United States Patent

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[54] HOUSING FOR A SEALED BEAM ARC LAMP

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 740,345, June 26, 1968, abandoned.

[52] **U.S. Cl.** **313/44**, 313/46, 313/113, 313/178, 313/220, 313/221, 313/318

[51] **Int. Cl.** **H01j 61/30**, H01j 61/52

[58] **Field of Search** 313/8, 44–46, 113–115, 313/174, 178, 220, 221, 312, 317, 318, 324

[56] **References Cited**

UNITED STATES PATENTS

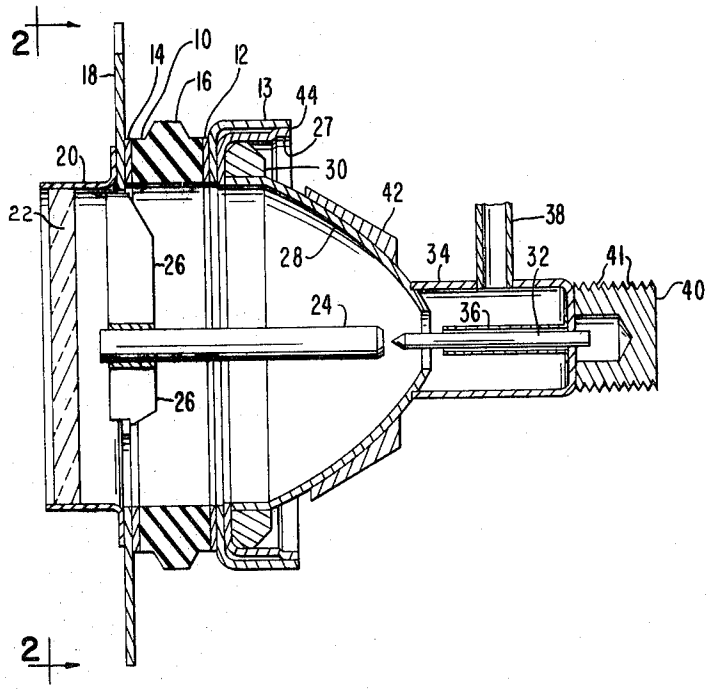
3,280,360	10/1966	Frost et al.	313/113 X
3,378,713	4/1968	Ludwig	313/113 X
3,497,742	2/1970	Richter	313/220 X
3,502,929	3/1970	Richter	313/220 X

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[57] **ABSTRACT**

Improved housing for a sealed beam arc lamp comprising an arcuate reflector having radial symmetry with respect to a beam axis, an optical window disposed substantially normal to the axis, a mounting ring having a truncated right-circular conical exterior surface disposed coaxially to the axis, and externally accessible helical screw threads disposed coaxially to the axis.

7 Claims, 2 Drawing Figures



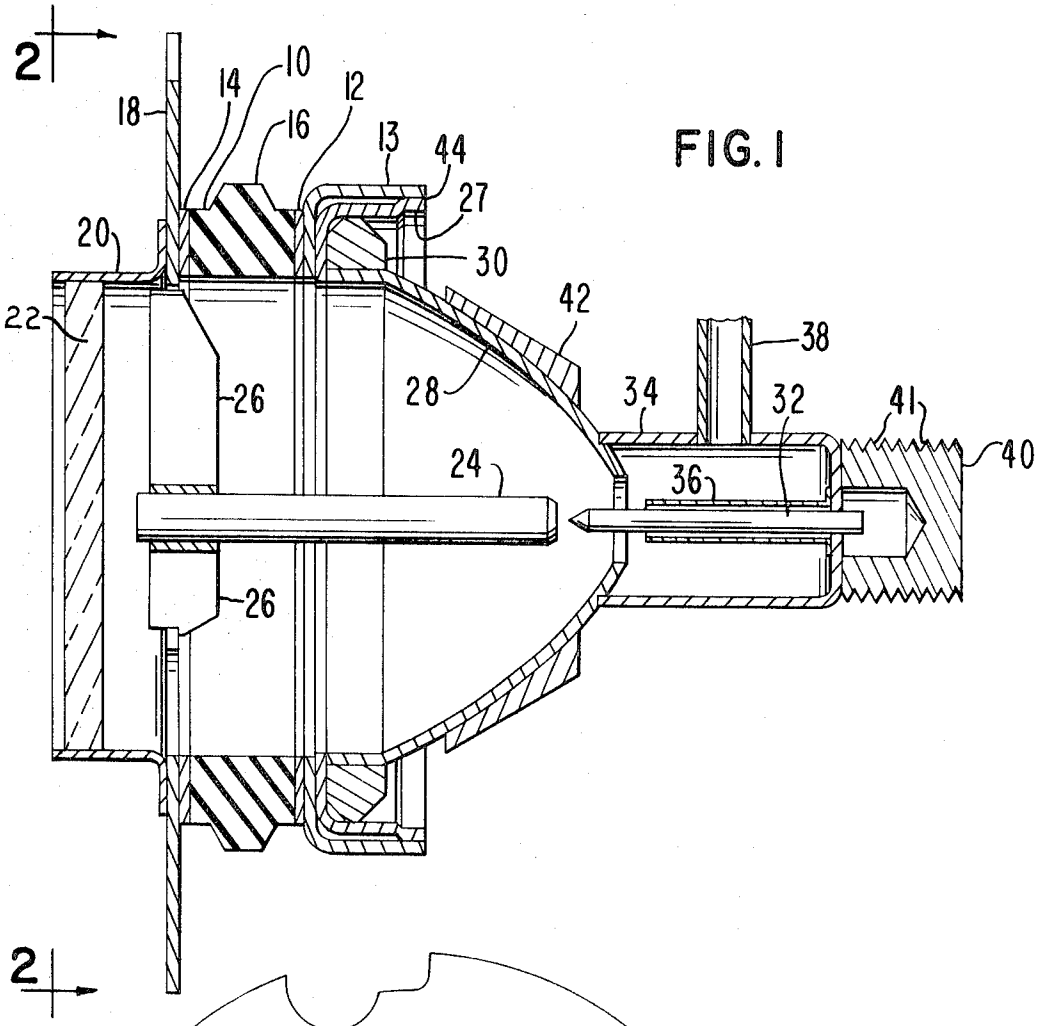


FIG. 1

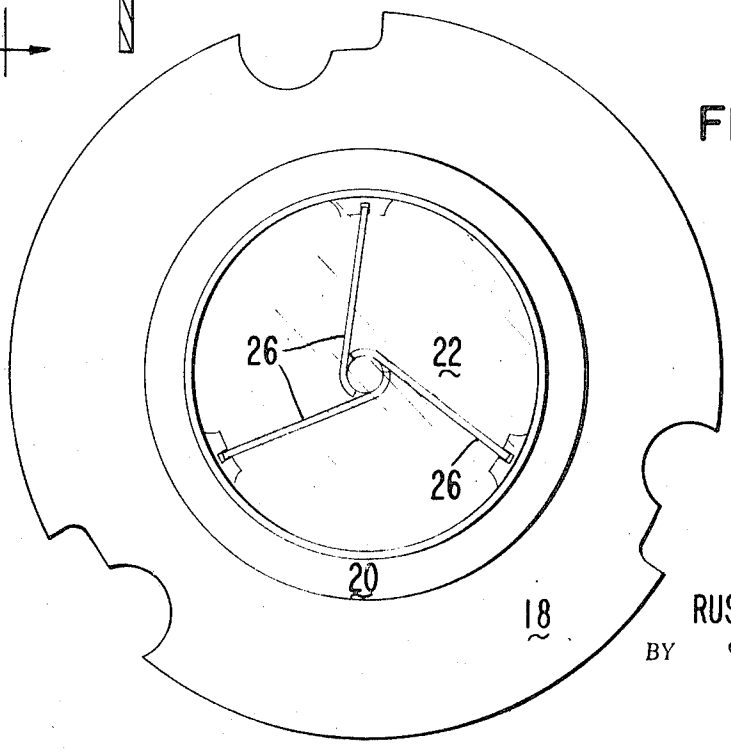


FIG. 2

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HOUSING FOR A SEALED BEAM ARC LAMP

This application is a continuation-in-part of U.S. Pat. application Ser. No. 740,345, filed June 26, 1968 and now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to arc lamps, and particularly to housings for high intensity, sealed beam short arc lamps such as that disclosed in U.S. Pat. No. 3,502,929 issued Mar. 24, 1970.

The housing of a high intensity, sealed beam, short arc lamp must perform many functions. First it must hermetically confine an ionizable gas under some 10 to 50 atmospheres of pressure. As the housing comprises several component parts, each part must be hermetically sealed to withstand this pressure.

The housing must conduct the large quantities of heat generated by the lamp arc from the lamp to adjacent cooling means. The aforementioned seals must therefore also withstand relative high temperature and thermal cycling. As the adjacent cooling means, which usually abuts the housing, is normally made of material other than that of which the housing itself is made, means must be employed to allow for the variations in thermal expansion temperatures causing a severe reduction in heat transfer, or one unit might compress and deform or crack the other.

The housing must also cooperate with a mounting for the lamp as a whole, and itself serve as a mounting for a cathode and anode positioned therewithin. It also must provide isolated electric conduction between these electrodes and externally accessible terminals. These housing terminals must in turn maintain good electrical contact with conductors attached thereto. Good contact may be made difficult by the aforementioned variations in thermal expansion of dissimilar metals and by the relatively rapid oxidation of conductors under elevated temperature conditions, producing oxide which functions as electrical insulation.

The lamp housing must also provide means to convert an approximate point source of light into a directed beam of light, provide an optical window through which the directed beam may exit the lamp, and position the lamp beam.

Accordingly, it is an object of the present invention to provide an improved housing for a sealed beam arc lamp.

More particularly, it is an object of the invention to provide a housing having improved means for conducting heat from an arc lamp to adjacent cooling means.

Specifically, it is an object of the present invention to provide an arc lamp housing which maintains improved thermal contact with abutting cooling means during thermal cycling of the lamp irrespective of the coefficient of thermal expansion of either the housing or the cooling means.

It is another object of the invention to provide a housing for a sealed beam arc lamp which may be mounted to project a beam along a predetermined axis and placed in good electrical and thermal contact within a mating cooling and socket means by rotation of the lamp housing about the predetermined axis.

SUMMARY OF THE INVENTION

Briefly described, the present invention is an improved housing for a sealed beam arc lamp. The housing comprises an arcuate reflector having radial symmetry with respect to a beam axis, an optical window disposed substantially normal to the axis, a right-circular conical exterior surface on the reflector, the surface being disposed coaxially to the axis, and externally accessible helical screw threads disposed coaxially to the axis. In the preferred embodiment the screw threads are in a stud attached to one end of the lamp superimposed over the projected apex of the conical surface of the mounting ring.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a cross-sectional view of an arc lamp having the preferred embodiment of the improved housing of the present invention; and

FIG. 2 is a frontal view of the lamp shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 illustrates a high intensity, short arc lamp having a composite, integral bulb and reflector which structure is termed "sealed beam." The lamp housing comprises a ceramic cylinder section 10 the ends of which are brazed to ductile metallic rings 12 and 14 respectively. The ceramic section has a raised, annular portion 16 which serves to inhibit electric breakdown along the exterior surface of the ceramic cylinder between the two metallic rings. Ring 12 is brazed to arcuate sealing ring 13 having an exteriorly accessible portion of which is nickel plated and serves as a lamp terminal. Ring 14 is in turn brazed to one side of rigid, nickel plated flange 18 which serves as the other lamp terminal. Flange 18 is also brazed to the flange of a tubular, metallic window support 20. The periphery of a disc-shaped optical window 22 is slightly recessed within and brazed to the window support.

A rod-shaped metallic anode 24 is supported within the lamp housing along the axis of the ceramic cylinder section 10 and window 22 by three struts 26 which extend radially from the anode to flange 18. In addition to support, the struts provide electrically conductive paths between the anode and the externally accessible terminal flange. The axis of anode 24 is that of the lamp and of its projected beam.

When brazed together the just described lamp elements form one of the two lamp subassemblies. The other subassembly comprises an arcuate sealing ring 27 which is brazed to an arcuate reflector 28 having radial symmetry with respect to the lamp axis. Stiffener ring 30 is brazed to sealing ring 27 and reflector 28 and serves to prevent the sealing ring from flexing under high internal pressure conditions.

A rod-shaped cathode 32 is supported along the lamp axis in spaced relation with anode 24 by a metallic cup 34. A tubular getter 36 is fitted about cathode 32 and brazed to cup 34. The getter comprises an oxygen-reactive metal such as zirconium, titanium or cerium, or an alloy thereof. The open end of cup 34 is brazed to reflector 28. A nickel exhaust tubulation 38 communicates through the cup into the interior region of the housing. Once the housing has been filled with an ionizable gas such as xenon and pressurized, the nickel tubulation is pinched off thereby confining the pressurized gas within the lamp housing.

A stud 40 is brazed to the cup 34 along the lamp axis. The stud has a reentrant void in which a portion of cathode 32 resides. The stud also has helical screw threads 41 disposed coaxially to the lamp axis.

In accordance with the present invention it has been found desirable to provide the exterior surface of the reflector with a portion which is a truncated right-circular cone concentric with the lamp axis. For this purpose, a positioning ring 42 is affixed to the exterior surface of reflector 28. This ring has a truncated right-circular conical exterior surface disposed coaxially to the lamp axis. The positioning ring and stud, cup 34 with tubulation 38, cathode 32, reflector 28, stiffener ring 30 and sealing ring 27 all form the second lamp subassembly. The two subassemblies are then placed together in forming the lamp assembly by placing sealing ring 27 within sealing ring 13 and heliarcing the tips of the two together along circumference 44. Although a separate ring 42 has been illustrated in FIG. 1, it should be understood that in some cases, especially where the wall of reflector 28 is relatively thick, the truncated right-circular conical surface portion could be provided on the wall of reflector 28 by machining or other forming operations. In these cases, a separate ring 42 would not be needed.

Most of the metallic members of the lamp housing are made of an iron-nickel alloy since this material has a coefficient of thermal expansion compatible with that of the ceramic element of the housing. This compatibility permits the formation of structurally sound ceramic-to-metal seals therebetween. As the metallic members adjacent the ceramic member are made of an iron-nickel alloy the other metallic members joined in turn thereto are also made of the alloy for the same reason. However, it would be highly impractical and expensive to make the cooling means itself, which surrounds the lamp

housing, also of this alloy irrespective of the particular type of cooling means employed since such is relatively heavy and expensive. Where the cooling means comprise radiating fins, aluminum is often used since it is light in weight, a good thermal conductor, and relatively inexpensive. It would be easy enough to design a female radiating fin cooling assembly into which the lamp housing mates were it not for the temperature cycling of the lamp. Such not being the case, means must be employed to allow for relative movement between the housing and cooling assembly in order to prevent physical separation or compression of the two structures. This is the function of threaded stud **40** in combination with the truncated right-circular conical surface of positioning ring **42** in the described embodiment. Stud **40** provides means for rigidly mounting the lamp to project its beam along a predetermined axis which axis is that of the stud itself. As the stud is screwed the lamp housing is advanced into its mounting and cooling means until ring **42** is brought into abutment with a mating, conical surface of the mount. At this point flange **18** and sealing ring **13** are in respective physical contact with conductors in the mounting.

When the lamp is ignited, portions of the housing are brought to elevated temperatures of approximately 300° C. Though it is possible to design arc lamp housings which would operate cooler, such is not desired per se due to gas pressure requirements, operating temperature requirements of the emissive cathode, and to minimize thermal gradients along each electrode for power efficiency. As a portion of each housing terminal is silver plated they do not tarnish and thus insure that good electric contact is maintained with mating contacts of the mounting regardless of the fact that other portions of the housing having the same electric potential in electric contact with the mount may become tarnished. Furthermore, flange **18** contacts its mounting mate in a direction coaxially to the tubularly shaped lamp. With this configuration differential expansion between the housing and mounting takes place tangentially thereto. The mating conductor in contact with ring **13** may be a spring-loaded collar to insure its continued contact. With these configurations the electric contacts tend neither to pull apart nor compress one another.

Threads **41** and ring **42** provide the major heat conductive interfaces between the housing and its mount. Nickel-iron alloyed screw threads **41** will expand during thermal cycling at a different rate than their female mates which are made of a material such as stainless steel. Nevertheless with these structures the two thermal conductors will become neither compressed nor fully separated under ordinary cycle ranges. Likewise, the surface of ring **42** will also maintain physical, and thus good thermal contact with its mating surface in the mounting. The taper of its surface has been designed to cause the surface of ring **42** to slide along the surface of its mate under differential expansive conditions therebetween. The projected apex of the truncated, conical surface has been designed to lie along the lamp axis at a point approximately midway between each end of screw threads **41**. This point corresponds to the depth to which stud **40** is screwed into its mounting mate. Of course, in cases where stud **40** is designed to be fully received within its mounting mate, the projected apex of the truncated, conical surface would be changed to coincide with the plane of the interface of stud **40** and cup **34**. In general, then, the apex of the conical surface should lie approximately in a plane coincident with that point of mutual contact between stud **40** and its mounting mate which is nearest to the conical surface. When this condition is met, thermal expansion will cause any point on the surface of ring **42** to move radially from the lamp axis a distance proportional to such radius and longitudinally a distance proportional to its coaxially measured distance to the aforementioned midpoint of the screw threads. The corresponding point along the surface of the mount in abutment with the surface of ring **42** will likewise expand and contract along their taper provided it too is integrally linked to the midpoint of the screw threads. In this manner the surface of **42** also maintains good thermal contact with its mounting mate throughout thermal cycling of the lamp without undergoing mechanical compression.

It should be understood that the described embodiment is merely illustrative of the application of the principles of the invention. Obviously many modifications may be made in this specific example without departing from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. In a sealed beam arc lamp including a housing for confining therewithin an ionizable gas, cathode and anode electrodes within said housing for initiating and maintaining an arc discharge, an optically transparent window in said housing, a reflector for focusing optical radiation emanating from said arc discharge through said window, and mounting means on said housing for supporting said lamp, THE IMPROVEMENT WHEREIN the exterior surface of said reflector is provided with a truncated right circular conical portion, the apex of said conical portion being proximate said mounting means.

2. In a sealed beam arc lamp according to claim **1** further including a positioning ring on said reflector, said positioning ring having on the exterior surface thereof said truncated right circular conical portion.

3. In a sealed beam arc lamp according to claim **1** wherein said optically transparent window is located at one end of said housing and wherein said mounting means comprises an externally threaded stud member located on the opposite end of said housing.

4. In a sealed beam arc lamp according to claim **1** further including a cylindrical getter coaxially surrounding a portion of one of said electrodes in spaced relation therewith.

5. In a sealed beam arc lamp according to claim **1** wherein said housing has a cup-shaped extension affixed to said reflector coaxially about said axis.

6. In a sealed beam arc lamp according to claim **5** wherein one of said electrodes is a solid cylinder mounted within said cup-shaped extension along said axis.

7. In an arc lamp according to claim **5** wherein said mounting means comprises in externally threaded stud affixed to the end of said cup-shaped extension distal said reflector.

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