Oct. 18, 1949. W. GRIFFIN 2,485,377

PROJECTION LAMP AND MOUNTING THEREFOR

Filed May 21, 1946

Fig. 2.

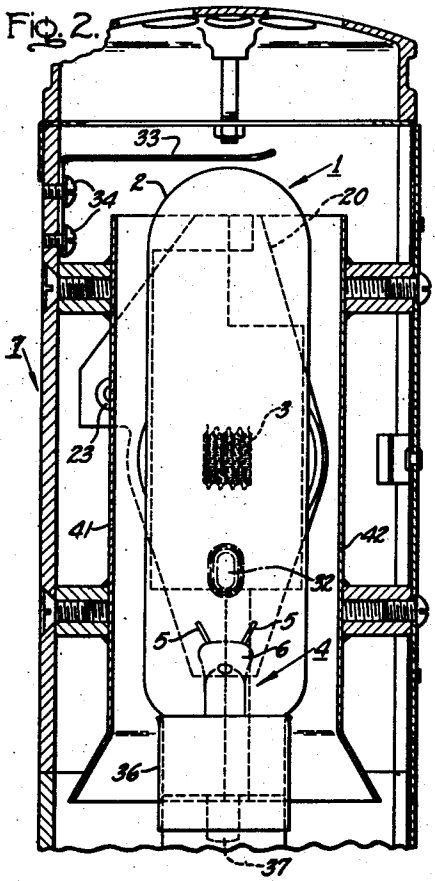


Fig. 1.

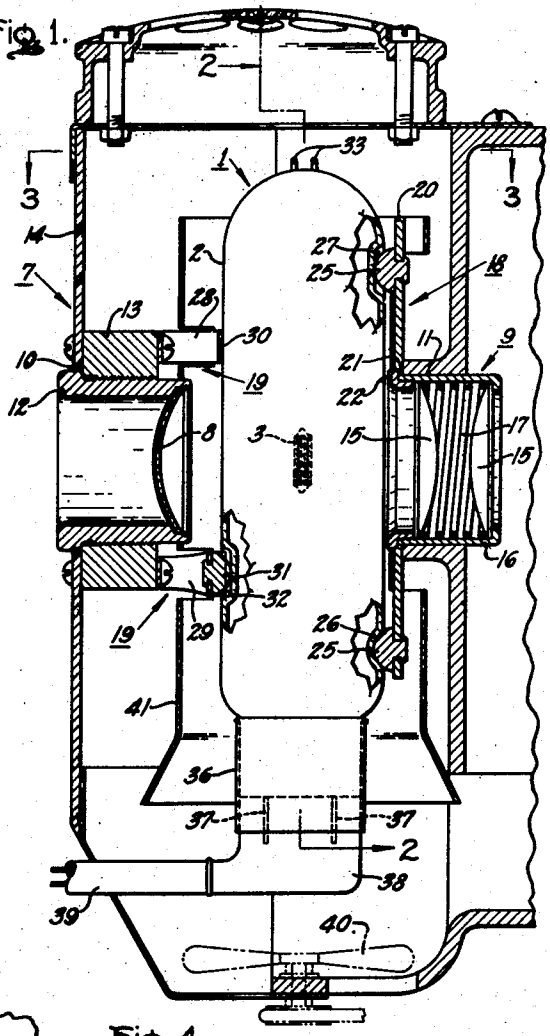


Fig. 3.

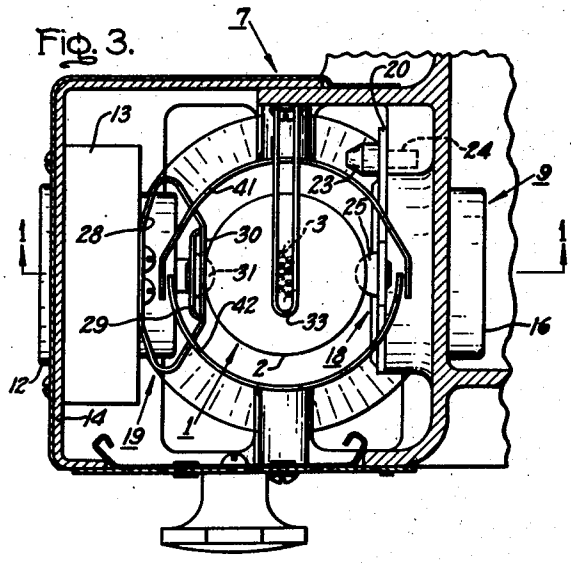
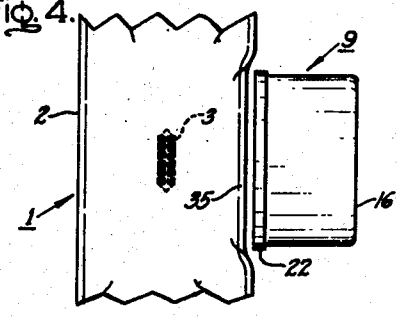


Fig. 4.



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PROJECTION LAMP AND MOUNTING THEREFOR

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7 Claims. (Cl. 240—41.3)

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This invention relates to light projection apparatus useful especially for picture projection, and is concerned with electric lamps for this purpose, and with their relation to light directing means of the projection apparatus.

Lamps commonly used for motion picture projection consist of a concentrated light source, usually of coiled incandescent filament type, in a tubular light transmitting bulb or envelope, usually of heat-resistive "hard glass" to stand the high temperature to which the lamps are subjected in use. It is very important that in use the concentrated light source be definitely and correctly positioned with respect to the primary light directing means of the apparatus, commonly consisting of a reflector behind the lamp and a light condenser of refractive character in front of it. It is also very desirable that the light source be properly and definitely located with respect to the tubular envelope wall, or, at least, with respect to the portion of the wall through which light reaches the condenser.

It has hitherto been sought to locate and position the light source with respect to the tubular envelope and the light-directing means by employing a "prefocused base," or an equivalent envelope part: i. e., a mounting structure connected or attached to the light source and to the tubular lamp envelope in a carefully determined relation to them. This not only demands a base of exacting dimensional accuracy and a socket of similar accuracy, which must be accurately placed with respect to the light-directing means of the projection apparatus, but also requires a "prefocusing" operation by a skilled operator during the manufacture of the lamp to assure the proper relation of the base to the light source and the envelope. The difficulties of such accuracy as regards both base and socket are greatly enhanced by the considerable distance from the base to the light source: i. e., any slight angular error in the alignment of base or socket gives rise to a greatly magnified linear error in the position of the light source with respect to the envelope and the light-directing means. Also, the mere bulk of the base and the socket makes it difficult to cool the parts effectively, by obstructing the desired upward flow of cooling air about and along the lamp envelope and the associated parts of the projection apparatus. The danger of overheating motion picture film travelling close in front of the condenser lens(es) is well known.

My invention makes it possible to overcome or avoid the above mentioned difficulties. Instead of relying on a base or other such mounting

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structure prefocused relative to the light source and the envelope wall, I orient and position the light source only in relation to the envelope wall; or, alternatively, I specially orient and position certain portions of the envelope wall relative to the light source. I then orient and position the lamp relative to the light-directing and other parts of the projection apparatus by the envelope wall, or by the specially oriented and positioned portions of this wall. Thus the base becomes a mere carrier of contact terminals for making electrical connections to the lamp; or it may even be dispensed with by making such connections directly to the usual external lamp leads as contact terminals. In any case, the contact terminal and connector features of lamp and projection apparatus can be so simplified and reduced in bulk as not to obstruct or interfere with the supply of cooling air. Moreover, the removal and replacement of a failing lamp becomes much easier and quicker.

Various other features and advantages of the invention will appear from the following description of species thereof and from the accompanying drawings in which:

Fig. 1 is a vertical section, partly in elevation, of a lamp and associated mounting and light-directing means according to my invention; Fig. 2 is a section on the line 2—2 of Fig. 1 with the lamp shown in elevation; Fig. 3 is a horizontal section on the line 3—3 of Fig. 1; and Fig. 4 is a fragmentary elevation of a modified form of lamp construction according to the invention.

The drawing shows a projection lamp 1 of an ordinary type comprising an elongated or tubular vitreous envelope or bulb 2 enclosing a concentrated light source 3 in the form of a compactly arranged tungsten wire filament helically coiled in a number of upright interconnected sections and forming part of the lamp mount 4. The coils 3 may lie in a single plane, or they may alternate between parallel planes as shown. The current leads 5, 5 to the filament 3 may penetrate the envelope 2 through a "press" or other stem seal 6. The upright tubular lamp 1 is mounted in a lamp housing 7 of a projection apparatus, the lamp being positioned between reflecting and refracting light-directing means at opposite sides of the envelope 2, the former consisting of a spherical concave reflector 8 and the latter of a light-condenser 9. The lamp housing 7 is provided with opposed circular apertures 10, 11 to receive and hold the reflector 8 and condenser 9, respectively. The reflector 8 is mounted in a tubular housing or barrel 12

which screws into a threaded socket 13 fastened on the inner side of the rear wall 14 of the lamp housing 7. The light condenser 9 is of a well known type comprising a pair of lenses 15, 15 mounted within a tubular housing or barrel 16 and held at a definite correct distance apart, against the internally shouldered ends of the barrel 16, by a helical compression spring 17 disposed between and engaging the lenses. In general, it is desired that the light center of the source 3 lie at coincident foci of reflector 8, and of condenser 9 or its lens adjacent the source 3.

It will be understood that as thus far described, these and various other features of the lamp and of the projection apparatus form no part of my present invention, and may, indeed, be greatly varied.

As shown in Figs. 1–3, the lamp 1 is supported in place within the lamp housing 7 by opposed holder means engaging opposite sides of lamp envelope 2 and comprising positioning means 18 for vertically aligning the lamp and resilient clamp means 19 for holding the lamp in engagement with the said positioning means. The positioning means 18 comprise a vertically disposed plate 20 apertured at 21 to snugly receive the condenser housing 16. The plate 20 is secured to the rear closure ring 22 of the condenser housing 16, as by welding for instance, and is fixed in proper rotative position about the axis of the cylindrical condenser housing 16 by means of a locating pin 23 which snugly fits into a hole 24 in the lamp housing 7. The plate 20 is provided with upper and lower vertically-aligned rounded bulb-engaging buttons or protuberances 25, 25 which may take the form of round-headed rivets with their shanks riveted through the plate 20. The envelope wall 2 is provided with corresponding surface configurations providing positioning shoulders in the form of socket recesses or depressions 26, 27 spaced longitudinally of the envelope on opposite sides of and definitely located with respect to the light source 3 therein, in which recesses the positioning elements or buttons 25, 25 engage to thus orient the light source 3 angularly about the vertical lamp axis and also position the lamp 1 and light source 3 vertically relative to the light-directive means 8, 9. While the lower envelope wall indentation or recess 26 is substantially of spherical or dimple shape strictly conforming to the lower button 25, the upper indentation or recess 27 is shown as elongated vertically, to take care of any slight variation in the vertical distance between the buttons 25, 25 or between the recesses 26, 27.

The clamp means 19 which holds the lamp in engagement with the positioning means 18 comprises a pair of vertically-spaced closed loop plate springs 28, 29 mounted on and projecting forwardly from the reflector socket 13 of the lamp housing. The springs 28, 29 engage the rear side of the tubular lamp envelope 2 at spaced points therealong on either side of the light source 3 therein, thus resiliently urging the lamp forwardly against the positioning means 18 with the matching protuberances and depressions 25, 26 and 27 on the positioning means and lamp envelope in interlocking engagement. The upper spring loop 28 is provided with a substantially flat bulb-engaging portion 30 while the lower spring loop 29 is provided with a rounded bulb-engaging button or protuberance 31, similar to the buttons 25, 25, which engages in a matching recess or depression 32 in the lamp envelope wall 2. The button 31, engaging in the envelope recess

32 located on the side of the envelope opposite to that side engaged by the buttons 25, thus serves to lock the lamp in proper lateral position so as to laterally line the light source 3 with the optical axis of the light-directive means 8, 9. Like the upper recess 27 in the front side of the lamp envelope, the recess 32 is elongated vertically to take care of any slight variation in the vertical position of the button 31 or the recess 32 itself.

To facilitate insertion of the lamp 1 from beneath, upward into the lamp housing 7 and into proper engagement with the positioning elements or buttons 25 and 31, a top stop 33 may be provided for engaging the upper end of the lamp envelope. The said top stop 33 comprises a hairpin-shaped wire loop having its looped end portion bent at right angles to overlie the lamp 1 and having its upright portion engaged slotwise with the shanks of clamping screws 34, 34 which are screwed into the lamp housing 7 to thereby fasten the wire loop thereto.

Besides the coaction of the buttons 25, 31 and the matching sockets 26, 27 and 32, Fig. 4 illustrates another novel feature with which the lamp envelope 2 may be provided. This is a special window portion 35 registering with the light condenser 9 and made relatively unreflective of light, thus reducing very greatly the reflection losses due to oblique incidence of light from the source 3 on the envelope wall portion corresponding to the condenser 9. By suitable optical treatment of the window portion 35 the reflection losses thereat may be reduced by approximately 80 per cent, since reflection occurs at both the inner and outer surfaces of the glass. For this purpose, the window portion 35 may be coated inside or out, or both, with a non-reflecting film of magnesium fluoride (MgF_2), for example. Other suitable non-reflective materials for this purpose are also known in the optical art.

Another means of reducing reflection losses at the window 35 is to mold or otherwise form this portion of the envelope wall flat, or at any rate with greatly reduced curvature, as shown in Fig. 4. By molding the window 35 concurrently with the recesses 26, 27 and 32 and locating the light source 3 in definite relation to the window and recesses, a definite fixed distance of the light source from the window and of both from the condenser may be maintained. Of course, a window portion 35 of the envelope 2 may be either treated or flattened, or both.

The direct advantage of flattening the window 35 will be better appreciated when it is realized that while light incident on glass in a direction normal to its surface suffers a reflection loss of only about 5 per cent, this loss increases very much as the angle of incidence becomes more and more acute, e. g., for a variation of incidence of 10 degrees from the perpendicular, the internal reflection loss is about 15 per cent, and the external loss about the same. A further advantage accrues in the diminished heating of the envelope wall due the energy of absorbed light.

As shown in Figs. 1 and 2, the lower end of the envelope 2 is equipped with a base 36 comprising a sheet metal shell in which apertured flat projecting contact prongs 37, 37 are insulatively mounted, constituting a familiar type of male connector. A corresponding known type of female connector 38, with contact-equipped openings for the prongs 37, 37, is connected to the flexible supply circuit cord 39. Thus, the bulb-held lamp 1 supports the parts 36, 38, instead of being supported by them as in prior devices. This

fact and the reduced bulk of the parts 36, 38 greatly improve the cooling of the lamp 1 and the associated parts by upflow of air or other cooling medium through the lamp housing 7, which may be assured and augmented by any suitable means, such as by a fan 40 revolving about a vertical axis directly below the part 38 and a lamp chimney which surrounds the lamp and which may comprise two half sections 41, 42 supported from the lamp housing 7.

While I have shown and described the preferred form of the invention, it is obvious that other modifications are possible within the scope of the appended claims. Thus, the arrangement of the bulb-supporting protuberances 25, 31 and matching depressions 26, 27 and 32 may be reversed by providing one or more of the protuberances on the lamp envelope 2 and the corresponding depressions on the bulb holder. Likewise, the protuberances 25, 31 and depressions 26, 27 and 32 may be of a shape other than that illustrated, for instance, they may be of matching ridge and groove shape.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, an electric lamp comprising a light source in an enclosing tubular envelope, light directing means at one side of the lamp opposite the light source, and opposed holder means engaging opposite sides of the lamp envelope to support the lamp in place, said envelope and holder means being provided with matching protuberances and depressions for holding the lamp with its light source positioned in definite relation to said light-directing means, said matching protuberances and depressions being located at one side of the envelope at spaced points therealong oppositely remote from the light source therein.

2. In combination, an electric lamp comprising a light source in an enclosing tubular envelope, said envelope having its outer wall surface formed at one side with surface configurations located at spaced points therealong on either side of and in definite relation to the light source therein, light-directing means at one side of the lamp opposite the light source, and opposed holder means engaging opposite sides of the lamp envelope to support the lamp in a predetermined position with respect to said light-directing means, said holder means comprising stationary positioning elements interlocking with the said envelope wall configurations on one side of the envelope, and resilient means engaging the opposite side of the envelope to maintain the said envelope wall configurations in interlocking engagement with the said positioning elements.

3. Projection apparatus comprising in combination coacting reflective and condensing refractive light-directing means separated to accommodate therebetween an electric lamp comprising a concentrated light source mounted in a tubular envelope, holder means for engaging the tubular envelope at zones oppositely remote from the light source and from said light-directing means but at the side of said envelope where one of said light-directing means is located, and additional holding means for engaging said tubular envelope at its opposite side.

4. An electric lamp comprising a tubular envelope containing a concentrated light source, the wall of said envelope being formed with surface configurations providing integral positioning shoulders spaced relatively widely apart longitudinally of the bulb, and the said light source being located in an accurately predetermined position with respect to and between the said spaced positioning shoulders.

5. An electric lamp comprising a tubular envelope containing a concentrated light source, the wall of said envelope being formed with surface configurations providing integral positioning shoulders aligned and spaced relatively widely apart longitudinally of the bulb, the said light source being located in an accurately predetermined position with respect to and between the said spaced positioning shoulders, the envelope wall being formed with additional surface configurations providing positioning shoulders located at points on said envelope longitudinally between the first-mentioned positioning shoulders and diametrically on the opposite side of the envelope.

6. An electric lamp comprising a tubular envelope containing a concentrated light source, the wall of said envelope being configurated to provide integral engagement dimples at points spaced relatively widely apart longitudinally of the bulb, the said light source being located in an accurately predetermined position with respect to and between the said spaced engagement dimples.

7. An electric lamp for light projection apparatus comprising a concentrated light source, an enclosing tubular envelope having a specially unreflective light-transmitting window portion for coaction with a light condenser of the projection apparatus and adapted to engage holder means at zones spaced longitudinally of the envelope and oppositely remote from the light source therein, and surface configurations on the wall of said envelope for engaging with corresponding positioning elements on said holder means to thereby position the lamp with its said window portion in registry with said light condenser.

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