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[54] **EXPLOSION PROOF QUARTZ-HALOGEN LAMP**
2 Claims, 1 Drawing Fig.

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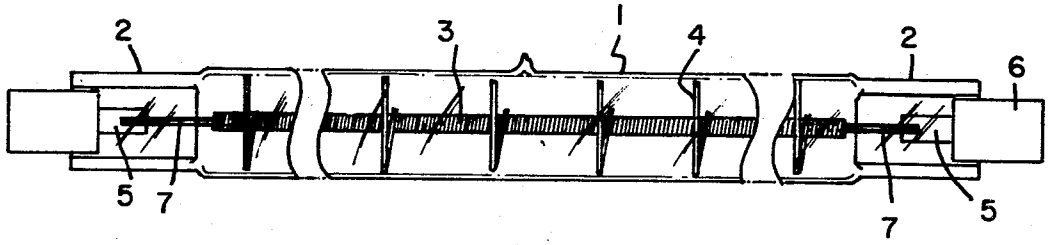
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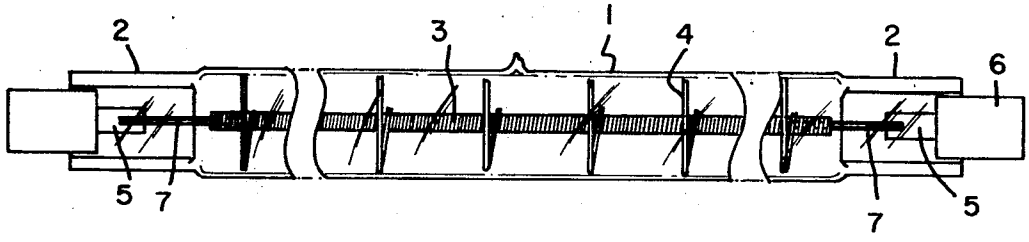
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ABSTRACT: A quartz-halogen lamp has a coiled filament connected to a ribbon connector by a tungsten conductor, the ribbon connector being embedded within a press seal of the lamp envelope.

The diameter of the conductor is at least about three times the diameter of the filament wire in order to prevent lamp explosions resulting from high amperage arcs that may occur at the time of filament failure.





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EXPLOSION PROOF QUARTZ-HALOGEN LAMP

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of quartz-halogen lamps. It especially relates to those lamps having a normal operating voltage of about 110 volts or higher and having a fill capable of being ionized.

2. Description of the Prior Art

Quartz-halogen lamps are efficient, compact sources of high intensity incandescent light and their commercial use has been steadily increasing since their inception several years ago. The construction of some halogen cycle incandescent lamps is such that the filament is connected into the lamp seal with an extension of the filament wire or with a separate tungsten wire the diameter of which is about the same or slightly larger than the filament wire. In the operation of such lamps, the incandescent tungsten filament gradually erodes until, at some point when the filament wire has decreased in diameter about 10 to 20 percent, the filament breaks. This failure of the filament caused no unusual problems in low voltage lamps, or lamps that do not sustain arcs upon failure, other than a normal replacement of the lamp. However, in those lamps having a particular combination of fill gas, fill pressure, applied voltage and lead tip spacing, an electric arc could occur across the filament break at the instant of failure. Ionizable gas, such as nitrogen, argon, halogen, krypton and the like, in the fill of the lamp permitted the arc to be instantaneously drawn between the lead-in wires of the lamps, thereby completely bypassing the filament. The electrical current resulting from such an arc could easily be in the order of several hundred amperes and could result in an extremely rapid heating of the lamp lead-in wires. Since one end of the lead-in wire was embedded in the press seal, where it was connected to a ribbon connector, the quartz surrounding the lead-in wire was also subjected to a great amount of rapid heating. The resultant thermal shock to the press seal in addition to mechanical stress induced by thermal expansion of the embedded lead-in wire could be sufficient to crack or weaken the press seal or envelope and cause an explosion of the lamps envelope. The results of the explosion were magnified because of the high pressure of the hot fill gases within the lamp envelope.

Since the elapsed time from filament failure to lamp explosion was extremely short, in the order of a few milliseconds, ordinary circuit protective devices, such as fuses or circuit breakers, would not prevent such explosions.

SUMMARY OF THE INVENTION

A quartz-halogen lamp in accordance with this invention has a coiled tungsten filament within a high silica glass envelope. Disposed within the envelope is a gaseous fill including halogen. The filament is connected to a thin molybdenum ribbon connector embedded in a press seal of the envelope, either by connecting a coiled filament having an insert therein directly to the ribbon or by means of a conductor connecting a filament leg to the ribbon. In any case, the diameter of the conductor that is connected to the ribbon and that extends into the envelope beyond the press seal area must be appreciably greater than the diameter of the filament wire, generally at least about three times greater. The reason for the larger mass of the conductor is this: when the filament eventually burns out and an arc thereacross is drawn, the conductor will not heat up as rapidly as would a thinner lead-in wire or the filament leg itself if it were connected directly to the embedded ribbon. The slower heating time resulting from the use of a heavier conductor permits the usual circuit interrupting devices, such as fuses or circuit breakers, to open the electrical circuit before the conductor has heated or expanded sufficiently to cause the lamp envelope to explode.

As mentioned above, the conductor should have a diameter of at least about three times the diameter of the filament wire in order to effectively prevent lamp explosions caused by arcing current at filament failure. This ratio, however, is dependent on the construction details of a particular lamp and especially on such characteristics as the operating voltage of the lamp, the thickness and area of the press seal, the diameter of the filament wire and the type of lamp fill.

In addition, for adequate protection against explosion, the thickness of the press seal should be at least double the diameter of the conductor embedded therein. Otherwise, the press seal may not be able to withstand the thermal shock resulting from even the slower heating of the conductors used in accordance with this invention. Preferably, for optimum protection against explosions, the conductor should be embedded substantially centrally within the press seal.

BRIEF DESCRIPTION OF THE DRAWING

The single drawing is an elevational view of a quartz-halogen lamp in accordance with this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawing, a quartz-halogen lamp in accordance with this invention comprises a tubular high silica glass envelope **1** having press seals **2** at either end thereof. Axially disposed within envelope **1** is a coiled tungsten filament **3** supported throughout the length of envelope **1** by spacers **4**. Completely embedded within press seals **2** are thin molybdenum ribbons **5** which are connected to external connectors fastened to ceramic bases **6**. Ribbons **5** are connected to the ends of filament **3** by means of tungsten wire conductors **7**, the diameter of conductors **7** being relatively massive in relation to the diameter of the tungsten wire of filament **3**. One end of conductor **7** is embedded within press seal **2** where it is connected to ribbon **5**, preferably by welding. The other end of conductor **7** protrudes axially into the interior of envelope **1** where it is connected to one end of filament **3**. Preferably that end of conductor **7** has a small coil tightly encircling it and the coiled end of filament **7** is screwed onto the small coil in order to establish a satisfactory mechanical and electrical connection between filament **3** and conductor **7**.

Envelope **1** contains a gaseous fill including an inert gas and a halogen. In operation, such a fill can ionize and result in a high current arc directly between conductors **7** at the time that filament **3** fails. However the mass of conductor **7** lowers the heating and expansion rate of conductor **7** and the surrounding portion of press seal **2** sufficiently to permit external protective devices to open the circuit before press seal **2** and/or envelope **1** ruptures or explodes.

In example, a 240 volt, 800 watt, T3 lamp had an overall envelope length of 4 inches and an outside diameter of three-eighths inch. Filament **3** was made of 6 mil tungsten wire coiled on a 48 mil mandrel at 102 turns per inch and had a coiled length of 2¾ inches. Conductor **7** consisted of a three-eighths inch length of 30 mil tungsten wire and had, at one end, a small coil consisting of 6 of 10 mil tungsten wire tightly encircling it. The small coil had previously been formed on a 28 mil mandrel; thus, when it was inserted onto conductor **7**, the fit therebetween was tight and secure. Conductor **7** was connected to filament **3** by screwing the small coil into one end of filament **3**.

The other end of conductor **7** was welded to ribbon **5** within press seal **2**, about one-half of the length of conductor **7** being embedded within press seal **2**. Press seal **2** was about five-eights inch long by seven-sixteenths inch wide by 0.093 inches thick, the thickness thus being about 3 times the diameter of the embedded portion of conductor **7**. Conductor **7** was disposed substantially symmetrically within press seal **2** to minimize any strains that might result from a nonuniform embedment.

When the lamps were operated to the point of filament failure, no explosions resulted from the arc occurring at filament failure within the time interval required for an ordinary circuit breaker to open the circuit. In contrast, such lamps invariably exploded at filament failure when the 6 mil filament wire was directly connected to the molybdemum ribbon.

In another example, in a 185 volt, 100 watt, T3 lamp the ratio of the diameter of conductor 7 to the diameter of the filament wire was about 3½ to 1, the diameter being 28 mils and 8 mils respectively. The 28 mil conductor similarly eliminated the explosions that had previously resulted when the 8 mil filament wire was connected directly to the molybdenum ribbon. In this example, the ratio of the thickness of the press seal to the diameter of the conductor wire was about 3 to 1.

In some cases, the inside diameter of a coiled filament may not be large enough to permit insertion therein of a conductor wire having at least three times the diameter of the filament wire. In such cases, the coiled end of the filament may be extended into the press seal region and, along with a conductor wire insert tightly fitted within the coiled end, be welded directly to the molybdenum ribbon. The insert, of course, should extend out of the press seal embedment a short distance into the interior of the envelope. In order to adequately protect against explosions at the time of filament failure, the diameter of the insert wire should be at least about 2 or 2½ times the diameter of the filament wire. The heat dissipating mass within the press seal embedment, then, consists of the combination of the insert and the coiled filament wire.

Although the invention has been described with particular reference to double-ended lamps having a press seal and a heat dissipating conductor at either end of a lamp envelope, it is also applicable to single-ended quartz-halogen lamps wherein the lead-in wires and molybdenum ribbon connectors are embedded within a single press seal at one end of the lamp envelope. Such lamps, in fact, are more likely to arc at the time of filament failure than are double ended lamps because of the closer spacing of the lead-in wires, which results in a shorter arcing distance.

We claim:

1. A tungsten-halogen lamp comprising; a tubular high silica glass envelope having a press seal at each end thereof; separate ribbon connectors embedded in each press seal; a coiled tungsten wire filament, having coiled ends, axially disposed within said envelope, each filament end electrically connected to one of said ribbon connectors; separate heat-dissipating tungsten conductors inserted into said coiled ends, one end of each of said conductors being embedded in a press seal, the diameter of said conductors being at least three times the diameter of said filament wire, the thickness of said press seal being at least double the diameter of the embedded portions of said conductors; and a gaseous fill within said envelope, said fill being ionizable at the normal operating voltage of said lamp and capable of forming an arc between said conductors upon filament failure.

2. The lamp of claim 1 in combination with an electric supply circuit having a circuit interrupting device therein, the relationship between said lamp and said device being such that upon failure of the lamp filament under arc causing conditions, said device opens the circuit before the lamp explodes.