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(54) Metal halide lamp with arc tube shield support.

(57) An improved metal halide discharge lamp having an outer envelope wherein is disposed an arc tube, a cylindrical member that prevents shard dispersion upon fracture of the arc tube and frame means. The arc tube and cylindrical member are both supported within the lamp by the frame means. The frame means is comprised of a single wire member having a small circular portion, a helical portion and a substantially straight portion. The straight portion may have a small wire attached thereto, in order to secure the cylindrical member in place when the member positioned within the helical portion of the frame means. The arc tube is electrically coupled to the frame means and is concentric to the cylindrical member.

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METAL HALIDE LAMP WITH ARC TUBE SHIELD SUPPORT

TECHNICAL FIELD

The present invention relates, in general, to metal halide discharge lamps and more particularly to metal halide discharge lamps configured to prevent breakage of the lamp's outer envelope by reducing shard dispersion upon an arc tube fracture.

BACKGROUND OF THE INVENTION

The high pressure discharge lamps of the invention operate by vaporizing mercury and selected metal halides and often are simply called metal halide lamps. High wattage metal halide lamps which achieve relatively high efficacy are known in the art. However, these high wattage lamps are too large for general illuminating purposes in a home or the like. Intermediate wattage metal halide lamps which can be used for some general illuminating purposes are known but their efficacy is low when compared with lamps of large sizes.

Through the recent development of miniature arc tubes, lamp designers have been able to achieve acceptable efficacies in smaller sizes of metal halide discharge lamps to justify its use as a replacement for the standard incandescent lamp. However, the remote possibility of a minor dispersion of glass shards resulting from a fracture of the pressurized light-source capsule (e.g., arc tube) contained within the lamp is a substantial impediment in the path of developing a feasible replacement in the industrial or commercial market. Although occurrence of such a fracture is rare, nevertheless,

it could present a safety hazard to a person or object in the immediate vicinity of the lamp (i.e., food preparation). Therefore, it would be desirable to devise a simple method that would allow for the safe use of such a lamp in an open fixture. An arc discharge lamp which substantially eliminates the problem of shard dispersion upon the fracture of the light-source capsule would constitute an advancement in the art.

Methods have been suggested to improve the ability of tungsten halogen and arc discharge lamps to withstand a fracture of the inner light-source capsule. In one example, the shards are restricted from impacting with the outer envelope through the use of a cylindrical body disposed about the arc tube, U.S. Patent 4,281,274, issued July 28, 1981 to Bechard et al. The problem with the arrangement described in Bechard et al is that the structure for mounting both the arc tube and the particular cylindrical body is complex and requires welding several parts together. This leads to increased cost and manufacturing difficulties during the process of making such a lamp.

It is believed, therefore, that an electric lamp that provides for a simple and inexpensive means for mounting an arc tube and preventing shard dispersion upon an arc tube fracture, and would also overcome the other disadvantages associated with the prior art devices mentioned above, would constitute a significant advancement in the art.

DISCLOSURE OF THE INVENTION

It is, therefore, a primary objective of this invention to overcome the disadvantages of the prior art devices such as mentioned above.

It is another object of this invention to provide an electric lamp which will substantially eliminate the possibility of minor shard dispersion upon fracture of a pressurized light-source capsule that is simple and inexpensive to manufacture.

Another object of this invention is to provide means for supporting a light-source capsule and containment means about the capsule which will cause little or no loss of luminous efficacy in lamps utilizing such means.

In accordance with one aspect of the present invention, there is provided an improved metal halide discharge lamp of the type having an outer envelope, a stem member located within the outer envelope having a pair of electrical conductors extending therefrom and a frame means located within the outer envelope and supported by one of the electrical conductors. The lamp also includes an arc tube, supported by and electrically coupled to the frame means, having a chemical fill including a sodium halide. The arc tube has a pair of electrical leads sealed into and passing through at least one end thereof to provide a pair of electrodes therein. A cylindrical member is also included in the lamp which is supported by the frame means and surrounds the arc tube. The improvement in the lamp lies with the frame means which comprises a single wire member, having a particular configuration, which supports the arc tube within the lamp and fixedly maintains the cylindrical member about the arc tube. The frame means extends along an axis substantially parallel to the longitudinal axis of the lamp.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE illustrates one embodiment of the metal halide lamp made in accordance with the teachings of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

For a better understanding of the present invention, together with other and further objects, advantages, and capabilities thereof, reference is made to the following disclosure and appended claims in conjunction with the above described drawing.

As used herein, the term "light-source capsule" denotes: an arc tube of an arc discharge lamp, or any light emitting capsule within the outer envelope of the lamp wherein the light-source capsule operates at a pressure other than atmospheric and the possibility of minor shard dispersion upon fracture of the light-source capsule exists.

Referring now to the drawing with greater particularity, the FIGURE shows a metal halide lamp 10 made in accordance with the teachings of the present invention. Metal halide discharge lamp 10 includes an evacuated outer envelope 12, which is hermetically sealed to a glass stem member 14, and an external base 16. Base 16 is formed for easy connection to an electrical source and is affixed to the hermetically sealed stem member 14 and outer envelope 12. A pair of electrical conductors 18 and 20 are sealed into and pass through stem member 14 and are electrically connected to base 16, external of outer envelope 12, to provide access for energization of discharge lamp 10.

Within evacuated outer envelope 12 and affixed to electrical conductor 20 is an electrically conductive frame means 22. Frame means 22 extends along an axis substantially parallel to the longitudinal axis of discharge lamp 10 and includes a circular portion 24, in operative contact with an uppermost portion 23 of outer envelope 12, a helical portion 25 and a substantially straight portion 26. Circular portion 24, in conjunction with the uppermost portion 23, and stem member 14 serve the dual function of maintaining frame means 22 in proper alignment and resisting deformation due to external shock to discharge lamp 10.

Disposed within outer envelope 12 is a cylindrical member 36, which may be in the form of a quartz sleeve or shield, which is supported by frame means 22. Also supported by frame means 22 and contained within quartz shield 36 is an arc tube 28. Arc tube 28 has a chemical fill including a sodium halide and electrodes 29 and 30 at one end thereof. Moreover, electrode 29 is mechanically and electrically connected to frame means 22 through an electrical lead 32 while electrode 30 is affixed to an electrical lead 34 which passes above a portion of cylindrical member 36 and is electrically and mechanically connected to electrical connector 18 by a connector wire 40. Wire 40 is preferably made of molybdenum. Cylindrical member 36 is located within and is supported by helical portion 25 of frame means 22. Cylindrical member 36 is secured in frame means 22 by a bend 21 and a small nickel wire 38 which is welded to the upper most part of said straight portion 26 of frame means 22. A small kink or bend in the uppermost part of straight portion 26 may be substituted for wire 38 in securing cylindrical member 36 in position.

The purpose of the present invention is to provide a simple and inexpensive means for maintaining the cylindrical member

about the arc tube and mounting the arc tube within the lamp without both a reduction in lamp performance and damage to the outer envelope. Three conditions had to be met in order to arrive at a solution to the aforementioned problem. Firstly, the particular cylindrical member to be used, which is a transparent shield or quartz tube, had to be securely held in place in such a manner so that it did not come in contact with the arc tube. Secondly, proper distances had to be maintained between the electrical conductors of opposite electrical potential. Thirdly, the arc tube and the cylindrical member had to be held securely in their proper positions during regular handling. Any breach of the above conditions would have reduced lamp performance, shortened lamp life and would not have provided a permanent solution to preventing outer envelope damage due to an arc tube fracture.

In the present invention the solution to the aforementioned problem was a cylindrical member 36 positioned about arc tube 28, in the form of quartz shield, in conjunction with frame means 22 within outer envelope 12. A single wire member is used to form frame means 22, thereby eliminating the need for welding together several wires in order to form the frame structure that supports quartz shield 36 and arc tube 28 itself. As illustrated in the FIGURE, arc tube 28 is parallel and substantially concentric to both quartz shield 36 and helical portion 25 of frame means 22. Lead 32 is electrically coupled to frame means 22 and lead 34 is electrically coupled to conductor 18, in stem member 14, by connector wire 40.

In one particular embodiment, a 40-watt lamp required the use of a quartz shield which had a wall thickness of about one millimeter in order to prevent the dispersion of shards and ultimate breakage of the outer envelope. The frame means was partially formed in a helix in order to allow the quartz shield

to be inserted freely and pushed up to touch the bend in the frame means (see the FIGURE). The length of the frame means was about 95 millimeters (mm). The helical portion was about 30 mm in length and had an average diameter of about 20 mm. In addition, the length of the quartz shield was about 38 mm and the diameter was about 19 mm.

In laboratory tests of the 40-watt metal halide lamp, purposely induced fractures of arc tube 28in the lamps proved that quartz shield 36, with the one millimeter wall thickness, was sufficient to prevent glass shards from damaging outer envelope 12. Cylindrical member 36 may also be made of other materials suitable for withstanding shard impact (i.e., hard glass). Additional testing showed that the use of quartz tubing and the helical frame had a negligible effect on lamp performance and lamp life. Other similar type lamps can be made shard-dispersion-proof by varying the diameter of the helical frame and the thickness of the quartz shield.

Thus, there has been shown and described an improved metal halide lamp that provides frame means therein for mounting an arc tube and fixedly maintaining a cylindrical member about the arc tube which will prevent shard dispersion upon a fracture of the arc tube itself. More particularly, frame means is provided in the form of a single wire member, which is parallel to the longitudinal axis of the lamp, that will serve to support the arc tube and the cylindrical member about the arc tube, thereby simplifying and lowering the cost of making such a lamp.

While there have been shown what are at present to be the preferred embodiments of the invention, it will be apparent to those skilled in the art that various changes and modifications can be made herein without departing from the scope of the invention as defined in the appended claims.

CLAIMS

WHAT IS CLAIMED IS:

1. An improved metal halide discharge lamp of the type having an outer envelope, a stem member located within said outer envelope having a pair of electrical conductors extending therefrom, frame means located within said outer envelope and supported by one of said electrical conductors, an arc tube supported by and electrically coupled to said frame means having a chemical fill including a sodium halide, said arc tube having a pair of electrical leads sealed into and passing through at least one end thereof to provide a pair of electrodes therein and a cylindrical member supported by said frame means and surrounding said arc tube, the improvement wherein said frame means comprises:

a single wire member, having a particular configuration, which supports said arc tube within said lamp and fixedly maintains said cylindrical member about said arc tube, said frame means extending along an axis substantially parallel to the longitudinal axis of said lamp.

2. The improvement according to Claim 1 wherein said particular configuration of said frame means comprises a small circular portion, a helical portion and a substantially straight portion, said circular portion being in operative contact with said outer envelope and said straight portion having means for securing said cylindrical member in position.

3. The improvement according to Claim 2 wherein said means for securing said cylindrical member includes a small wire welded to said straight portion of said frame means.

4. The improvement according to Claim 1 wherein said cylindrical member is a quartz sleeve that prevents shard dispersion upon a fracture of said arc tube.

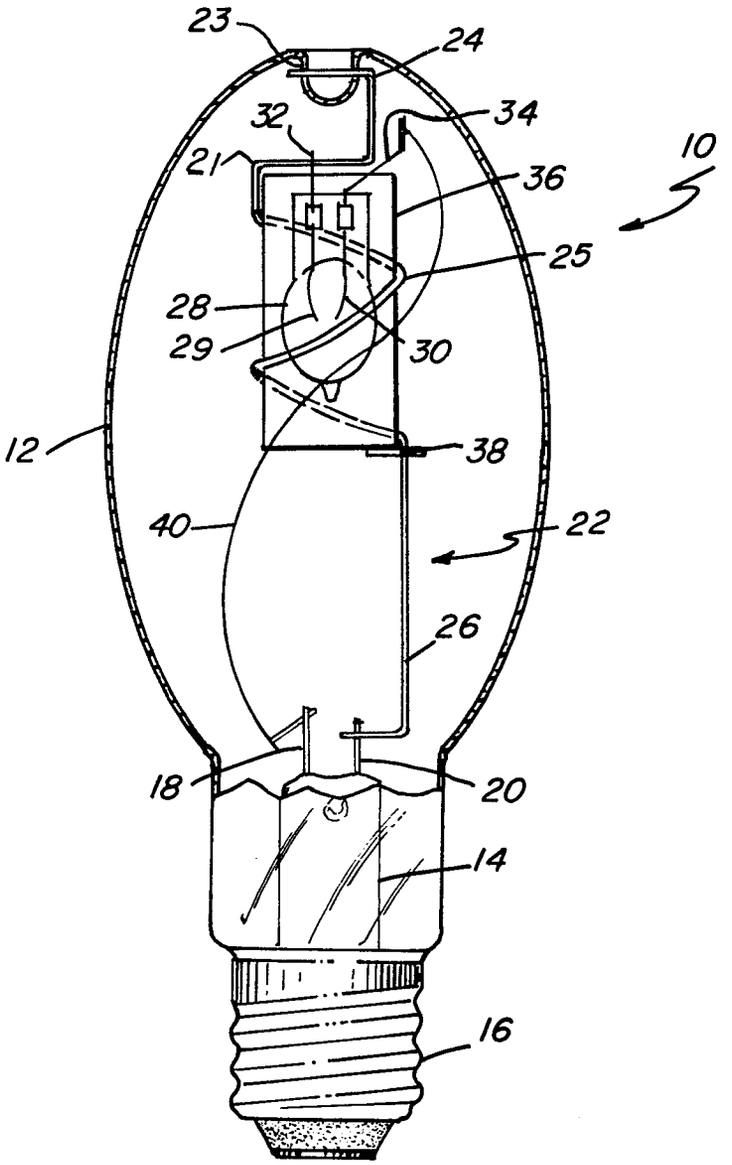
5. The improvement according to Claim 4 wherein said quartz shield has a wall thickness of about 1 millimeter for a 40-watt lamp.

6. The improvement according to Claim 4 wherein said arc tube is parallel and substantially concentric to said quartz shield and said helical portion of said frame means, one of said electrical leads of said arc tube is electrically coupled to said frame means and other of said electrical leads is electrically coupled to an electrical conductor in said stem member by a connector wire.

7. The improvement according to Claim 3 wherein said small wire is made of nickel.

8. The improvement according to Claim 6 wherein said connector wire is made of molybdenum.

9. The improvement according to Claim 1 wherein said cylindrical member is a hardglass sleeve.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