

Feb. 24, 1970

W. J. KNOCHEL ET AL
CERAMIC DISCHARGE LAMP HAVING A FLEXIBLE METAL
ELECTRODE CONNECTOR
Filed Aug. 18, 1967

3,497,756

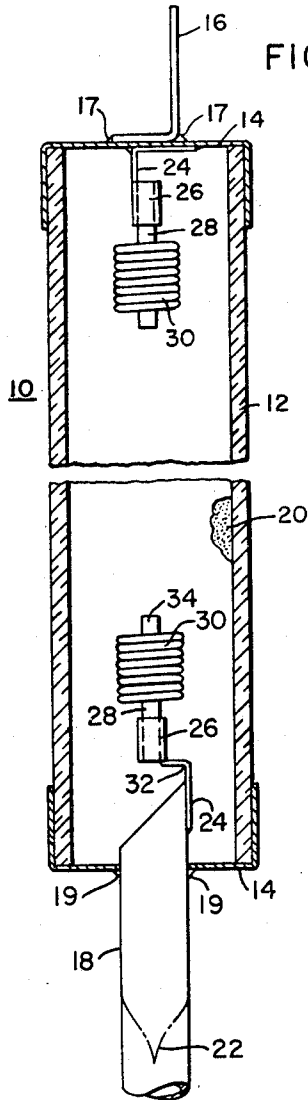


FIG. 1

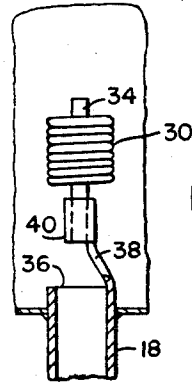


FIG. 2

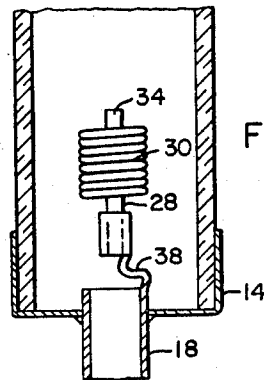


FIG. 3

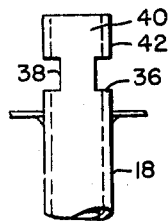


FIG. 4

WITNESSES:

Robert M. Farber

James F. Young

INVENTORS

Henry Skwirut &
William J. Knochel

BY

Blair R. Studabek
ATTORNEY

1

3,497,756

CERAMIC DISCHARGE LAMP HAVING A FLEXIBLE METAL ELECTRODE CONNECTOR

William J. Knochel, West Orange, and Henry Skwirut, Verona, N.J., assignors to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 18, 1967, Ser. No. 661,700

Int. Cl. H01j 5/50

U.S. Cl. 313—331

10 Claims

ABSTRACT OF THE DISCLOSURE

A ceramic discharge device including a tubular light transmitting envelope of sintered polycrystalline alumina closed at each end by refractory metal cup-shaped caps to provide a hermetically sealed enclosure for the discharge sustaining filling contained therein. A discharge sustaining electrode is mounted within each end of the tubular envelope and electrically connected through the end cap to external lead-in conductors. The electrodes are mounted to the end caps by flexible refractory metal straps having a pair of fingers at the interiorly extending ends which wrap around and are welded to the electrode stem. The flexible refractory metal support members are bendable and in addition to providing a flexible mounting for the electrode are settable with a predetermined bend to establish and substantially maintain a predetermined distance between the inwardly extending end of the electrode supported thereby and the adjacent closure member or end cap.

BACKGROUND OF THE INVENTION

This invention relates to discharge devices and more particularly to high temperature ceramic arc tubes for use in ceramic discharge lamps.

A particular problem encountered in conventional ceramic discharge device constructions has been the breaking away of one of the electrodes, particularly on the tubulation side of the device, when attempting to repair the lamp or when the lamp is being handled roughly during processing or use. Additionally the efficiency of a ceramic discharge lamp is generally controlled to a great extent by the temperature at the coldest point within the arc tube. This temperature is generally referred to in the art as the cold spot temperature. The coldest spot within a ceramic discharge lamp generally occurs behind the electrode at the tubulation end of the lamp and since the sodium vapor pressure or for that matter the vapor pressure of most of the additives is controlled by the lowest temperature in the assembly, it is desirable to be able to control to some extent the temperature in that area.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a new construction for the electrode mounts in a ceramic discharge device.

Another object of the present invention is to provide an electrode mount for ceramic discharge lamps which will not fail when subjected to shock and vibration.

Yet another object of the present invention is to provide an electrode mount for a ceramic discharge lamp which is adjustable to control the distance between the electrode and its adjacent closure end means.

2

The foregoing objects are accomplished in accordance with the present invention by providing, in a ceramic discharge device comprising an elongated light transmitting ceramic envelope containing a discharge sustaining filling and hermetically sealed at each end by a closure means carrying an electrical conductor externally thereof and a discharge sustaining electrode interiorly thereof; a flexible refractory metal strap supporting each of the electrodes within the envelope and providing at least a portion of the electrical connection between the electrode and the adjacent closure means. The flexible refractory metal strap includes a first bendable narrow portion and a second portion which includes a pair of electrode gripping fingers whereby the electrode is flexibly mounted within the ceramic discharge device and the metal strap is settable with a predetermined bend to establish and substantially maintain a predetermined distance between the inwardly extending end of the electrode supported thereby in the adjacent closure member.

As will be apparent as the description proceeds the mounting means of the present invention provides not only a resilient mount for the electrode which eliminates failure due to shock or vibration during the manufacture or use of the lamp but also provides for control of the cold spot temperature in the discharge device by permitting the electrode to be prepositioned at a preselected distance from the end of the lamp.

BRIEF DESCRIPTION OF THE DRAWING

The above recited objects, and others, along with many of the attendant advantages of the present invention will become readily apparent and better understood as the following detailed description is considered in connection with the accompanying drawing in which:

FIGURE 1 is a sectional view of a ceramic arc tube illustrating one embodiment of the flexible electrode mount of the present invention;

FIG. 2 is a sectional view of the tubulation end of a ceramic discharge device illustrating another form which the flexible electrode mount of the present invention may take;

FIG. 3 is a sectional view of the tubulation end of a ceramic discharge device similar to FIG. 2 illustrating the mechanism for controlling electrode spacing; and

FIG. 4 is a schematic view of the tubulation of the FIG. 2 and FIG. 3 embodiments prior to mounting an electrode thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in detail to the drawings wherein like reference characters represent like parts throughout several views. There is shown in FIG. 1 a ceramic discharge lamp generally designated 10 employing a flexible electrode mount of the present invention. The discharge lamp of the present invention generally includes a ceramic body in the form of a high density sintered polycrystalline alumina arc tube 12 hermetically sealed at each end by refractory metal end caps 14. For purposes of illustration end cap 14 has been employed to seal off the ends of the polycrystalline aluminum body member 12. As is well known in the art the ends of a polycrystalline alumina discharge tube can be equally sealed by a refractory metal disk in a manner well known in the art. The end

caps 14 may be hermetically sealed to the polycrystalline alumina body member by means of any of a number of well known ceramic to refractory metal sealing compositions. However, the sealing compositions disclosed in co-pending application Ser. No. 562,061, filed June 30, 1966 for "Sealing Compositions" by R. B. Grekila et al. and owned by the assignee of the present invention, are preferred.

Current for operating the lamp is generally supplied at one end of the arc tube by a refractory metal, preferably tantalum, lead-in conductor 16 which is secured to the outer face of the end cap 14 as, for example, by brazing. Current is generally supplied to at least one of the electrodes by means of exhaust and fill tubulation 18 illustrated at the bottom end of the discharge tube of FIG. 1. The exhaust and fill tubulation 18 is secured centrally to the end cap by a titanium braze illustrated at 19 and permits the exhausting of the sealed arc tube and the subsequent filling thereof with a starting gas such as, for example, argon along with a discharge sustaining filling. The discharge sustaining filling may be any of the well known mercury-metal or mercury-metal halide arc sustaining fillings, such as for example, an amalgam of sodium and mercury as indicated at 20. After the filling procedures, tubulation 18 is pinched off to provide a hermetic seal at 22 thus completing the fabrication of an operative arc tube.

As illustrated at the non-tubulation end of the arc tube a flexible tantalum strap 24 having a pair of gripping fingers 26 thereof is brazed at one end to the interior surface of the end cap with the fingers 26 at the other end securely wrapped about and welded to the leg 28 of a coiled tungsten filament. The tantalum strap portion of the electrode mount is approximately .01 inch thick and has a width of approximately $\frac{1}{16}$ of an inch and provides for the resilient mounting of the electrode within the arc tube. A similar electrode mount is illustrated at the lower end of FIG. 2 where a similar tantalum strap 24 carrying fingers 26 are secured about and welded to the leg 28 of a coiled tungsten filament electrode 30. The illustrated, essentially right angle, bend at 32 in the tantalum strap 24 may be a greater or lesser angle to control and set the distance between the tip of the electrode 34 and the interior surface of the end cap 14. By making the essentially right angle at 32 an acute angle the temperature near the end cap 14 at the end of the arc tube can be substantially increased to increase the vapor pressure of the discharge sustaining metal.

A further embodiment which the electrode support of the present invention may take is illustrated in FIGS. 2, 3 and 4. The FIGS. 2, 3 and 4 embodiment is quite similar to the embodiment of FIG. 1 except that the support mount for the electrode 30 is formed directly from the interiorly extending end of the exhaust and fill tubulation 18. As more clearly illustrated in FIG. 4 the exhaust and fill tubulation which is essentially a tubular conduit is cut away at 36 except for a thin strap 38 which may be for purposes of example approximately $\frac{1}{16}$ of an inch in width and approximately $\frac{1}{10}$ of an inch in height. An enlarged portion 40 of the strap 38 forms an extension of the strap and operates as a pair of fingers which are wrapped around and welded to the leg 28 of a coiled tungsten electrode. It should be pointed out that for purposes of providing a superior weld the edges 42 of the portion 40 should not touch when wrapped about the electrode leg 28. Again for purposes of illustration the finger portion 40 is approximately $\frac{1}{8}$ of an inch in width and approximately $\frac{1}{10}$ of an inch in height. The $\frac{1}{8}$ inch width assures that the edges 42 will not touch when wrapped about electrode leg 28. As illustrated in FIGS. 2 and 3 flexible strap 38 may be employed to both set and maintain the distance between the end 34 of electrode 30 and the interior surface of the adjacent end cap 14, thus aiding in the control of the cold spot temperature within the arc tube. Furthermore the strap portion 38

also provides for a resilient flexible mounting of the electrode within the arc tube and is not subject to failure or fracture during rough handling which sometimes accompanies manufacture, shipment and use of a lamp.

As can be seen from the foregoing the novel electrode mounting means of the present invention provides for two fold utility. The straps, both 24 and 38, provide for the resilient flexible mounting of the electrode within the arc tube and additionally permit the selective setting of the distance between the end of the attached electrode and its adjacent end cap by placing therein a preset bend which will both establish and substantially maintain the distance selected throughout the life of the lamp.

Since numerous changes may be made in the above-described device and different embodiments of the invention may be made without departing from the spirit thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A ceramic discharge device comprising: an elongated light transmitting ceramic envelope containing a discharge sustaining filling; closure means sealed to and sealing off each end of said ceramic envelope; electrical conductor means secured to said closure means and extending externally of said sealed envelope; and a pair of discharge sustaining electrodes and means securing one each of said electrodes to the closure means sealing off each end of said envelope, said securing means comprising a flexible refractory metal strap.

2. A ceramic discharge device according to claim 1 wherein said refractory metal straps are tantalum.

3. A ceramic discharge device according to claim 1 wherein at least one of said refractory metal straps is formed from an extension of a refractory metal exhaust-and-fill tubulation extending through a closure means and forming one of said electrical conductor means.

4. A ceramic discharge device according to claim 2 wherein said flexible tantalum strap is settable with a predetermined bend to substantially maintain a predetermined distance between the inwardly extending end of its associated electrode and the adjacent closure means.

5. A ceramic discharge device comprising:

- a light transmitting ceramic envelope containing a discharge sustaining filling;

- closure means sealed to and sealing off each end of said ceramic envelope;

- conductor means in electrical contact with the external surface of each of said closure means, at least one of said conductor means comprising a length of refractory metal tubulation extending through said closure means into the interior of said envelope;

- a pair of discharge sustaining electrodes within said envelope each electrically connected to one of said closure means; and

- a flexible refractory metal strap supporting each of said electrodes within said envelope and providing at least a portion of said electrical connection between said electrodes and their adjacent closure means, at least one of said metal straps forming an extension of said tubulation.

6. A ceramic discharge device according to claim 5 wherein said flexible refractory metal straps include a first bendable, narrow portion and a second portion including a pair of electrode gripping fingers.

7. A ceramic discharge device according to claim 6 wherein said first bendable portion of said flexible refractory metal strap is settable with a predetermined bend to establish and substantially maintain a predetermined distance between the inwardly extending end of the electrode supported thereby and the adjacent closure member.

8. A ceramic discharge device according to claim 5

5

wherein said at least one refractory metal strap is brazed to the inwardly extending end of said tubulation.

9. A ceramic discharge device according to claim 5 wherein said at least one refractory metal strap is integral with an extension of said tubulation.

10. A ceramic discharge device according to claim 9 wherein said at least one refractory metal strap includes a first bendable, narrow portion and a second portion including electrode gripping fingers.

2,254,945	9/1941	Hunt et al. -----	313—331 X
2,411,548	11/1946	Laico -----	313—331 X
2,894,166	7/1959	Mohn -----	313—223 X
2,917,653	12/1959	Noiles -----	313—332
2,971,110	2/1961	Schmidt -----	313—317 X
3,363,134	1/1968	Johnson -----	313—325
3,385,463	5/1968	Lange -----	313—317 X

6

JOHN W. HUCKERT, Primary Examiner

10 ANDREW J. JAMES, Assistant Examiner

References Cited**UNITED STATES PATENTS**

244,481	7/1881	Perkins -----	313—333
2,200,954	5/1940	Glassberg -----	313—284 X

U.S. Cl. X.R.

313—222, 317, 318, 335