LAMP AND HOUSING ASSEMBLY

Inventor: Charles J. Miller, Bellevue, Ohio
Assignee: General Electric Company
Filed: Nov. 14, 1969
Appl. No.: 876,708

U.S. Cl. 240/11.4 H
Int. Cl. F21I 15/08
Field of Search 240/11.4 AC, 41, 41.35, 47, 240/11.4

References Cited
UNITED STATES PATENTS
3,379,868 4/1968 Taillon 240/41.35 X
3,426,234 2/1969 Hayasaka et al. 240/11.4 X
3,494,693 2/1970 Elmer 240/47 X

Primary Examiner—James J. Gill
Attorney—Norman C. Fulmer, Henry P. Truesdell, Frank L. Neuhauser, Oscar B. Waddell and Joseph B. Forman

ABSTRACT
A heat-confining member is provided adjacent to a lead-seal portion of a lamp, and is positioned and proportioned so as to cause a sufficiently uniform temperature gradient at the seal to prevent the seal from cracking. The arrangement is particularly useful with arc tube lamps which operate at high temperatures.

12 Claims, 4 Drawing Figures
Inventor:
Charles J. Miller
by Norman C. Hulme
His Attorney
LAMP AND HOUSING ASSEMBLY

BACKGROUND OF THE INVENTION

Certain lamps have a tendency to develop cracks in their glass or quartz envelopes at the vicinity of the stem seals where the electric leads enter the envelopes. Such cracks are likely to permit air to enter into, and any fill gas to leak out of, the envelope thus destroying the usefulness of the lamp. This problem of seal failures has been particularly prevalent with arc tube lamps which operate at high temperatures. Such a type of lamp, and a reflector housing arrangement therefore, is disclosed in U.S. Pat. No. 3,379,868 of John K. Taillon, issued Apr. 23, 1968 and assigned to the same assignee as the present invention. The aforesaid problem of seal cracking has heretofore been partly but not completely solved by arrangements for reducing the operating temperature at the seal region. One technique for reducing the seal temperature is to increase the length of the neck portion of the lamp. For example, the aforementioned patent shows an elongated arc tube lamp having a seal at each end thereof and intended for direct current operation wherein the anode operates at a higher temperature than the cathode. To reduce the temperature at the anode seal, the anode neck portion is made relatively longer than the cathode neck portion so that the anode seal will be farther away from the hot operating end of the anode electrode. Another technique shown in the aforementioned patent for reducing the seal temperature, is to cement the seal (particularly the anode seal) in the case of a lamp intended for direct current operation) to a housing with a cement material that is sufficiently heat conductive so as to reduce some of the heat away from the seal.

In spite of the foregoing measures, cracking of lead seals has remained a problem.

SUMMARY OF THE INVENTION

Objects of the invention are to provide an improved lamp and housing assembly, and to provide an arrangement for reducing the likelihood of cracks occurring at lead seals of lamps.

The invention comprises, briefly and in a preferred embodiment, an arrangement of a lamp having a lead-seal, and a heat-confining member positioned adjacent to the lead-seal, the heat-confining member being positioned and proportioned to distribute the temperature at the lead-seal so as to cause more uniform temperature in the lead-seal region. This more uniform temperature, or reduction in temperature gradient, reduces the likelihood of cracking at the seal. Thus, contrary to prior art techniques of simply cooling the seal to reduce the likelihood of cracking, the invention provides distribution of heat over the seal region to reduce the likelihood of cracking. The invention can advantageously be used in combination with means for cooling the lead-seal region.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front view of a projection lamp and reflector-housing assembly in accordance with a preferred embodiment of the invention.

FIG. 2 is a cross-sectional side view taken on the line 2--2 of FIG. 1.

FIG. 3 is a cross-sectional end view of the assembly taken on the line 3--3 of FIG. 2, and

FIG. 4 is a perspective view of a preferred embodiment of a heat-confining member in accordance with the preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The assembly shown in the drawing is generally similar to that disclosed in the aforesaid U.S. Pat. No. 3,379,868. A compact high-intensity arc tube lamp 11 comprises a quartz envelope having a bulb portion 12 and having neck portions 13 and 14 extending therefrom on opposite sides thereof, on a common axis. Elongated tungsten anode and cathode electrodes 16 and 17 are positioned on the axis of the lamp with the inner ends thereof spaced apart within the bulb portion 12, and respectively extending into the anode neck portion 13 and cathode neck portion 14. The outer ends of the anode and cathode electrodes 16 and 17 are respectively welded to molybdenum foils 18 and 19, these foils in turn being welded to inlets 21 and 22. In the process of manufacture, the foils 18 and 19 are wetted by the quartz of the necks 13, 14 to provide hermetic seals. The lamp contains an ionizable filling which includes an inert gas such as argon and a halogen or metal halide such as indium iodide. Further details of the lamp 11 and its manufacture are disclosed in U.S. Pat. No. 3,305,289 to Elmer G. Fridrich, issued Feb. 21, 1967 and assigned to the same assignee as the present invention. The lamp shown is intended for direct current operation, which causes the anode electrode 16 to operate at a considerably higher temperature than the cathode electrode 17, and therefore the anode electrode 16 is made thicker and longer than the cathode electrode 17.

A reflector housing 26 is provided, preferably made of glass and having an ellipsoidal inner surface covered with a reflective coating 27. A pair of apertures 31, 32 are provided in the wall of the housing 26 on a line passing through the near focus /1 of the reflector and transverse to its optical axis. The housing 26 is shaped to provide inwardly extending collars 33 and 34 at the apertures 31 and 32, as shown.

The arc tube 11 is mounted generally along a line extending through the apertures 31 and 32, with the arc region thereof coinciding with the near focus /1 of the reflector. The lead-seal regions and/or the inlets 21, 22 of the lamp extend into the recesses 31 and 32 and are set in a glassy cement 36, for holding the lamp in correct position, as will be described.

Anode and cathode electrical connection wires 37 and 38 are respectively connected to the anode and cathode inlets 21 and 22, as shown. Further details of the reflector housing 26 are disclosed in the aforesaid U.S. Pat. No. 3,379,868.

In accordance with the invention, a heat-confining member 41, preferably in the form of a hollow cylindrical split sleeve made of metal, is fitted in the anode aperture 31 so as to at least partially surround the anode neck 13 in the region of the stem seal at the foil 18. As best shown in FIG. 4, the heat-confining member 41 preferably comprises a split sleeve in the form of a hollow metal cylinder having a slit 42 lengthwise thereof, and provided with one or more tabs 43 extending laterally therefrom at an end thereof. Prior to cementing the anode stem of lamp 11 in place, the member 41 is inserted through the anode aperture 31 from the outside of the housing 26, so that the tabs 43 seat against the outer rim of the aperture 31 thereby correctly positioning the member 41 in place.

The split sleeve member 41 preferably is normally sprung to a slightly greater diameter than that of the aperture 31, so as to seat snugly therein. The inner end of the member 41 preferably is beveled, as shown at 44, in a manner such that the longest dimension of the member 41 is on the side thereof away from the slit 42. The member 41 is positioned in the aperture 31 so that the slit 42 is toward the rear of the reflector. This shape and positioning of the heat-confining member 41 provides the greatest heat-confining effect, as will be hereafter described, for the least amount of material in the member 41. After the lamp 11 and the heat-confining member 41 are in place, the cement 36 is applied. Ceramic end caps 46 and 47 are then positioned over the anode and cathode apertures 41 and 42 on the outside thereof.

As mentioned above, high-temperature arc lamps have been particularly prone to developing cracks at the lead-seals thereof. In the case of a direct current type of arc tube lamp, as shown in the drawing, the anode lead-seal, which generally operates at a higher temperature than the cathode lead-seal, is particularly prone to cracking. The region in which the undesirable cracking occurs, usually is in the quartz envelope at the vicinity of the foil 18; however, the region in which cracking may occur extends partly down the anode stem 13.
3,636,341

3 toward the bulb portion 12 of the lamp 11. The foregoing are referred to herein as the lead-seal region or portion of the lamp.

It has been found that the invention greatly reduces the likelihood of cracking at the lead-seal region, and the invention can be used in addition to, or in lieu of, the above-mentioned techniques of cooling the lead-seal by making the stem 13 extra long, and by encasing at least part of the lead-seal region with a heat-conductive cement 36. The invention functions by confining heat in the region of the lead-seal, and this is accomplished partly by heat reflection from the inner surface of the member 41, and partially by physical confinement of some of the heat in the region of the lead-seal. This confinement, or partial confinement, of heat in the lead-seal region, provides a more uniform temperature in this region, and thus reduces the likelihood of cracking. Expressed in another way, the theory of the invention is that the undesirable cracking at the lead-seal region was due primarily to irregular temperature gradient in this region, whereby the prior techniques of cooling the lead-seal region have not been entirely effective in reducing the tendency for the cracks to occur, because such cooling techniques had little effect on the temperature gradient; or, in some cases, tended to increase the temperature gradient along the lead-seal region, thereby tending to nullify any beneficial effect from the cooling.

Since the rear inside portion of the reflector 26 has some heat-confining effect, the slit 42 in the member 41 may be quite wide, and the inner end of the member 41 may be cut away from the form of a bevel 44 as shown to shorten the length thereof along the slit 42, without adversely affecting the functioning of the invention. Various types of lamps may benefit from utilizing the invention at one or more lead-seals thereof.

While a preferred embodiment of the invention has been shown and described, various other embodiments and modifications thereof will become apparent to persons skilled in the art, and will fall within the scope of invention as defined in the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a lamp and mounting arrangement wherein said mounting comprises a member having an opening therein and said lamp comprises an envelope including an elongated lead-seal extending externally of a bulb portion of the envelope, the improvement comprising a heat-confining member positioned at least partially around and spaced from said lead-seal thereby defining a heat-confining airspace along said lead-seal, said heat-confining airspace being substantially devoid of any matter except air and thereby being adapted to increase the uniformity of temperature gradient along said lead-seal when said lamp is operating.

2. A combination as claimed in claim 1, in which said heat-confining member is of hollow cylindrical configuration and is positioned around said lead-seal.

3. In a lamp and mounting arrangement wherein said mounting comprises a member having an opening therein and said lamp comprises an envelope including an elongated lead-seal extending externally of a bulb portion of the envelope and positioned axially with respect to said opening, the improvement comprising a heat-confining member of substantially hollow cylindrical shape positioned in said opening and extending therefrom so as to be spaced from and at least partly surround said elongated lead-seal of the lamp thereby defining a heat-confining airspace along said lead-seal, said heat-confining airspace being substantially devoid of any matter except air and thereby being adapted to increase the uniformity of temperature gradient along said lead-seal when said lamp is operating.

4. An arrangement as claimed in claim 3, in which a portion of said mounting member extends substantially parallel to and spaced from said elongated lead-seal, and in which said heat-confining member comprises a resilient split sleeve fitted resiliently in said opening, said split sleeve being oriented so that the split thereof faces toward and is adjacent to said portion of the mounting member whereby said portion of the mounting member aids in confining heat at said split.

5. An arrangement as claimed in claim 4, in which said split sleeve is provided with one or more tabs extending laterally outwardly at an end thereof and seated against said mounting member adjacent to said opening thereby positioning said split sleeve axially in said opening.

6. An arrangement as claimed in claim 3, in which a portion of said mounting member extends substantially parallel to and spaced from said elongated lead-seal and in which said heat-confining member is beveled at the end thereof extending from said opening, said heat-confining member and the bevel thereof being oriented such that the shorter length of said heat-confining member faces toward and is adjacent to said extending portion of the mounting member whereby said portion of the mounting member aids in confining heat at said beveled end of the heat-confining member.

7. An arrangement as claimed in claim 6, in which said heat-confining member comprises a resilient split sleeve having a split in the wall thereof along the shorter length thereof whereby said portion of the mounting member aids in confining heat at said split.

8. An arrangement as claimed in claim 6, in which said heat-confining member is provided with one or more tabs extending laterally outwardly at the end thereof opposite from said beveled end and seated against said mounting member adjacent to said opening thereby positioning said heat-confining member axially in said opening.

9. An arrangement as claimed in claim 8, including cement interposed in the space between said lead-seal region and the inside of said heat-confining member at the region of said opening in the housing member.

10. In a lamp and reflector arrangement comprising a concave reflector provided with a pair of opposed lateral anode and cathode openings in the wall thereof on a line normal to the optical axis and passing substantially through its focus, and an elongated lamp comprising a bulb portion and anode and cathode stems extending from said bulb portion on opposite sides thereof and terminating in anode and cathode lead-seals, respectively, said lamp being positioned in said reflector along said line and attached to said reflector at said openings, said anode stem comprising a lead-seal region located at least partly within said reflector and outside of the confines of the reflector anode opening, the improvement comprising a low-cylindrical heat-confining member mounted in said anode opening and extending within said reflector and spaced from and substantially surrounding said anode lead-seal region thereby defining a heat-confining space along said lead-seal region adapted to increase the uniformity of temperature gradient along said lead-seal region when said lamp is operating.

11. An arrangement as claimed in claim 10, in which said heat-confining member comprises a split sleeve oriented with the split thereof toward the back of the reflector whereby said reflector aids in confining heat at said split.

12. An arrangement as claimed in claim 10, in which the end of said heat-confining member within said reflector is beveled, said beveled heat-confining member being oriented so that the short side thereof is toward the back of the reflector whereby said reflector aids in confining heat at said beveled end of the heat-confining member.

* * * * *