Oct. 21, 1969 R. J. ZOLLWEG ET AL 3,474,277

CERAMIC ARC LAMP CONSTRUCTION

Filed Aug. 3, 1966

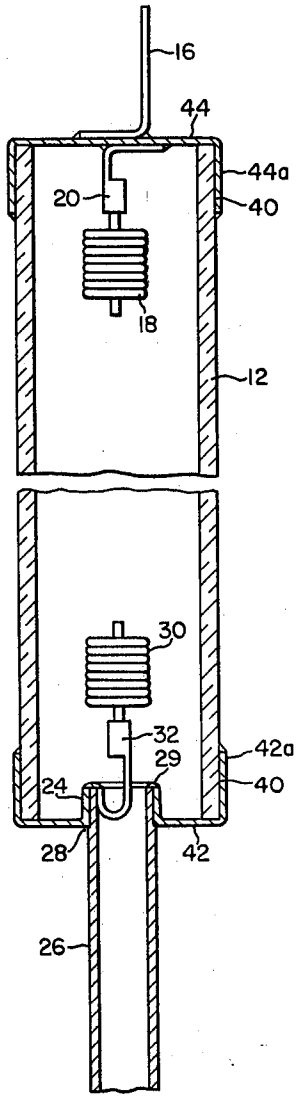


FIG.2.

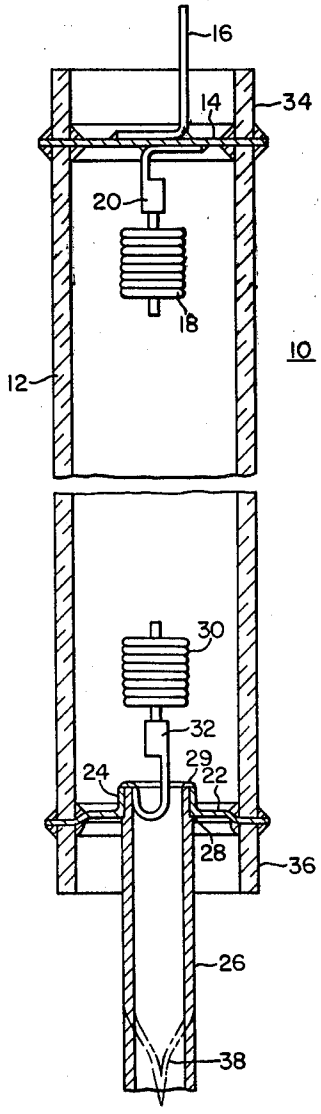


FIG.1.

WITNESSES

Theodore F. Wrobel

James F. Young

INVENTORS

Robert J. Zollweg

and Dietrich F. Ennulat

BY Blair P. Studebaker

ATTORNEY

United States Patent Office 3,474,277 Patented Oct. 21, 1969

3,474,277

CERAMIC ARC LAMP CONSTRUCTION

Robert J. Zollweg, Pitcairn, and Dietrich F. Ennulat, Turtle Creek, Pa., assignors to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Aug. 3, 1966, Ser. No. 569,994
Int. Cl. H01j 17/16, 61/30; H01k 1/28
U.S. Cl. 313—220 5 Claims

ABSTRACT OF THE DISCLOSURE

A ceramic discharge device including a sealed light transmitting ceramic body closed at at least one end by a refractory metal closure member having a centrally located cylindrical flange extending inwardly of the ceramic body to define an opening into which a length of refractory metal exhaust tubulation is inserted with the inwardly extending edge of the tubulation positioned adjacent the inwardly extending edge of the flange with said inwardly extending edges welded togther. A discharge sustaining electrode may also be secured to the tubulation by the weld.

This invention relates to ceramic arc lamps and more particularly to improved construction for ceramic arc lamps employing refractory metal closure members.

Alkali metal vapor discharge lamps employing ceramic envelopes, particularly envelopes constructed of high density polycrystalline alumina, are at present enjoying considerable interest as an important new source of illumination. The ceramic bodied lamps have been found to be extremely resistant to attack by the alkali metal vapors employed in the discharge of such lamps, even at high temperatures. It has become a general practice to seal off the ends of the ceramic envelope with refractory metal caps or end discs such as for example closure members of niobium or tantalum.

A continuing problem with ceramic arc lamps has been the sealing off of the envelope ends of such lamps to produce seals which are both vacuum tight and also resistant to attack by the alkali metal vapors as well as vapors of such other metals as zinc and cadmium used in making up the discharge employed in the lamps. The problem of sealing the refractory metal closure members to the ceramic envelope has been successfully solved by employing the glassy metallic oxide sealing compositions disclosed in copending application Serial No. 526,016, filed June 30, 1966, for Sealing Compositions by William J. Knochel, Francis C. M. Lin, Shih-Ming Ho and Richard B. Grekila which is also owned by the assignee of the present invention. It has been a practice to employ titanium brazes to secure the refractory metal exhaust tubulation to the refractory metal closure members. The seal provided by the titanium braze between the refractory metal exhaust tubulation and the refractory metal closure member has apparently been successful for lamps containing for example materials such as mercury, sodium and argon vapors as a part of the discharge. However, it has been found that for lamps containing zinc and cadmium vapors failures have occurred in the region of the titanium braze due to attack by the metal vapors.

Accordingly, it is an object of the present invention to provide a ceramic arc lamp having components substantially resistant to attack by vapors of zinc and cadmium in addition to alkali metal vapors.

Another object of the present invention is to provide an arc lamp construction which is simple in design and which readily facilitates the vacuum tight sealing off of the interior of the lamp body.

A further object of the present invention is the provision of a closure member configuration for ceramic arc lamps which is compatible with the vacuum tight association of the refractory metal exhaust tubulation thereto.

Yet another object of the present invention is to provide an arc tube configuration which is conducive to the vacuum tight arc welding of a refractory metal closure member to the refractory metal exhaust tubulation.

A still further object of this invention is the provision of a ceramic arc lamp which is limited only by the temperature characteristics of the ceramic elements in determining the temperature limits within which it may be operated.

The foregoing objects are accomplished in accordance with the present invention by employing, in a ceramic discharge lamp having a light transmitting ceramic body, a refractory metal closure member having a centrally located cylindrical flange extending inwardly of said envelope which defines an opening into which a refractory metal exhaust tube may be inserted. The exhaust tube extends into the opening in said closure member until its inwardly extending end terminates adjacent the inward extending end of the flange whereby a vacuum tight seal, resistant to attack from the discharge sustaining vapors, is established by arc welding said flange to said tube along the edge defined by their respective inwardly extending ends.

The above described objects along with many of the attendant advantages of the present invention will become more readily apparent as the same become 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 lamp employing disc closure members constructed in accordance with the present invention; and

FIG. 2 is a sectional view of a ceramic arc lamp employing cap-shaped closure members constructed in accordance with the present invention.

Referring now in detail to the drawings and more particularly to FIGURE 1 there is shown a sectional view of a ceramic arc lamp constructed in accordance with the present invention and generally designated **10**. The ceramic envelope or tube **12** is preferably constructed of high density polycrystalline alumina having an alumina content in excess of 99.5% Al_2O_3. One end of the envelope is closed off by a refractory-metal, disc-shaped, end closure member **14** of for example niobium or tantalum. A lead-in conductor **16** is spot welded to the exterior surface of disc **14** and a mounting strap **20** which supports a coiled tungsten electrode **18** is spot welded to the interior surface of disc **14**. The other end of the lamp envelope or body **12** is closed off by a second disc-like closure member **22** which has located centrally therein an opening which is defined by a cylindrical flange **24**. The flange **24** may be formed in the niobium or tantalum disc or piercing the disc in the center and drawing out the central portion of the disc to form the cylindrical shape. The interior diameter of the flange **24** is such that it will receive, in a close fitting relationship, a piece of exhaust tubulation **26**.

The exhaust tubulation **26** is inserted into the flange **24** a distance such that interior edge or end of the tubulation terminates adjacent the inwardly extending end of the flange **24**. The tubulation **26** may be provided with a machined shoulder at **28** to assure precise alignment with inward edge of flange **24** or may be merely marked to indicate the depth with which the tubulation should penetrate within the disc **22**.

The refractory metal tubulation **26** is secured vacuum tight to the flange **24** of end disc **22** by means of an arc weld **29**. This arc weld is preferably a TIG (tungsten inert gas) weld. A comparatively sharp edge defined by the interior ends of the tubulation **26** and the flange **24** facilitates the attaching of the welding arc to the surface

thereof in the well known manner. The second arc supporting electrode **30** carried by a refractory metal strap **32** may have the end of the strap secured directly, as shown in FIGS. 1 and 2, on the interior surface of the tubulation **26** and is arc welded thereto during the arc welding of the tubulation to the disc.

The TIG welded niobium to refractory metal seal not only provides the resistance to vapor of zinc and cadmium not found in titanium brazes but additionally eliminates the temperature limitations afforded by the brazes so that arc lamps may be operated at temperatures limited esesentially only by the temperature characteristics of the ceramic components of the discharge device. The end discs **14** and **22** are sealed to the ceramic body **12** and back up rings **34** and **36** are sealed to the refarctory metal discs by a suitable sealing composition as for example the metallic-oxide sealing compositions disclosed in the aforementioned copending application Ser. No. 562,016. The ceramic back up rings **34** and **36** are generally of the same cross sectional configuration as the tube or body member **12** and are employed to balance any strains set up between the closure member and the alumina parts due to the temperatures encountered by the lamp ends during operation.

Refractory metal tubulation is necessary in the lamp construction to provide access to the interior of the lamp body for evacuation and filling thereof. Upon completion of the evacuation and filling of the lamp, tubulation **26** is customarily pinch sealed as shown in dotted lines at **38**.

The embodiment of FIG. 2 is similar to the embodiment of FIG. 1 except that cap-shaped closure members **42** and **44** are employed instead of the disc-shaped closure members of the FIG. 1 embodiment. The embodiment of FIG. 2 includes a ceramic envelope or tube **12** sealed off at its ends by refractory metal, cap-shaped closure members **42** and **44** of for example niobium or tantalum. The seals between end caps and the ceramic envelope are accomplished by means of the metallicoxide sealing compositions above referred to which seal the outer surface of the ceramic tube to the interior surface of the skirt portions **42***a*, **44***a* of the end caps as at **40**. As in the FIG. 1 embodiment, tantalum or niobium exhaust tube **26** is inserted into the cylindrical flanged opening in the end cap **42** until its innermost end is adjacent the innermost end of the flange **24** and the coextensive edge provided by the ends of these two members is arc welded at **29**.

As a preferred construction the lamps of the FIGS. 1 and 2 embodiments are constructed of a ceramic envelope of high density polycrystalline alumina with the closure members and exhaust tubulation of niobium or tantalum. The ceramic envelope preferably is 5/16 to 3/8 inch in diameter and the exhaust tubulation has an outside diameter of 1/8 inch. Weld **29** is formed by employing a tungsten arc inert gas welding method and is known in the art as a TIG weld.

By welding the lead in conductors **16** and the electrode support straps **20** to the end closure members **14** and **44** and by providing a TIG weld to seal the refractory metal exhaust tubulation to the end closure members **22, 42** it will be seen that an arc lamp construction is provided which is highly resistant to substantially all alkali metal vapors as well as vapors of zinc and cadmium and that operational temperatures for the lamp are now limited only by the temperature characteristics of the ceramic components of the lamp. The provision of a sharp edge to which the welding arc may attach provides a simple configuration which readily facilitates the manufacture of the ceramic arc 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.

We claim as our invention:

1. A ceramic discharge lamp comprising;

(a) a light transmitting ceramic envelope;

(b) a first refractory metal closure member sealing off one end of said envelope, said first refractory metal closure member having a first electrode secured thereto and extending internally of said envelope;

(c) a second refractory metal closure member sealing off the other end of said envelope, said second refractory metal closure member having an integral reentrant flange extending inwardly of said envelope and defining an opening therein;

(d) a refractory metal tubulation extending within said opening with its inward end terminating adjacent the inwardly extending end of said flange, said end of said tubulation and said end of said flange defining an edge, said refractory metal tubulation being secured to said refractory metal closure member by a weld at said edge; and

(e) a second electrode secured to said refractory metal tubulation at said edge by said weld and extending internally of said envelope.

2. A ceramic discharge lamp according to claim **1** wherein said ceramic envelope is high density polycrystalline alumina of tubular cross section.

3. A ceramic discharge lamp according to claim **1** wherein said closure members are niobium and said tubulation is tantalum or niobium.

4. A ceramic discharge lamp according to claim **1** wherein said closure members have a cap-like configuration and said reentrant flange is cylindrical in cross section.

5. A ceramic discharge lamp according to claim **1** wherein said closure members have a cap-like configuration with the inner surface of the skirt portion of said refractory metal cap being sealed to the external surface of the peripheral walls of said envelope.

References Cited

UNITED STATES PATENTS

993,883	5/1911	Schickert	219—105 X
2,254,945	9/1941	Hunt et al.	313—217 X
2,441,841	5/1948	Phelps	220—2.2
2,971,110	2/1961	Schmidt	313—221
3,243,635	3/1966	Louden et al.	313—220 X
3,363,134	1/1968	Johnson	313—221 X

JAMES W. LAWRENCE, Primary Examiner

PALMER C. DEMEO, Assistant Examiner

U.S. Cl. X.R.

220—2.2; 313—317, 221, 252, 281