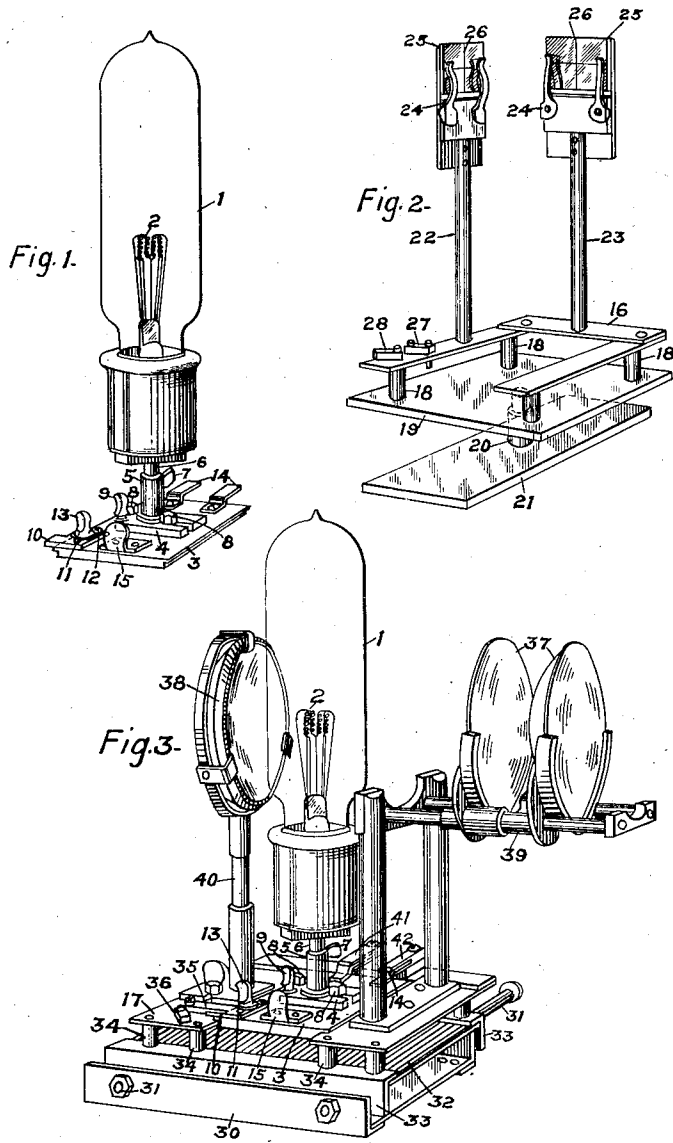


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OPTICAL APPARATUS AND METHOD OF OPERATING THE SAME.
APPLICATION FILED OCT. 23, 1919.

1,338,818.

Patented May 4, 1920.



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OPTICAL APPARATUS AND METHOD OF OPERATING THE SAME.

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Specification of Letters Patent.

Patented May 4, 1920.

Continuation of application Serial No. 98,824, filed May 20, 1916. This application filed October 23, 1919.
Serial No. 332,757.

To all whom it may concern:

Be it known that I, ARTHUR R. DENNINGTON, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Optical Apparatus and Methods of Operating the Same, of which the following is a specification.

This application is a continuation of my prior application Serial No. 98,824, filed May 20, 1916.

My invention relates to projection apparatus, and, in its broadest aspects, contemplates a method of and a means for the preadjustment of a light source with reference thereto and the ready renewal of the light source upon failure thereof.

In projection apparatus of the type used in the exhibition of motion pictures and stereopticon slides, it is essential that the source of light be accurately positioned with respect to the lens system. If an incandescent lamp, of the standard commercial type, constitutes the light source, it is necessary to provide a method and a means whereby the filament thereof may be brought within, and moved along, the optical axis of the lens system in order to bring the lamp into accurate focus.

It has been proposed heretofore to provide a special form of base and to so attach the same to the bulb of an incandescent lamp that the filament shall be located in a predetermined position with respect to the base. This construction involves an elaborate and commercially impractical scheme for attaching the lamp base to the bulb, and the lamp must be used in connection with a special form of socket which, in itself, is a limitation of the uses to which such a lamp may be put.

It is an object of my invention to provide means adapted to cooperate with an incandescent lamp having an ordinary base, such as the so-called Edison or screw-threaded base, that has been secured to the lamp bulb in accordance with approved manufacturing methods conducive to quantity production.

Another object of the invention is to provide means for conveniently and effectively

prefocusing what may be termed a standard commercial incandescent lamp, such as just described. This means embodies the additional feature of permitting a focused lamp to be removably associated, through the agency of a removable support, with an optical system so that it may be removed and reinserted into the lens system without destroying any previous adjustment the lamp may have received. This arrangement contemplates the renewal of a failed lamp by having a plurality of removable supports or bases, each adapted to permit the optical adjustment of a lamp carried thereby, and the maintenance of this adjustment when the base is disassociated or removed from the optical system.

A further object of the invention is the provision of two optical systems having certain corresponding elements and having their axes coincident, in the sense that the two systems are so related to each other that any optical adjustment of a lamp in either system will be effective in the other.

In the accompanying drawing, Figure 1 is a perspective view of an incandescent electric lamp mounted upon a support constructed in accordance with my present invention. Fig. 2 is a perspective view showing a device for obtaining a preliminary focusing adjustment of the lamp and support shown in Fig. 1, and Fig. 3 is a perspective view of a portion of a projection lantern showing the lamp and the holder of Fig. 1 in position thereon.

Projection apparatus of the kind to which my present invention relates has heretofore commonly involved the use of electric arcs as sources of light. Constant attention on the part of the operator has been necessary to maintain the luminous crater of the arc in the proper focal position in the optical system, and for this reason, among others, incandescent lamps are to be preferred to arcs, since the lamp filament, when once placed in the proper position, will remain fixed during the life of the lamp. It is the general purpose of my present invention to facilitate the initial adjustment and focusing of incandescent lamp filaments for this use. An exceedingly fine adjustment is required, since a very small displacement of

the light source from its proper focal position will correspondingly decrease the illumination upon the screen.

In carrying out my present invention, I provide a projection lantern having any desired system of condensing lenses and a mirror in front of which the light source is to be positioned. The light source, which may conveniently be a standard incandescent electric lamp having one or more concentrated helical filaments, is adjustably mounted upon a carrier that may be readily inserted or removed from the optical system. A universal adjustment for the lamp is provided, and such adjustment is preferably made independently of the projection apparatus by means of a focusing device which is adapted to receive the lamp support in a position corresponding to that which the support assumes in the projection lantern. By means of an optical indicating device to be more particularly described below, the position of the lamp filament with respect to the lamp support is accurately adjusted, so that, when it is desired to make use of the lamp which has been so adjusted, it is necessary merely to place the support in position in the lantern housing, when the lamp filament will be found to be in accurate focus. Several interchangeable lamp holders are preferably provided, and lamps may be focused thereon and kept in reserve until needed. When it is required to replace the lamp that is in use, such replacement may be quickly made by merely removing the lamp holder from the housing and substituting one of the holders carrying a focused lamp.

In accordance with this invention, there is provided a preliminary focusing apparatus suitable for use with, but independent of, a lens system such as used in the exhibition of motion pictures and stereopticon slides, said apparatus being substantially a duplicate of parts of the mechanism associated with said lens system. The principal features embodied in the focusing apparatus consist of placing a light source upon a portable base, whose image is to be projected upon a screen, projecting the image of the light source upon the screen, and then locating the image within a defined area or spot by means of an adjusting mechanism. Specifically, this apparatus may comprise what is, in fact, a master frame by which a source of light, such as an incandescent lamp, may be correctly adjusted before insertion into a projection apparatus. The master frame is adapted to receive a supporting base for a lamp, said base being provided with means which permits the adjustment of the lamp so as to bring its filament within, and movable along, an optical axis which is coincident with that of the projecting apparatus. The lamp-support-

ing base is so constructed that it may be removed from the master frame after the lamp has been adjusted and easily and quickly fitted into the projection apparatus, said lamp being conditioned to be in proper focus with respect to said apparatus.

For a more particular description of my invention, reference may now be had to Fig. 1 of the accompanying drawing, which shows an incandescent lamp 1 provided with the usual form of a screw-threaded base and having a concentrated helical filament 2 which, as shown, consists of four vertical sections arranged in a single plane and spaced apart by a distance substantially equal to the diameter of one of the sections. This type of lamp is well adapted for projection purposes but it is, of course, to be understood that my invention is not restricted to this specific kind of lamp. The lamp 1 is mounted upon a support consisting of a base member 3, a plate 4 which is transversely adjustable upon the base member 3, and a vertical sleeve 5 secured to the plate 4 and inclosing a pin 6 which is slidable within the sleeve 5 and may be secured in position therein by means of a thumb screw 7. The plate 4 is slotted at diagonally opposite corners for sliding engagement with bolts 8, and is secured in its adjusted position, with respect to the base member 3, by means of a thumb screw 9. Extending outwardly from one corner of the base member 3 is an L-shaped stop 10 which is provided with a slot 11 through which extend screws 12 and 13, the screw 13 being provided with a thumb-screw head by means of which the stop 10 may be fixed in adjustable position. The base member 3 also carries electric contact members 14 and a handle 15.

Two opposite edges of the base member 3 are rabbeted to fit slidably upon a three-sided frame 16 shown in Fig. 2, and also to fit a similar frame 17 which forms a part of the projecting apparatus shown in Fig. 3. The frame 16 shown in Fig. 2 is carried by pins 18 that are secured to a plate 19 which is centrally pivoted upon a pin 20 attached to a base member 21. On two adjacent sides of the frame 16 are secured rods 22 and 23 which carry, at their upper ends, clips 24 adapted to receive mirrors 25 which are preferably provided with cross lines 26 or other indicating markings. Two stops 27 and 28 are secured to the frame 16, the stop 27 being adapted to cooperate with the stop 10 of the lamp support shown in Fig. 1 and the stop 28 being adapted to be turned to engage the rear side of the stop 10 and hold it firmly in place. It is, of course, possible, though ordinarily not desirable, to dispense with the focusing device shown in Fig. 2 and to place the focusing mirrors directly upon the projection ap-

paratus, in which case the filament is adjusted in the exact position where it is to be used.

Fig. 3 shows the structure already described in connection with Fig. 1 in place upon a projection device which, in most respects, is of usual and ordinary construction. As shown, this projection device consists of a shallow box-like base 30 carrying two transverse rods 31 upon which is slidably mounted a supporting member 32 having depending sides 33 which are provided with perforations through which the rods 31 extend. This construction permits the base member 32 to be moved along the rods 31 from the position shown, as is usual when the same apparatus is to be used for projecting motion pictures and also for projecting stereopticon slides. The supporting member 32 carries a set of pins 34, upon which is mounted the frame 17 mentioned above as being adapted to receive the base member 3 of the lamp holder shown in Fig. 1. The frame 17 is provided with stops 35 and 36 which are similar in position and function to the stops 27 and 28 shown in Fig. 2. The frame 17 also carries an optical system consisting of lenses 37 and a spherically curved mirror 38 which are mounted upon adjustable supports 39 and 40.

Electric current is supplied to the lamp through contact members 41 and 42 secured to the rear end of the frame 17, as shown in Fig. 3, and cooperating with the contact members 14 attached to the plate 3 of the lamp holder. These contact members should be sufficiently long to allow for the various positions which the plate 3 may take in the frame 17, in accordance with the position of the stop 10.

In utilizing the apparatus which I have shown and described, a lamp is placed upon the lamp holder as shown in Fig. 1, and the lamp holder is slipped upon the frame 16 of the focusing device shown in Fig. 2. By proper manipulation of the thumb screws 7, 9 and 13, the operator adjusts the lamp filament to its proper position with reference to the cross lines on the mirrors 25. This adjustment may be effected by noting the location or position, by means of the eye, of the image upon the mirrors. The lamp is first turned until the plane of the filament sections is parallel to one of the mirrors, preferably the one carried by the support 22, and the vertical line on this mirror is preferably alined with one section of the filament. The vertical adjustment of the filament may be obtained by means of the pin 6 and thumb screw 7. By this adjustment it is possible to bring the center of the image substantially in alinement with the intersection of the cross lines on the mirrors. Since the junction of the cross lines on the mirror corresponds to the axis of the optical

system with which the lamp is to be used, this adjustment offsets the filament just sufficiently to allow the image of the filament from the spherical mirror to fill the spaces between the coil sections and thus produce a virtually unbroken area of uniform brilliancy facing the condenser lenses. After the lamp is adjusted with reference to one of the mirrors 25, the focusing frame is rotated upon its supporting pin and the filament is alined laterally by reference to the cross lines upon the other mirror 25, the lamp being slightly rotated, if necessary, in order to bring the plane of the filament into exact coincidence with the vertical cross line. This latter adjustment alines the filament edgewise with respect to the vertical line on the mirror carried by support 23. The reason for focusing the lamp with the plane of its filament parallel to the mirror 25 carried by support 22, is that, when the lamp holder is placed within the lens system shown in Fig. 3, the face of the filament is parallel with the face of the mirror 38, thus giving more light than if the filament was presented edgewise. The adjustments being completed, the thumb screws are all tightened to prevent relative movement between the lamp and the base plate 3, after which the lamp holder is removed from the focusing device and may either be placed at once in its operative position, as shown in Fig. 3, or may be preserved until needed. In obtaining the foregoing optical adjustments of the lamp it is obvious that in certain instances all may not be found necessary on account of the accidental proper location, in a given plane, of the light center, due either to the construction of the lamp or prior adjustment of the support therefor.

In the broadest sense, my invention consists in the preliminary adjustment of a light source such as an incandescent lamp with reference to an optical system, irrespective of any method or means. The most important feature in accomplishing this adjustment is through the agency of a lamp supporting base that may readily be dissociated or removed from the optical system. By this means the necessary optical adjustment of the lamp may be made by the trial method in the optical system of which the lamp is a part thereof, without resorting to any special form of focusing device, or by the use of focusing mirrors mounted upon the projection apparatus. But for the sake of convenience and uniformity of results obtained, it is preferable to use a standard or duplicate optical system in adjusting the lamp. However, whichever method is employed, the lamp may be removed and held in an adjusted position until needed.

The apparatus which I have shown and described does not require any material al-

teration of the ordinary apparatus with which projection lanterns are used. I prefer that the lantern housing be provided with a swinging door which may be held
 5 closed by a trigger catch under tension of a spring, an arrangement which facilitates the removal and replacement of burned-out lamps, though this particular construction is, of course, not essential.

10 It is to be understood that the structural details and method steps set forth herein may be modified in many respects without departing from the spirit and scope of my invention and that, therefore, no limitations
 15 are to be imposed upon my invention except such as are indicated in the appended claims.

By the term "standard commercial incandescent lamp," as used in the foregoing description and in certain of the claims, is
 20 meant a lamp having an ordinary base and which has become so standardized as to permit quantity production, which inherently involves manufacturing variations in
 25 the location of the light center. Because of these variations, it is impossible to use effectively such a lamp in an optical system without providing adjustable means for focusing the same. Special lamp bases and
 30 methods of attaching the same have been proposed heretofore, but by the present invention it is possible to use a lamp provided with a screw-threaded or other common form of base attached in the usual way, and
 35 this feature is intended to be expressed by the term in question.

Where two optical systems having their axes coincident are specified in the claims, I wish to be understood that this is not
 40 meant in a geometrical sense, but is intended to describe two optical systems so related to each other that any optical adjustments made to a lamp with reference to one system will be effective in the other.

45 What is claimed is:

1. In an optical system, the combination of a based electric incandescent lamp of the concentrated-filament type, said lamp having
 50 had its base secured to the bulb with the usual manufacturing accuracy, and means for prefocusing the based lamp with reference to the system, said means and lamp being adapted for removal and reinsertion in the system without disturbing any optical
 55 adjustment previously made.

2. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having
 60 had its base secured to the bulb with the usual manufacturing accuracy, and means for prefocusing the based lamp with reference to the system, said means including a supporting device comprising an adjustable base member carrying the lamp,
 65 said base member being removably asso-

ciated with the said supporting device, whereby any optical adjustment previously made by virtue of the said base member may be maintained effective independently
 70 of the system.

3. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having
 75 had its base secured to the bulb with the usual manufacturing accuracy, and means for prefocusing the based lamp with reference to the system, said means including a supporting device, and an independently adjustable base member carrying the lamp,
 80 said base member being removably associated with the supporting device, whereby any optical adjustments previously made by virtue of said base member may be maintained effective independently of the system.

4. In an optical system, the combination
 85 of a based electric incandescent lamp of the concentrated filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, and a base member for supporting and prefocusing the
 90 based lamp with respect to the system, said base member being adapted to maintain effective, independent of the system, any optical adjustment the lamp carried thereon may have received.
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5. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having
 100 had its base secured to the bulb with the usual manufacturing accuracy, a carrier for said based lamp comprising a supporting member, a base member carrying said lamp adjustably secured to the said supporting member, the base member being
 105 adapted to permit the removal and reinsertion of the lamp supported thereon without disturbing any optical adjustment previously made by virtue of said base member.

6. In an optical system, the combination
 110 of a based electric incandescent lamp, and means for carrying and preadjusting the same, said means being removably associated with the system and adapted to preserve any preadjustment given the lamp supported on and obtained by virtue of said
 115 means, whereby the lamp may be removed and reinserted in the optical system without disturbing any adjustment previously made.

7. In an optical system, the combination
 120 of a based incandescent lamp, and means for carrying and preadjusting the based lamp with reference to the system, said means including separable and independently adjustable parts, whereby an adjusted
 125 lamp may be removably associated with the projection system and remain conditioned to effectively cooperate therewith.

8. In an optical system, the combination of a based electric incandescent lamp, means
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for carrying and prefocusing the based lamp with reference to the system, said means comprising a removable focusing mechanism, said mechanism including a plurality of parts each capable of adjustment in a different plane and, if removed, adapted to maintain any previous adjustment given the lamp carried thereon and made by virtue thereof.

9. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, a mechanism for prefocusing the based lamp with reference to the system, the said mechanism being provided with a removable base member carrying said lamp, said base member being comprised of a plurality of separate parts, one of said parts being adjustable in a vertical plane, another in a horizontal plane, and a third in a profile plane, whereby the lamp carried by the base member may be maintained optically adjusted independent of the system.

10. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, a mechanism for prefocusing the based lamp with reference to the system, the said mechanism being provided with a removable base member carrying said lamp, said base member including a plurality of separate parts each being independently adjustable with respect to one another, whereby the lamp carried by the base member may be maintained optically adjusted independently of the system.

11. In an optical system, the combination of a based electric incandescent lamp of the concentrated filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, a mechanism for prefocusing the based lamp with reference to the system, the said mechanism being provided with a removable base member carrying said lamp, said base member being comprised of a plurality of parts, each being capable of adjustment and adapted to cooperate with one another, so as to permit the bringing of the light center of the lamp within and move it along the optical axis, whereby the lamp carried by said base member may be maintained optically adjusted independently of the system.

12. In an optical system, the combination of a based incandescent lamp of the concentrated filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, and supporting means for optically positioning the based lamp, said means including a lamp carrying base member, said base member being re-

movably associated with the supporting means and adapted to maintain effective any optical adjustment given the lamp carried thereby, whereby the lamp may be removed and reinserted at convenience without disturbing any optical adjustment previously made.

13. In an optical system, the combination of a based electric incandescent lamp of the concentrated-filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, and means for carrying and adjusting the said based lamp with respect to the system, said means being adapted to maintain effective any optical adjustment which may be given the lamp carried thereby regardless of whether the lamp is retained in, or removed from, the optical system.

14. In an optical system, the combination of a based electric incandescent lamp of the concentrated-filament type, said lamp having had its base secured to the bulb with the usual manufacturing accuracy, and means for adjusting the based lamp with respect to the system, said means including a removable lamp carrying base member adapted to maintain effective any optical adjustment given the lamp carried thereon, whereby the lamp may be removed and reinserted into the optical system without disturbing any previous adjustments it may have received.

15. In an optical system, the combination of an incandescent electric lamp, a removable support therefor comprising a base member, a carrier for the light source mounted upon the said base member, means for adjusting the said carrier in two directions with respect to the said base member, and means for determining the movement of the said base member in a third direction.

16. A support for an incandescent electric lamp or other source of light comprising a base member, a supporting member adjustably secured to the said base member, a carrier for the light source adjustably mounted upon the said supporting member, and an adjustable stop attached to, and extending beyond, the said base member.

17. A support for an incandescent electric lamp or other source of light comprising a base member, a supporting member secured to the said base member and adapted to be slidably adjusted thereon, a carrier for the light source mounted upon the said supporting member and adjustable perpendicularly with respect to the said base member, and an adjustable stop attached to and extending beyond the said base member.

18. A support for an incandescent electric lamp or other source of light comprising a base member, a supporting member secured to the said base member and adapted to be slidably adjusted thereon, a carrier

for the light source mounted upon the said supporting member and adjustable perpendicularly with respect to the said base member, and an adjustable stop for limiting the movement of the said base member in a direction perpendicular to the directions of adjustment of the said supporting member and the said light carrier.

19. An optical device comprising a frame for supporting an optical system of lenses, mirrors or the like, in combination with means for supporting a light source in effective relation to the said optical system comprising a base plate slidably mounted upon the said frame, a stationary stop upon the said frame, and a cooperating adjustable stop upon the said base plate for limiting the sliding movement of the said base plate, and a carrier for a light source mounted upon the said base plate, means for adjusting the said light carrier in two directions perpendicular to the direction of sliding movement of the said base member.

20. An optical device comprising a frame for supporting an optical system of lenses, mirrors or the like, in combination with means for supporting a light source in effective relation to the said optical system comprising a base plate slidably mounted upon the said frame, a stationary stop upon the said frame and a cooperating adjustable stop upon said base plate for limiting the sliding movement of the said plate, a carrier for a light source mounted upon the said base plate, means for adjusting the said light support in two directions perpendicular to the direction of sliding movement of the said base member, electric contact members fixed to the said frame, and contact members carried by the said base plate and adapted to engage the said first-named contact members.

21. The method of preliminarily adjusting an incandescent lamp with respect to an optical system, that consists in using two optical systems having their axes coincident and certain elements duplicate, adjusting the lamp in one of these systems and using it in the other, this adjustment being accomplished by mechanism which is adjustable in one of the optical systems and

adapted to be received in the other without further adjustment.

22. The method of preliminarily adjusting an incandescent lamp with respect to an optical system, that consists in using two optical systems having their axes coincident and certain elements duplicate, adjusting the lamp in one of these systems and using it in the other, this adjustment being accomplished by mechanism which is adjustable in one of the optical systems and adapted to be received in the other without further adjustment, said mechanism including a removable member for supporting the lamp.

23. The method or preliminarily adjusting an incandescent lamp with respect to an optical system, that consists in using two optical systems having their axes coincident and certain elements duplicate, adjusting the lamp in one of these systems and using it in the other, this adjustment being accomplished by mechanism which is adjustable in one of the optical systems and adapted to be received in the other without further adjustment, said mechanism including means which permit the adjustment of the lamp in each of three planes.

24. The method of expediting the replacement, in a projection system, of a failed incandescent lamp of the concentrated-filament type having a base secured to the bulb with the usual manufacturing accuracy, which consists in prefocusing another lamp similar thereto upon a mechanism adapted to be incorporated into the optical system without requiring further adjustment of the lamp.

25. The method of expediting the replacement, in a projection system, of a failed incandescent lamp having a base secured to the bulb with the usual manufacturing accuracy, which consists in preadjusting another lamp similar thereto upon a removable base adapted to be incorporated into the optical system with the lamp carried thereon in its preadjusted condition.

In testimony whereof, I have hereunto subscribed my name this twenty-first day of October, 1919.

ARTHUR R. DENNINGTON.