March 13, 1962 E. H. WILEY ETAL 3,025,424

ELECTRIC LAMP

Filed June 16, 1958

Fig. 1.

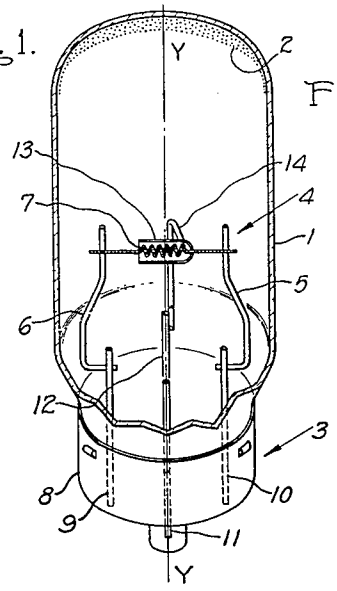


Fig. 2.

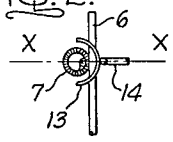


Fig. 3.

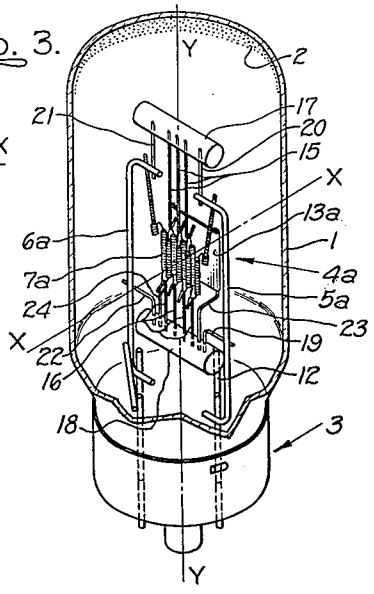


Fig. 4.

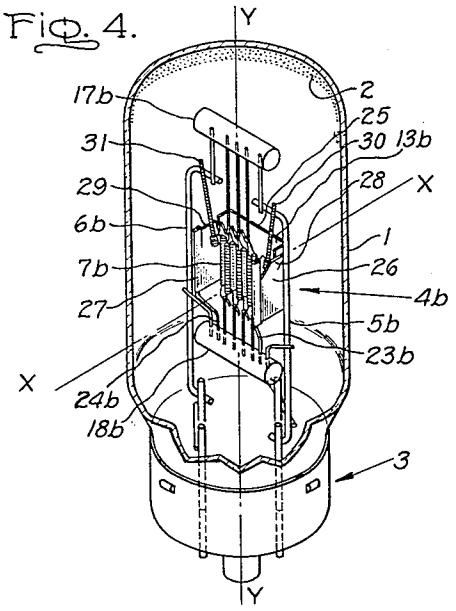


Fig. 5.

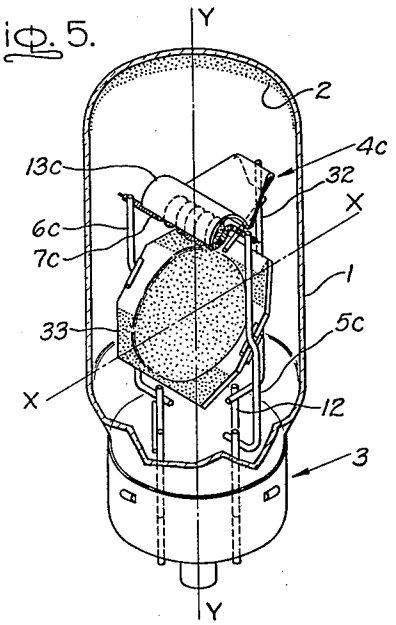
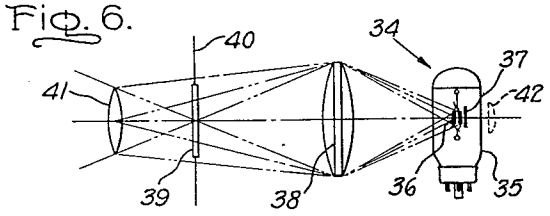


Fig. 6.



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ELECTRIC LAMP

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2 Claims. (Cl. 313—115)

This invention relates to lamps and, more particularly, to incandescent lamps useful in light projection devices.

Light projection systems have generally heretofore employed a reflector behind the light source of the system to redirect the back light to the projector's optical system. Such an arrangement requires an accurately formed, aligned and spaced geometric shape to redirect the back light. Further, if such a reflector is placed external to the lamp envelope, it is subjected to oxidation and deterioration during use.

Placing a reflecting surface or baffle in close proximity to the incandescent filament coils of a high voltage projection lamp, that is, one operating on the normal household voltage of about 105 to 125 volts, presents certain problems. Such a baffle should be of refractory material as it must be able to withstand the incandescent heat of the filament coils. It was generally believed that placing a conducting material close to an incandescent coil having a high voltage potential across the portion of the coil in close proximity to the conducting material would cause the filament coil to arc out due to reducing of the gap width between the two sides of the high voltage potential.

Further difficulty is experienced in projection lamps due to the blackening of the transparent lamp envelope as a result of gas and tungsten vapor emitted from the incandescent filament coils.

It is an object of the present invention to provide an improved projection lamp.

Another object of the present invention is to provide a projection lamp with an improved light redirecting baffle.

A further object of the present invention is to provide a projection lamp having improved baffle for minimizing blackening of the lamp envelope.

Briefly stated, according to the present invention, a reflecting shield or baffle of refractory material is placed in close proximity to the incandescent filament coils of a projection lamp, which has a high voltage impressed across the coils.

Such a baffle acts to direct light in a direction to increase the apparent brightness of the light source, that is, the spaces between the turns and segments of the filament coils are at least partially filled in with light, the effect of which is to increase the black body characteristic of the surface and to thereby increase the apparent brightness of the source. Such a baffle in close proximity to the incandescent coils requires no critical geometric shape or spacing in the optical system of the light projection device.

Other objects and advantages of the invention will appear to those skilled in the art from the following description and accompanying drawings, in which:

FIG. 1 is an elevation view, partly in section, of a projetcion lamp embodying the invention,

FIG. 2 is a partial side view, partly in section, of the projection lamp of FIG. 1,

FIG. 3 is a pictorial view, of a projection lamp embodying a modification according to the present invention,

FIG. 4 is a pictorial view of a projection lamp embodying a modification according to the present invention,

FIG. 5 is a pictorial view of a projection lamp embodying another modification according to the present invention,

FIG. 6 is a diagrammatic view illustrating the use of projection lamp accordance to the present invention in suitable optics system.

In the drawings, similar parts are designated by the same numbers; and the longitudinal lamp axis is designated by axis Y—Y, the light projection or optical axis of the lamp is designated by X—X. It will be noted from the drawings that the filament for a projection lamp, as conventionally built, may consist of a "coiled coil" filament as appears in FIGS. 1 and 5 and which consists of a coiled wire which, in turn, is coiled, thereby forming several large turns or segments; or may be of the "bi plane" type, consisting of a series of straight segments of coiled wire, generally in two planes, as illustrated in FIGS. 3 and 4.

Referring to FIGS. 1 and 2, there is shown a high voltage projection lamp according to the instant invention which comprises a transparent vitreous envelope or bulb **1** having an opaque coating **2** at one end and base **3** at the other end, and enclosing a mount shown generally at **4**. The mount **4** comprises lead-in wires **5** and **6** supporting a filament **7**, herein shown having the form of a coiled coil containing large turns or segments of coiled wire. The filament may be of tungsten wire.

The lamp base **3** may be of any desired design, however, as herein illustrated, consists of a positioning ring **8** and a plurality of lead-in conductors **9**, **10**, **11** and **12** sealed through the lamp envelope. The lead-in supports **5**, **6** are secured to the inner end of lead-in wires **10**, **9** respectively. Lead-in wire **12** supports a baffle **13** in close proximity to the lamp filament, through baffle support **14**. The baffle **13** must be of refractory material and may suitably be made of a conducting metal such as molybdenum or tungsten. The exact geometric shape and location from the filament of the baffle **13** is not critical; for the reasons that hereinafter appear, it is desirable, but not necessary, that the baffle **13** partially enclose the filament **7** particularly above the filament when the lamp is in its preferred operating position, as hereinafter explained, leaving uncovered the portion of the filament **7** which lies in the light projection axis X—X of the lamp, FIG. 2 toward the projector optics system. The baffle **13**, due to the cylindrical shape of the filament **7**, takes on a generally semicircular or trough-shaped cross-section. The baffle may be constructed from .003 inch thick molybdenum sheet and placed within about ½ mm. of the coil. While the exact location of the baffle **13** is not critical, the beneficial results obtained from the baffle are diminished as the distance between the baffle and incandescent coil is lengthened. The location of the baffle from the incandescent coil depends somewhat on the coil diameter of the filament coils and the segment or turn spacing of the filament, and also on wattage of the lamp. For lamps up to about 1500 watts, the baffle may reasonably be placed between 1 and 3 coil diameters from the coil segments or turns.

By placing the baffle very near the light source in this manner, the source which is partially transparent between the turns and the segments of the fiament is made to appear brighter by filling in the open spaces with reflected light. By having the baffle very near to the light source in this manner, the critical alignment and baffle shape is not needed. Further, since this baffle is inside the lamp, no glass transmission losses are encountered as with an external reflector. Also, compared to an internally mounted reflector placed further away and more accurately focused, this proximity baffle is cheaper to manufacture.

When the lamp is in its preferred operative position, as hereinafter explained, the baffle **13** may partially encircle and enclose the filament **7**, thereby acting as a restriction to the natural flow of gas in an upward direction, preventing the cooling of the filament by convection currents and acting to collect tungsten vapors liberated by the filament so as to minimize the blackening of the bulb due to these vapors. Inasmuch as the incandescent filament is not as rapidly cooled when the proximity baffle restricts the flow of gas around the filament, the filament temperature can be maintained at a higher point with a lesser amount of power input than would otherwise be obtained. This is also due in part to the reflected power from the proximity baffle.

Another advantage is that the baffle is just slightly larger than the light source **5**, thereby permitting utilization of the maximum source size and baffle image size to be projected to the optics system of the light projection apparatus.

Contrary to the popular belief that a conducting material placed so close to a coil having a high voltage impressed therethrough would so shorten the electrical path that an arc discharge would occur, the baffle according to the instant invention tends to suppress the occurrence of the arc due to recombination of the ions in the conducting path, thereby inhibiting the occurrence of arc discharge.

While the lamp illustrated in FIGS. 1 and 2 may be burned with its longitudinal axis Y—Y and its light axis X—X in any desired position, the gas flow restricting effects of the baffle **13** are best when the lamp is burned with the baffle **13** partially covering the area above or below the filament **7**, since, of course, the natural tendency of the gas stream in the lamp is to move upward in the vicinity of the hot filament. This baffling effect of the gases is therefore best obtained when the lamp is burned with its lonigtudinal axis Y—Y in a vertical position while its light projection axis X—X are horizontal; or while the longitudinal axis Y—Y of the lamp is held horizontally and the light projection axis X—X of the lamp is vertical. The gas baffling effect of the reflector **13** is a minimum when both the longitudinal lamp axis Y—Y and the light projection axis X—X are horizontal.

Referring to FIG. 3, there is shown a modification of the invention which is similar to that illustrated in FIGS. 1 and 2 except that the filament is of the biplane type. More specifically, the projection lamp includes the bulb **1** having an opaque coating **2** at one end and a base **3** at the other end enclosing a mount shown generally at **4*a***. The mount **4*a*** comprises lead-in wires **5*a*** and **6*a*** including a filament **7*a*** of the biplane type. The filament coils **7*a*** are supported by support wires **15, 16** fused into an upper bridge **17** and lower bridge **18**, respectively, which in turn are secured to the lead-in conductors **5*a*, 6*a*** through wires **19, 20, 21**, and **22**.

A baffle **13*a***, according to the instant invention, may be supported by two supporting wires **23, 24** which are fused into one of the bridges. The baffle **13*a*** is, of course, made of suitable refractory metal. The exact geometric shape and location of the baffle **13*a*** from the filament is not critical; the baffle takes on approximately the shape of the filament structure; therefore, as shown, it is of approximately rectangular shape. The baffle may be placed within about 2 mm. of the filament coil; however, the exact location of the baffle **13*a***, as stated above, is not critical, but the beneficial results obtained from the baffle are diminished as the distance between the baffle and the incandescent coil is lengthened.

It will be evident that the placing of the substantially flat reflecting baffle very near the light source in the manner described causes a virtual image of the filament to be formed behind the reflecting baffle the same distance as the filament is in front of the baffle, and makes the light source appear brighter by filling in the open spaces between the turns and segments of the coil with reflected light.

Since the baffle **13*a*** can function as a restriction to the natural flow of gas in an upward direction preventing the cooling of the filament by convection currents, the lamp illustrated in FIG. 3 is best burned with its light axis X—X in a vertical direction, preferably with the light emitting in a downward direction. This has the further advantage that the light is transmitted through the bottom of the glass at a point where the tendency for the bulb to blacken is a minimum and the heat due to the incandescent filament is likewise a minimum thereby passing the light through a relatively cool portion of the lamp envelope and minimizing the tendency of local overheating in the envelope wall. This arrangement has the other advantages hereinbefore described in the discussion of the modification according to FIGS. 1 and 2.

Referring now to FIG. 4 there is illustrated a modification similar to FIG. 3 except that the baffle more nearly encircles and encloses the filament coils thereby producing the desired advantages to a greater degree when burned in a proper position. The lamp as illustrated has a biplane filament **7*b*** suspended from an upper and lower bridge **17*b*, 18*b*** respectively. The baffle **13*b*** is supported by two support wires **23*b*, 24*b*** fused into one of the bridges **18*b***. The baffle **13*b*** is of generally channel shape having its elements approximately parallel to the individual segments of the biplane filament, and consists of a center portion **25** and two end legs **26** and **27** at approximately right angles to the center portion **25**. The end legs **26** and **27** are adjacent to the end segments of the filament **7*b*** and the baffle **13*b*** thereby partially encircles and encloses the filament **7*b***. In the lamp illustrated, small tongues **28, 29** were cut into the sides **26, 27** respectively of the baffle **13*b*** and bent outwardly at the top so as to permit clearance between the baffle **13*b*** and supports **30, 31** which form the electrical connection between the filament **7*b*** and the lead-in conductors **5*b*, 6*b***.

The baffle **13*b*** efficiently performs as a gas flow restriction when the lamp is burned with its light projection axis X—X vertical, particularly when the light is projected in a downward direction through the bottom of the lamp envelope; and further performs effectively as a gas flow restriction when the lamp is burned with both the lamp longitudinal axis Y—Y and the light projection axis X—X in a horizontal position. The gas flow restricting effect of the baffle **13*b*** is a minimum when the longitudinal lamp axis Y—Y is vertical.

Referring now to FIG. 5 there is shown a coiled coil type projection lamp having an elliptical, non-axial reflector. The reflector and optics system are more fully described in copending application Serial No. 742,384 filed June 16, 1958 by Emmett H. Wiley, now Patent No. 2,904,714 granted September 15, 1959, and assigned to the assignee of the present invention. Briefly, however, the lamp consists of a coiled filament **7*c*** supported by lead-in conductors **5*c*, 6*c***, partially encircling or covering the filament **7*c***. A baffle **13*c*** may be supported in place from support wire **32** secured to the inner end of lead-in wire **12**. The baffle **13*c***, due to the cylindrical shape of the filament **7*c*** takes on a generally semicircular or trough-shaped cross-section. When the lamp shown in the embodiment of FIG. 5 is mounted with its longitudinal axis Y—Y vertically, the baffle **13*c*** partially encircles and encloses the filament **7*c*** at its top, acting as a restriction to the natural flow of gas in an upward direction around the filament and preventing the cooling of the filament by the convection current, and further acting to collect tungsten vapors liberated by the filament thereby minimizing the blackening of the bulb due to the vapors. In this position the light from the filament **7*c*** as well as the light from the baffle **13*c***, is projected downwardly onto the elliptical reflector **33** which then reflects the light horizontally along the light axis X—X. As more fully described in the above mentioned co-pending application,

such an arrangement has the further advantage that the light is transmitted through the portion of the bulb which does not collect tungsten vapor gas and which is not excessively heated by hot convection currents.

A typical optics system which can utilize the modifications of FIGS. 1 through 4 is illustrated in FIG. 6. In this figure, an incandescent projection lamp **34** according to the present invention is used as the light source and consists essentially of a sealed glass envelope **35** containing an incandescent biplane filament **36** and a proximity baffle **37** according to the present invention. The light from the lamp **34** passes through a condensing lens **38**, through a transparent film **39** at the film gate **40** and into the objective lens **41** of the projector. While possessing all the desirable advantages hereinbefore enumerated, such an optics system has the further advantage of eliminating the need for a back reflector **42** (shown dotted) of geometric design and accurately located in the optical system.

While many modifications will occur to those skilled in the art, for example, the baffles **13***a*, **13***b* in the biplane lamps may be supported on support wires secured to lead-in wires, the invention is to be limited only by the claims annexed to and forming a part of this specification.

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

1. A high voltage incandescent projection lamp comprising a sealed light-transmitting envelope, a biplane filament in said envelope operable at a voltage in excess of about 100 volts and comprising a plurality of spaced parallel segments of coiled wire arranged adjacent a common plane within a substantially rectangular outline, and a substantially flat, imperforate, refractory sheet metal reflector having a peripheral outline of the same order of size as said filament and located behind and in close proximity to said filament in a plane parallel to said common plane, said reflector being electrically insulated from said filament and being spaced therefrom a distance of approximately two millimeters corresponding to between one and three coil diameters of the coiled segments of said filament whereby a virtual image of the filament is formed behind the reflector and the spaces between said filament segments are filled in with reflected light.

2. A lamp as set forth in claim 1 wherein said reflector is provided with leg portions adjacent to the end segments of the filament partially encircling and enclosing said filament.

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