United States Patent

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[73] Assignee **Sylvania Electric Products Inc.**

[54] **TUNGSTEN HALOGEN LAMP HAVING IMPROVED FILAMENT SUPPORT**
4 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **313/279,** 313/222, 313/274, 313/276, 313/315
[51] **Int. Cl.** **H01k 1/18**
[50] **Field of Search** 313/222, 223, 271, 274, 275, 276, 279, 315

[56] **References Cited**

UNITED STATES PATENTS

3,335,312	8/1967	Cardwell, Jr.	313/279
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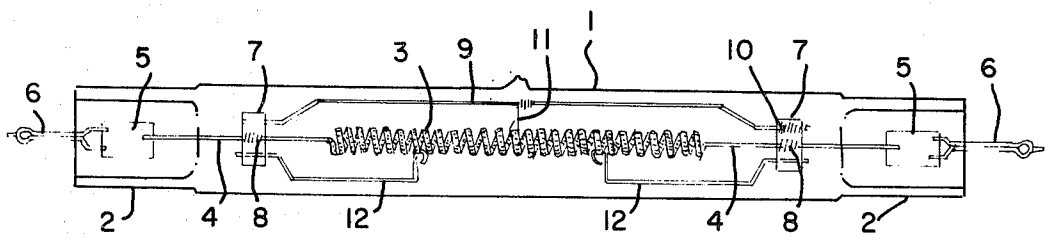
ABSTRACT: A tungsten halogen lamp has a coiled coil filament tensionally mounted and axially disposed within a fused silica tubular envelope. A support rod extends substantially parallel to the filament for at least the entire length thereof. The filament is supported at one or more points throughout its length by means of suitable arms connected to the support rod or by loops in the rod itself. The ends of the support rod can be fixedly attached to rigid lamp members or one end may be slidably supported to permit longitudinal thermal expansion of the rod.



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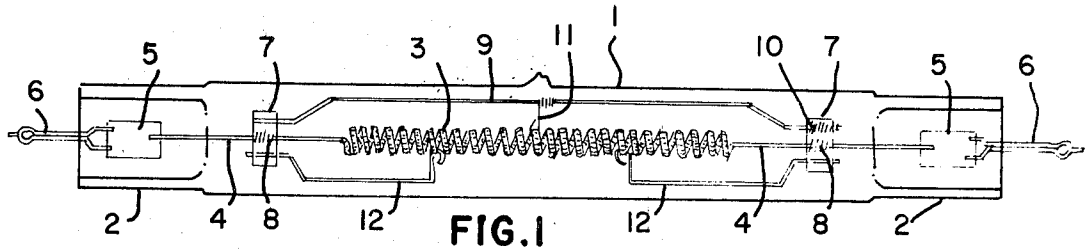

FIG.1

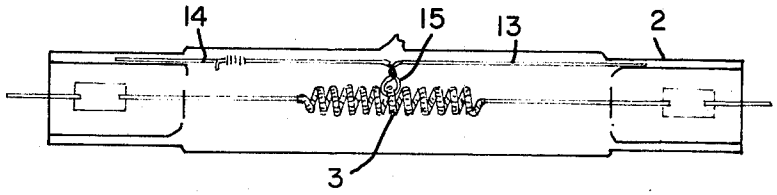

FIG.2

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TUNGSTEN HALOGEN LAMP HAVING IMPROVED FILAMENT SUPPORT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of double ended tungsten halogen lamps and especially to an improved filament mount for such lamps.

2. Description of the Prior Art

Double-ended tungsten halogen lamps heretofore have often comprised a simple helically coiled filament axially disposed within a tubular envelope. In those cases where the filament was long enough to require support at intermediate points throughout its length, spiral wire supports or metal discs could be used to space the filament from the envelope wall. Examples of such supports are shown in U.S. Pat. Nos. 3,443,144, issued to R. W. Freese, Jr. on May 9, 1967, and 3,355,613 issued to D. R. Dayton et al. on Nov. 28, 1967.

Coiled coil filaments came to be used in such lamps when the service requirements thereof dictated the use of heavier wire than could conveniently be used in simple coiled filaments. The heavier wire coiled coil filaments permitted a heavier loading of the filaments in terms of watts of electrical power per inch of filament length; in addition, lamp life could be increased through the use of such heavier wire.

Where the length of coiled coil filaments was such as to require additional support throughout its length, the previously used spiral wire supports or metal discs were unsatisfactory since they failed to grip the coiled coil filament securely or the filament could undesirably rotate within the support. Some methods that were developed to support such coiled coil filaments are shown in U.S. Pat. Nos. 3,408,719, issued on Nov. 5, 1968, to R. H. Van Sickler et al. and 3,225,247 issued on Dec. 21, 1965, to E. G. Audesse et al.

Although the supporting structures shown therein are satisfactory for some purposes, they are not suitable in some applications where, for example, it is desired that the filament comprise an integral length of wire or it is desired that no support wire be embedded in the residual exhaust tube tip. In the latter case, embedment of a wire in the exhaust tip usually necessitates that the tip be longer than it would be if no wire were embedded therein. Additionally, embedment of a wire therein could result in cracking of the fused tip if the diameter of the wire were not kept quite small.

In some lamps, a filament is supported by means of a support wire which has one end embedded in a press seal of the lamp and which has one unsupported end. Such support wires can be satisfactory if they are not too long. However, in filament mounts of this type, it is possible for the unsupported end to be transversely displaced if, say, the wire is quite long in relation to its diameter and the lamp has undergone rough handling. Displacement of the support wire could result in an undesirable displacement of the filament from its precise alignment within the lamp envelope and could, consequently, cause a local hot spot, with possible rupture, of the envelope.

This invention presents an improved filament mount that is capable of maintaining a filament in a substantially constant axial position throughout the life of the lamp.

SUMMARY OF THE INVENTION

A double-ended tungsten halogen lamp, in accordance with this invention, comprises a coiled coil tungsten filament axially disposed within a fused silica transparent tubular envelope. The envelope is hermetically sealed at each end by press seals within each of which is disposed a ribbon connector. Internal lead-in wires connect each ribbon connector to a respective end of the filament. External lead-in wires are connected to the ribbon connectors and extend out of the press seals in order to permit electrical connection to an external electrical power source.

A support rod extending beyond the ends of the filament is longitudinally disposed within the envelope between the filament and the envelope wall, substantially parallel to the filament. The ends of the support rod are mounted in suitably rigid lamp members, such as a press seal or fused silica bridge, located at each end of the lamp.

The filament is supported at one or more points throughout its length by suitable engagement thereof to the support rod. Engagement may be made by suitable hooks or loops formed directly in the support rod or by separate arms attaching the filament to the support rod.

The support rod may be mounted so that each end thereof is fixedly attached to the aforementioned rigid lamp members, such as by embedment within the press seal or silica bridge. However, one end of the support rod may be slidably mounted, such as in a rigidly positioned tubular element, in order to permit longitudinal thermal expansion of the rod.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of a lamp, in accordance with this invention, having a filament mount which includes silica bridges.

FIG. 2 shows an example of a lamp without silica bridges.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1 of the drawing, the lamp illustrated therein is of the regenerative cycle type containing a halogen such as bromine, iodine or chlorine or compounds thereof to maintain the bulb walls free of blackening for a long useful life. The lamp comprises a fused silica tubular envelope 1 having at each end thereof an integral press seal 2. A coiled coil tungsten filament 3 is axially disposed within envelope 1 and is connected at its respective ends to interior lead-in wires 4 having ends hermetically sealed in respective press seals 2 and connected to molybdenum ribbons 5 which are also hermetically sealed therein. Exterior lead-in wires 6 are connected to respective ribbons 5 within press seals 2 and extend externally to provide means for connection to an electrical power source.

The internal end of each lead-in wire 4 is bent into a shape that corresponds to about half of a secondary turn of filament 3. Lead-in wires 4 are connected to respective ends of filament 3 by inserting the bent ends of lead-in wires 4 into the primary turns at each end of filament 3. A secure connection is obtained by use of a lead-in wire 4 having a diameter about 1 mil less than the diameter of the primary mandrel on which filament 3 is coiled.

A fused silica rod or bridge 7 is transversely attached, such as by embedment, to each lead-in wire 4 at a point between each press seal 2 and the respective end of filament 3. In order that the attachment of each bridge 7 to respective lead-in wire 4 be suitably rigid and secure, lead-in wire 4 may have a coil 8 tightly encircling it within the situs of embedment, in the manner shown in U.S. Pat. No. 3,466,489, issued on Sept. 9, 1969, to E. G. Audesse et al.

Support rod 9 is disposed between filament 3 and the bulb wall, substantially parallel to filament 3 for at least the body length thereof. Support rod 9 comprises a halogen-resistant refractory metal, preferably tungsten, and is spaced closer to the bulb ball than to filament 3 in order to prevent heating of support rod 9 to an undesirably high temperature during lamp operation. The ends of support rod 9 can be supported by embedment thereof in bridge 7, as shown at the left end of the lamp in FIG. 1, support rod 9 being bent beyond the filament body to bring it into register with bridge 7.

In cases where the position, length and operating temperature of support rod 9 is such that transverse deformation thereof could occur due to thermal elongation if both ends were rigidly fixed, one end, shown as the right end in FIG. 1, can be slidably supported in a tubular element, such as coil 10. Upon thermal elongation of support rod 9, the left end remains rigidly fixed but the right end can slide within coil 10 to compensate for the elongation. The relationship of coil 10 to support rod 9 is such that, while relative axial motion, i.e., elongation, is permitted therebetween, radial or transverse

motion is substantially prevented. In one example where the diameter of support rod **9** was 35 mils, satisfactory results were obtained when coil **10** had an inside diameter of 40 mils. Coil **10** was wound from a length of 8 mil tungsten wire at about 100 to 110 percent pitch and was partially embedded in bridge **7** in the manner previously described. The pitch of coil **10** should not exceed about 150 or 200 percent in order to prevent excessive silica flow between the turns during embedment.

Although coil **10** comprises the slidable support of the specific embodiment shown, other slidable supports may be used with satisfactory results. For example, the slidable support may comprise a tube of refractory sheet metal that is rigidly supported or it may even comprise a hole through fused silica bridge **7**.

In the lamp shown in FIG. **1**, filament **3** is supported at its center by means of arm **11** attached to support rod **9**. Arm **11** comprised a length of 15 mil tungsten wire formed into a coil at one end and a hook at the other end. The hook securely encircled a primary turn of filament **3** and the coiled end of arm **11** engaged support rod **9** by encirclement thereof.

Additional support for filament **3** at points between the center and the ends thereof is provided by support wires **12** at each end of the filament mount. One end of each support wire **12** is embedded in respective bridge **7** and the other end, hook shaped, engages and supports respective points of filament **3**.

In order to improve the embedded attachment of support wires to bridge **7** for those wires which do not include an encircling coil **8** within the situs of embedment, a shallow groove may be formed in the embedded portions of the wires or the wires may have a small angular bend therein. Such grooves or bends aid in improving the mechanical bond between the fused silica and wire and in preventing rotation and loosening of the wire within the bridge.

In the manufacture of a 3,000-watt, 180-volt, 85,000-lumen lamp of the type shown in FIG. **1**, filament **3** was formed by first primary coiling, then secondary coiling a long length of tungsten wire, and then cutting the coiling into lengths of 2.8 inches. Inserts **4**, support wires **12** and support rod **9** with arm **11** thereon were then connected to filament **3** and, the assembly being mounted in a suitable positioning device, left bridge **7** was heated to the softening point and impressed on respective elements **12**, **4** and **9**. Right bridge **7** was similarly connected to respective elements **12** and **4** and coil **10**. Filament **3** was then stretched sufficiently to permit insertion of the right end of support rod **9** into coil **10**.

An outer lead assembly comprising ribbon **5** and external lead-in wire **6** was then welded to each respective lead-in wire **4** and the filament mount was inserted into a ¾-inch diameter open-ended fused silica envelope **1**. Press seals **2** were then formed in the envelope, the filament being stretched 1 or 2 mm. at the time of forming the second press seal in order to maintain the filament in tension and provide for expansion during operation. Envelope **1** was then exhausted, filled and sealed in the usual manner to complete the lamp. During normal operation, the electrical loading on the finished lamp was about 1,000 watts per inch of filament length.

FIG. **2** shown another embodiment of a lamp in accordance with this invention in which the ends of the support rod are embedded directly in the press seals. The support rod therein comprises two separate elements, a long member **13** and a short member **14**. Long member **13** has one end embedded in right press seal **2** and extends substantially parallel to and beyond the body of filament **3** except for an intermediate portion **15** that bends around and supportingly engages a primary turn of filament **3** at about the center thereof. Short member **14** has one end embedded in left press seal **2** and the other end formed into a coil, similar to coil **10** of FIG. **1**. Members **13** and **14** are substantially collinear, the innermost end of member **13** extending through and slightly beyond the coil of member **14**. In FIG. **2** the extensional portion of member **13** is shown bent at a right angle, the purpose of which is to prevent withdrawal thereof during assembly of the mount and manufacture of the lamp.

Although the embodiments shown herein illustrate only one point of support between the support rod and filament **3**, it is within the contemplation of this invention that filament **3** may be supported at additional points throughout its length by the support rod. For example, there may be additional supporting arms **11** therebetween as in FIG. **1**. Or the support rod may be looped or bent around filament **3**, in the manner shown in FIG. **2**, at several points thereof.

We claim:

1. A tungsten halogen lamp comprising: an elongated fused silica envelop having press seals at each end thereof and a fill including a halogen; ribbon connectors hermetically sealed within said press seals; an elongated coiled-coil tungsten filament axially disposed and tensionally mounted within said envelope; internal lead-in wires connecting each end of said filament to a respective ribbon connector; external lead-in wires connected to said ribbon connectors; two silica bridges disposed within said envelope, one bridge near each end of said envelope, said bridges being supported by said respective internal lead-in wires; an elongated halogen-resistant means extending longitudinally within said envelope beyond both ends of said filament, said means supporting said filament and substantially preventing transverse displacement thereof, one end of said means being rigidly supported in one of said bridges and the other end of said means being slidably supported in the other of said bridges.

2. The lamp of claim **1** wherein the slidably supported end of said means is disposed within a tubular member embedded in a fused silica bridge.

3. The lamp of claim **1** wherein the slidably supported end of said means is disposed within a hole through a fused silica bridge.

4. The lamp of claim **2** wherein said tubular member comprises a tungsten coil wound at between about 100 to 200 percent pitch.

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