prism, with the desired cylindrical curvature on one or both faces may require to be placed both at or near the gate and at or near the condenser face. In the event of the intermediate gate not being placed directly between the other two, either at one level or at different levels, it may be desirable to deflect to some extent the subsidiary cone or portion of light used to illuminate the intermediate gate, and in that event a deflecting prism may be used at the condenser and a

straightening prism at the gate, of the character already described. A dividing plate is preferably fitted between the gate apertures and the projection lenses in a two colour projector, to prevent the formation of secondary images, and in three colour projectors two such dividing plates are preferably fitted.

As illustrative of the invention I will describe with reference to the accompanying diagrams some examples of its application.

Figs. 1 and 2 indicate in face view and sectional side elevation one form of apparatus for two colour projection in which the two gates are disposed one above the other, for the projection of two colour records in superimposition on the screen. The two colour filters are not shown in the figure.

c is a condenser and g g the two projection gate apertures. d d represent two deflecting prisms disposed in front of the condenser and each serving to deflect a subsidiary cone of the light rays from the condenser face, so that each such cone covers one of the gate apertures g g and a margin round it, the areas of illumination of the respective cones overlapping each other at the gate as shewn. s s are straightening prisms placed near the gate apertures and serving to bend the deflected rays again so that each condensed subsidiary cone passes normally through the gate aperture and the centre of the corresponding projecting lens l l. p is a dividing plate disposed between the two lenses and the gate apertures as before mentioned.

In the form shown by Figs. 3 and 4 which are a face view and a sectional side elevation respectively, there are two gate apertures g g disposed side by side, at a slight separation. d^1 d^1 are two deflecting prisms placed in front of the condenser c to deflect the rays of the right and left hand portions of the light from the condenser so that these portions each cover one of the gate apertures and a margin round it. Straightening prisms s^1 are placed close to each gate aperture g g to bend the deflected rays back so that each portion passes normally through the gate aperture and the centre of the corresponding projection lens. The deflecting prisms d^1 d^1 are formed with a positive cylindrical curvature so as to converge and direct on to the desired areas at the gates light from the outlying upper and lower portions of the condenser, so that the light from an approximately square area A B C D of the condenser face (Fig. 3) is converged into the form of an equally long narrower area A^1 B^1 C^1 D^1 at the gate, thus obtaining a higher illumination of the gate apertures and effecting a gain of illumination represented for example by the hatched strips in Fig. 3. The straightening prisms s^1 are formed with a negative cylindrical curvature to enable the converged and deflected rays to focus again at or about the common focus.

Diagrams 5 and 6 are a face view and a sectional plan view of another arrangement having two projection gates disposed side by side and adapted to give more light to one gate than to the other, the deflecting prism d^2 at one side being cylindrically curved on both faces as shown in Fig. 6 and by the separate detail views Fig. 6^a which show these prisms in vertical section so as to illuminate a more or less rectangular area having its longer sides horizontal at the gate and a margin round same from a rectangular area A^2 B^2 C^2 D^2 of the condenser face, having its longer sides vertical, and the other deflecting prism d^3 cylindrically curved on one face only serving to illuminate the corresponding gate aperture g^2 and a margin round same from the condenser area A^2 E F D^2. The straightening prisms bend back the cones of light rays so that these pass normally through the gate apertures and the centres of the lenses l l, and at the same time by means of the cylindrical curvature given to both faces of prism s^2 and the single cylindrical curvature on s^3 bring the condensed rays more or less to a common focus. Fig. 6^b shows a detail vertical section through the prisms s^2 s^3.

Figs. 7 and 8 show diagrammatically arrangements of three colour gates which can be illuminated by means such as described from the different areas of condenser face shown. In these figures three gate areas A B C disposed side by side

at the same level (Fig. 7) or at different levels (Fig. 8) are respectively illuminated from the areas A^1 B^1 C^1 of the condenser c by the employment of suitable deflecting prisms adapted to converge the rays of the respective horizontally narrow condenser face areas A^1 B^1 C^1 on to vertically narrow areas A B C at the gate, straightening prisms or devices being used in combination with the deflecting prisms for the purpose above mentioned. Similar results may be obtained by turning the entire system round 90° so that the gates become vertical instead of horizontal.

It is to be understood that in two colour projectors the gates may be arranged alongside each other at different levels.

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 colour cinematograph projector having two or more gate apertures and corresponding projection lenses, in which, by a prismatic element provided in, at, or near to the condenser, a portion of the condensing light is deflected towards a gate-aperture so as to illuminate that gate-aperture and a margin round it, and in which, by a prism at the gate, the deflected beam is redirected to pass normally through the gate-aperture and through the centre of the corresponding projection lens.

2. A colour cinematograph projector as claimed in Claim 1 hereof in which a cylindrically curved element is combined with the prismatic element in, at, or near the condenser to distort the condensing light passing through it so as to more effectively illuminate the gate-aperture and a margin round it, and in which a cylindrically curved element is combined with the prismatic element at the gate to more or less correct the distortion introduced by the curved element at the condenser whilst preserving the functioning of the prismatic element at the gate.

3. A two colour cinematograph projector having both gates illuminated as defined in Claim 1 or Claim 2 hereof.

4. A three colour cinematograph projector having two of the three gates illuminated as defined in Claim 1 or Claim 2 hereof.

5. A three colour cinematograph projector having the three gates illuminated as defined in Claim 1 or Claim 2 hereof.

6. Apparatus as claimed in any of the preceding claims in which an ordinary condenser is used and any deflecting prism at the condenser is placed close thereto and on the gate-side thereof.

7. Apparatus as claimed in any of the preceding claims in which the condensing light is divided among the two or three gate apertures in desired unequal proportions.

8. The herein described improvements in illumination devices for optical projection apparatus substantially as set forth or figured for the purposes set forth.

Dated this 22nd day of November, 1915.

HYDE & HEIDE,
2, Broad Street Buildings, Liverpool Street, London, E.C.,
Patent Agents for the Applicant.

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

A.D. 1915. MAY 21. Nº 7659.
WORKMAN'S PROVISIONAL SPECIFICATION. (1 SHEET)

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

Fig.1.

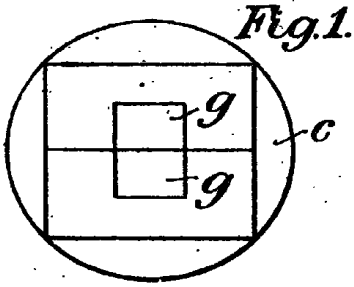


Fig.2.

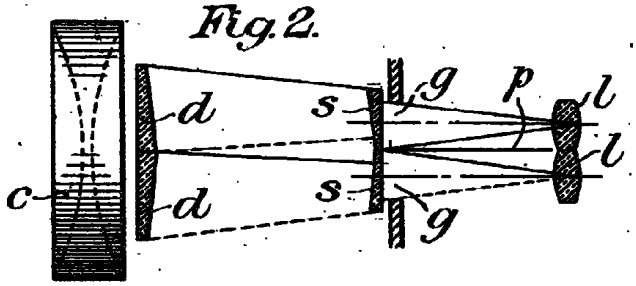


Fig.3.

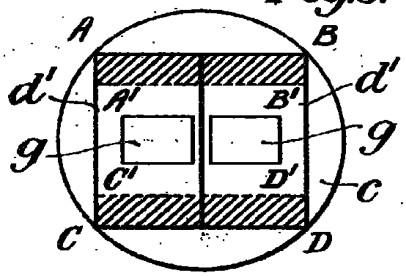


Fig.4.

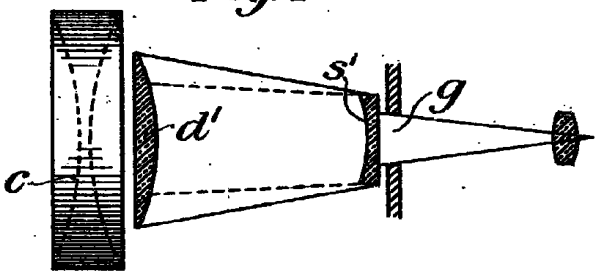


Fig.5.

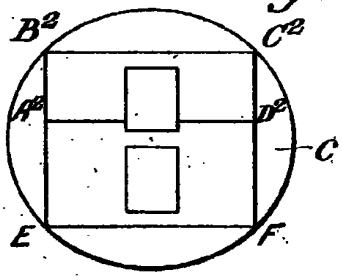


Fig.6.

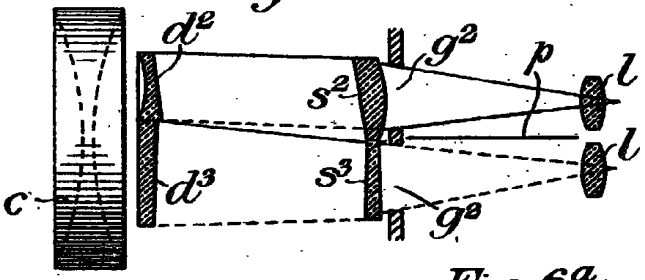


Fig.6ª

Fig.7.

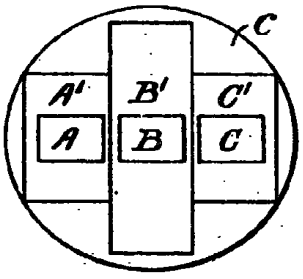


Fig.8.

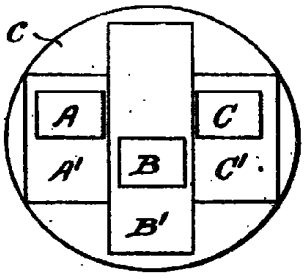
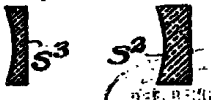


Fig.6ᵇ



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A.D. 1915. MAY 21. N° 7659
WORKMAN'S COMPLETE SPECIFICATION.

(1 SHEET)

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

Fig. 1.

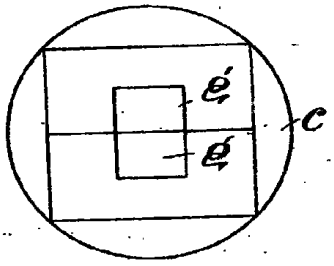


Fig. 2.

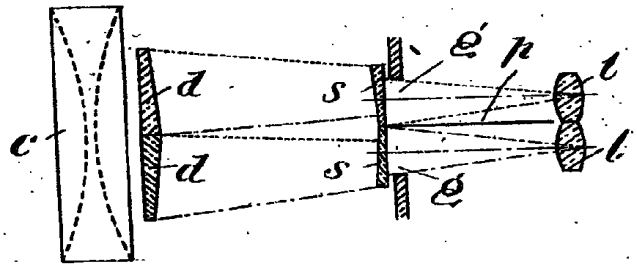


Fig. 3.

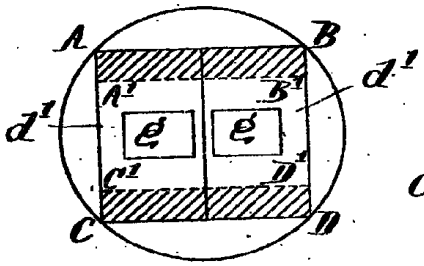


Fig. 4.

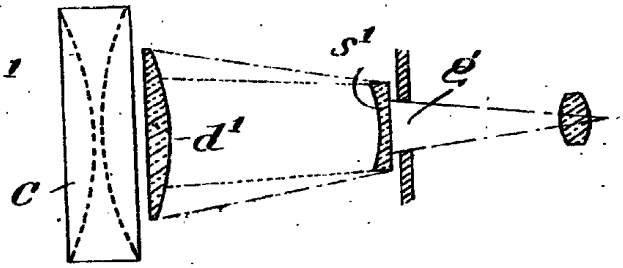


Fig. 5.

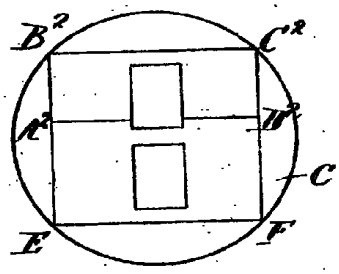


Fig. 6.

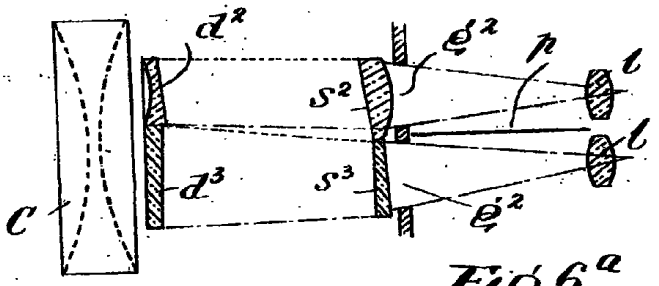


Fig. 6ª

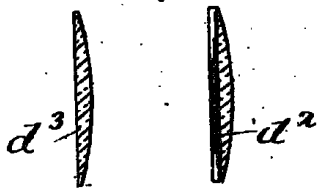


Fig. 7.

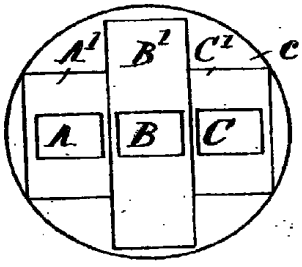


Fig. 8.

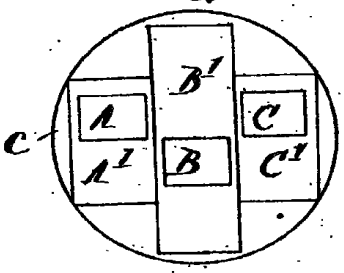
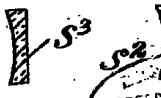


Fig. 6ᵇ.



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