

[54] TUNGSTEN HALOGEN LAMP HAVING  
IMPROVED SEAL OF MOLYBDENUM  
ALUMINIDE

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[58] Field of Search ....313/315, 317, 318

[56]

References Cited

UNITED STATES PATENTS

3,549,933 12/1970 Smalley.....313/318 X  
3,211,826 10/1965 Holcomb et al.....313/318 UX

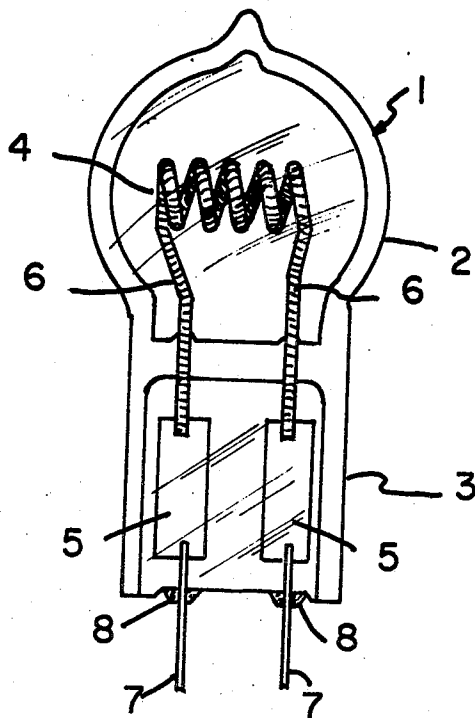
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ABSTRACT

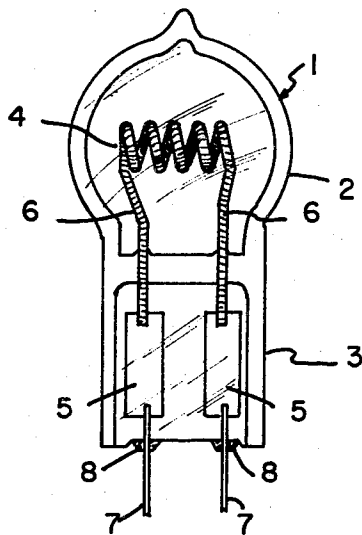
A tungsten halogen lamp has molybdenum ribbon connectors embedded within a press seal of the lamp. A molybdenum lead-in wire extends from each ribbon connector externally of the press seal. The lead-in wire has an oxidation resistant molybdenum aluminide coating thereon. A bead of soft glass seals the opening in the press seal caused by the lead-in wire.

10 Claims, 1 Drawing Figure



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# TUNGSTEN HALOGEN LAMP HAVING IMPROVED SEAL OF MOLYBDENUM ALUMINIDE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates to tungsten halogen lamps. Such lamps have a quartz or other high silica glass envelope and a fill including halogen.

### 2. Description of the Prior Art

The high silica glass used in tungsten halogen lamps is not as readily sealable as are lower melting point glasses, such as the so-called soft and hard glasses commonly used in lamp manufacture. As a result, tungsten halogen lamp envelopes are generally sealed by means of a press seal. Such a seal is formed by heating the open end of a tubular envelope to the softening point and then pressing the end between two jaws to form a press seal.

Because of the high operating temperature of such lamps, a molybdenum ribbon connector is usually embedded within the press seal in order to provide for electrical connection to the lamp and to prevent seal failure due to thermal expansion. Examples of such lamps are shown in U. S. Pats. No. 3,497,753 and No. 3,466,489.

Such press seals are generally satisfactory when the seal temperature, during operation of the lamp, is not excessively high. However, at seal temperatures above about 350° to 400°C, the external lead-in wire can oxidize, the rate of oxidation increasing with temperature, and cause premature seal failure. The reason for the oxidation is that since the external lead-in wire is not completely hermetically sealed within the press seal, air can penetrate part way into the press seal around the lead-in wire and cause oxidation of the heated wire. The resultant increase in wire diameter caused by the oxide formation can cause excessive stresses in the press seal, leading to a premature seal failure. Such a condition is especially likely to occur when the lead-in wire is made of molybdenum.

## SUMMARY OF THE INVENTION

A tungsten-halogen lamp in accordance with this invention has a tungsten filament within a high silica glass envelope; the envelope also has a fill including halogen in order to provide regeneration of the filament, as is known in the art.

The envelope has a press seal at one or both ends thereof; completely embedded within the press seal is a thin molybdenum ribbon connector. Internal lead-in wires connect the ribbon connectors to separate ends of the filament. External molybdenum lead-in wires are attached to the ends of the ribbon connectors and extend externally of the press seal in order to provide for electrical connection of the filament to an external power supply.

In order to prevent oxidation of the external molybdenum lead-in wires, there is a molybdenum aluminide coating on the surface of said wires. The molybdenum aluminide coating is preferably formed by a reaction with the molybdenum wire so that the coating is chemically bonded to the molybdenum, that is, the coating is an integral part of the wire and will not separate or "peel" therefrom. Preferably, the coating is quite thin, less than about 1 mil, in order to not impair the connection, such as by welding, of the wire to the molybdenum ribbon.

In operation, the aluminum in the aluminide coated wire oxidizes to aluminum oxide, in the presence of air; the aluminum oxide thus formed prevents further oxidation of the metal underneath.

In the formation of a press seal around the molybdenum ribbon connectors and the lead-in wires connected thereto, there can often be a minuscule air passage between the wire and the embedding silica glass. Such a passage can often extend from the end of the press seal to the molybdenum ribbon connector. The effect of such a passage is that air can slowly penetrate therein and cause oxidation of the molybdenum ribbon connector. Such a result can be accelerated in miniaturized

lamps, of the type shown in the drawing, where the press seal is at temperatures above about 400°C. during operation.

In order to prevent penetration of air into the passage and thereby protect the ribbon connector from oxidation, the passage can be substantially sealed by a bead of soft glass melted around the terminus of the lead-in wire at the end of the press seal. The soft glass has a lower melting point than does the high silica glass, about 500° to 600°C for the soft glass versus about 1500° to 1600°C for high silica glass. Thus, the soft glass can flow to some extent into the interstice between the wire and the silica glass. In addition, the soft glass fuses to the silica glass and bonds well to the wire.

## BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE in the drawing is an elevational view of a single-ended tungsten halogen lamp in accordance with this invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawing, tungsten halogen lamp 1 has a high silica glass envelope 2 having a press seal 3 at one end thereof. Disposed within envelope 2 is tungsten filament 4. Completely embedded within press seal 3 are two spaced apart molybdenum ribbon connectors 5. Filament 4 has two legs 6, the legs being connected to the ends of separate ribbon connectors 5. External lead-in wires 7 are welded to the opposite ends of ribbon connectors 5 and protrude externally of press seal 3. Lead-in wires 7 consist of straight lengths of 25 mil molybdenum wire and have a coating of molybdenum aluminide, about 0.3 to 0.5 mils thick, thereon.

The aluminide coating was formed by packing the wires in a mixture consisting of 90 parts of aluminum powder, 10 parts of inert material (such as powdered silica) and 1 part of halide activator (such as sodium fluoride) and then heating the packed wires at 1,900°F for 2 hours in a hydrogen atmosphere.

The interstitial passages around lead-in wires 7 were sealed by means of a soft glass bead 8 applied in the following manner: after lamp 1 had been exhausted, filled and sealed, a short length, about ½ mm. long, of soft glass tubing, about 40 mil I.D. and 100 mil O.D., was disposed around the terminus of each lead-in wire 7 abutting the end of press seal 3. A sharp flame was then used to melt the glass tubing (melting point about 500° to 600°C) and cause it to partially flow into the interstices, fuse to press seal 3 and bond to lead-in wires 7.

Life tests on two groups of 650 watt lamps, having a rated life of 25 hours, were made. The lamps had an operating temperature in the middle of the press seal of 625°C, considerably higher than any published rating for tungsten halogen lamps. The first group of lamps had aluminide coated wires and soft glass bead seals in accordance with this invention and the second group of lamps were prior art lamps, that is, without aluminide coating or soft glass bead seals.

The first group of lamps operated for substantially the rated life thereof, about 25 hours, and failed in the normal fashion, that is, because of tungsten evaporation from the filament. The second group of lamps failed in about 5 to 10 hours and the failure due to rupturing or cracking of the press seals.

Although this invention has been described with particular reference to tungsten halogen lamps, it is also applicable to other lamps having a press seal with a thin ribbon connector embedded therein and where oxidation of the external lead-in wire or of the ribbon connector can cause premature lamp failure. Quartz infrared heating lamps are an example. Such lamps are similar to tungsten halogen lamps with the exception that the lamp fill contains no halogen.

The invention may also be useful in the field of arc discharge lamps, since the arc tubes thereof generally have press seals at either end thereof. Such lamps do not have a filament in the arc tube but have, instead, electrodes at each end of the arc tube. Thus, each embedded ribbon is connected to an electrode.

I claim:

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1. A tungsten halogen lamp comprising: a high silica glass envelope having a press seal; a filling within said envelope including halogen; a tungsten filament within said envelope, a molybdenum ribbon connector embedded within said press seal; means electrically connecting said filament to said ribbon connector; a molybdenum external lead-in wire connected to said ribbon connector within said press seal, said lead-in wire protruding externally from said press seal, said lead-in wire having a molybdenum aluminide coating thereon.

2. The lamp of claim 1 wherein said coating is chemically bonded to the molybdenum wire.

3. The lamp of claim 1 wherein said coating is less than about 1 mil thick.

4. The lamp of claim 1 wherein a soft glass bead seals the terminus of said lead-in wire at the end of said press seal.

5. The lamp of claim 4 wherein said bead is fused to the high

silica glass of said press seal and is bonded to said lead-in wire.

6. The lamp of claim 5 wherein said soft glass extends partially inward in said press seal around said lead-in wire.

7. A lamp comprising: a high silica glass envelope having a press seal; a molybdenum ribbon connector embedded within said press seal; a molybdenum external lead-in wire connected to said ribbon connector within said press seal, said lead-in wire protruding externally from said press seal, said lead-in wire having a molybdenum aluminide coating thereon.

8. The lamp of claim 7 wherein said coating is chemically bonded to the molybdenum wire.

9. The lamp of claim 7 wherein said coating is less than about 1 mil thick.

10. The lamp of claim 7 wherein a soft glass bead seals the terminus of said lead-in wire at the end of said press seal.

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