Aug. 12, 1969 W. J. KNOCHEL ET AL 3,461,334

CERAMIC DISCHARGE LAMP

Filed Feb. 27, 1967

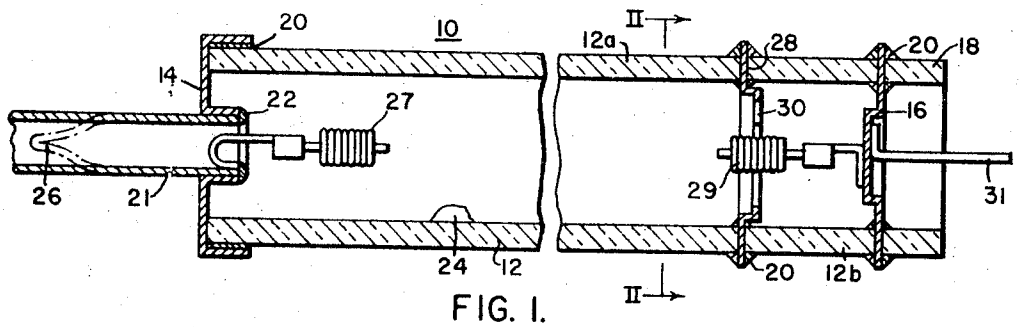


FIG. 1.

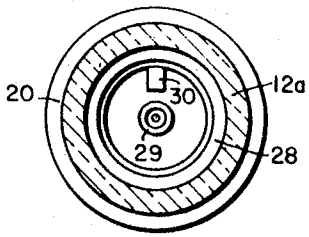


FIG. 2.

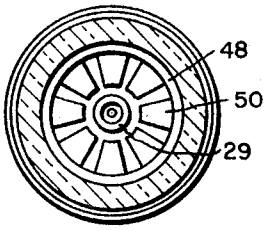


FIG. 5.

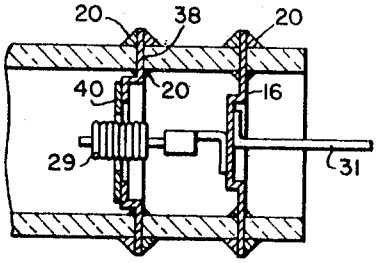


FIG. 3.

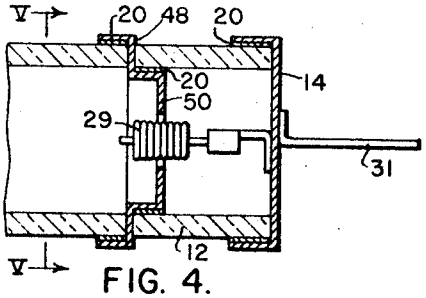


FIG. 4.

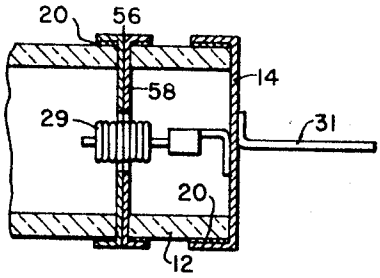


FIG. 6.

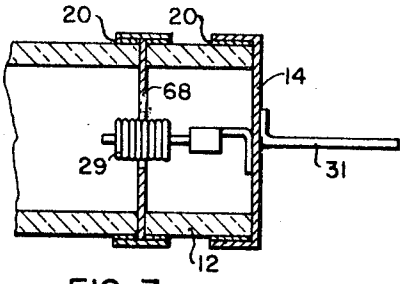


FIG. 7.

WITNESSES:

Leon M. Garman

James F. Young

INVENTOR

William J. Knochel and

Hugh D. Fraser.

BY

Blair P. Studebaker

ATTORNEY

United States Patent Office 3,461,334 Patented Aug. 12, 1969

3,461,334

CERAMIC DISCHARGE LAMP

William J. Knochel, West Orange, and Hugh D. Fraser, West Caldwell, N.J., assignors to Westinghouse Electric Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Feb. 27, 1967, Ser. No. 618,845
Int. Cl. H01j 17/16, 61/02
U.S. Cl. 313—198 7 Claims

ABSTRACT OF THE DISCLOSURE

A ceramic discharge lamp having an elongated tubular polycrystalline alumina envelope closed at each end by an electrode carrying refractory metal closure member and having interposed through said ceramic envelope a ring-shaped refractory metal starting electrode adjacent one of the electrodes carried by one of the end closure members.

Background of the invention

This invention relates to ceramic discharge devices and more particularly to a ceramic discharge device employing a refractory metal starting electrode sealed through the ceramic arc tube.

In their conventional form ceramic discharge lamps employing polycrystalline alumina arc tubes require a high voltage surge of from 440 to 800 volts, or the use of a spark coil to initiate the discharge. This problem exists similarly in the conventional high-pressure, mercury-vapor, discharge lamp. In the high-pressure mercury type lamps, which generally employ a quartz arc tube, a press seal at each end of the arc tube seals off the interior. Through one of these press seals a starting electrode enters the discharge cavity in the same manner as the primary arc sustaining electrodes. Unfortunately, with the narrow diameters, 5/16 or 1/4 inch internal diameter tubes, employed in the ceramic discharge lamps a similar solution is not practical. Not only does size present a problem, but additionally, the use of refractory metals for the closure members in the form of disks or caps would require that the starting electrode, should it enter through the end of the lamp, be sufficiently isolated from the electrically conductive end cap by means of suitable insulating material.

Summary of the invention

It is an object of the present invention to provide a starting electrode for a ceramic discharge lamp.

Another object of the present invention is to provide a ceramic discharge lamp wherein a starting electrode is provided that does not extend through either of the refractory metal end caps.

A further object of the present invention is the provision of a ceramic discharge lamp having a starting electrode secured through the walls of the ceramic envelope.

The foregoing objects are accomplished in accordance with the present invention by employing, in a ceramic discharge lamp having an elongated light transmitting ceramic envelope confining a discharge sustaining filling,

closure means sealed to and sealing off each end of said ceramic envelope, and a discharge sustaining electrode and lead-in conductor secured to each of said closure means, the improvement comprising; a refractory metal starting electrode sealed through the wall of said envelope adjacent one of said discharge sustaining electrodes. The foregoing improvement is accomplished by employing at least two separate tubular parts to form the ceramic discharge confining envelope with a ring-shaped refractory metal starting electrode sealed between the separate tubular parts and extending both internally and externally of the envelope.

Brief description of the drawings

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

FIGURE 1 is a section view of a ceramic discharge device illustrating one form which the starting electrode of the present invention may take;

FIG. 2 is a sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a sectional view of one end of a ceramic discharge device illustrating another embodiment of the present invention;

FIG. 4 is a sectional view of one end of a ceramic discharge device illustrating yet another embodiment of the present invention;

FIG. 5 is a sectional view taken along the line V—V of FIG. 4;

FIG. 6 is a sectional view of one end of a ceramic discharge device illustrating yet another form which the starting electrode of the present invention may take; and

FIG. 7 is a sectional view of one end of the ceramic discharge device illustrating a still further embodiment of the present invention.

Description of the preferred embodiments

Referring now in detail to the drawings, wherein like reference characters represent like parts throughout the several views, and more particularly to FIG. 1 there is shown a ceramic discharge device generally designated **10** illustrating one form or embodiment of the starting electrode 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 tube **12** hermetically sealed at each end by a refractory metal disk or end cap. For purposes of illustration an end cap **14** is employed to seal off one end of the polycrystalline alumina body member **12** while a disk type hermetic seal is illustrated at the other end employing a refractory metal disk **16**. When a disk type seal is employed as illustrated by the disk **16** short polycrystalline alumina backup rings are necessary as for example backup ring **18**. When cup-shaped caps are employed as for example end cap **14** the alumina backup rings are unnecessary. In both the end cap construction and the end disk construction shown in FIG. 1 the hermetic seal is accomplished by employing a ceramic sealing composition between the refractory metal disk or cap and the polycrystalline alumina body member as illustrated at **20**.

Although many suitable ceramic sealing compositions are known the sealing compositions disclosed in copending application Ser. No. 562,016, filed June 30, 1966 for "Sealing Compositions" by R. B. Grekila et al. and owned by the assignee of the present invention, are preferred.

Each of the end closure members **14** and **16** are provided with a primary or discarge sustaining electrode and an electrical lead-in conductor to carry current to the electrode. End cap **14** has mounted thereon a primary electrode **27** and refractory metal exhaust-and-fill tubulation **21** serves as the lead-in conductor. At the other end, end disk **16** carries a primary electrode **29** on its inner face and has a strap-type lead-in conductor **31** secured, as by brazing, to its outer face. Of course a strap-type lead-in conductor can be used with a cap shaped closure member and refractory metal exhaust-and-fill tubulation can be used with the disk-type closure member. Normally the arc tube will be sealed at both ends with the disk-type or cap-type closure member and the use of each type in the FIG. 1 embodiment is primarily for purposes of illustration.

As shown at the left-hand end of FIG. 1 the exhaust-and-fill tubulation is secured centrally to the end cap or disk sealing off polycrystalline alumina arc tube **12**. This exhaust-and-fill tubulation is generally secured to the refractory metal end disk or cap by a titanium braze as illustrated at **22** 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 for example, as amalgam or sodium and mercury as indicated at **24**. After the filling procedures, the tubulation **21** is pinched off to provide a hermetic seal at **26** thus completing the fabrication of an operative arc tube.

To obviate the requirement of a high voltage surge for example 440 to 800 volts or for the use of a spark coil to initiate the discharge, the discharge lamp of the present invention employs a starting electrode **28**. The use of a starting electrode as herein contemplated requires that the polycrystalline alumina envelope **12** be constructed of two separate parts **12***a* and **12***b* and have secured therebetween, by the above-described sealing compositions **20**, the starting electrode **28** in the form of a niobium or tantalum ring. The ring may have welded thereto a tantalum strap electrode **30** if desired. Although the part **12***a* of the ceramic tube **12** must necessarily be a light transmitting ceramic such as for example polycrystalline alumina, the part **12***b* need not necessarily be light transmissive but may be of some other ceramic as for example high density recrystallized alumina or other non-translucent high-temperature ceramic since it is positioned behind the arc producing area between the electrodes **27** and **29**.

FIG. 3 illustrates another form which the starting electrode of the present invention may take. In this embodiment, the stepped niobium ring **38** has brazed thereto a tantalum ring **40**.

The embodiments of FIGS. 4 and 5 includes a stepped niobium or tantalum ring **48** which may have a plurality of serrations or teeth **50** as an aid in directing the arc between the primary electrode **29** and starting electrode **48**. The construction of the starting electrode **48** and its association with the polycrystalline alumina envelope provides increased strength over the embodiments of FIGS. 1 and 3 in that all the seals employing the sealing compositions **20** are circumferential in nature as opposed to the butt seals employed in the FIGS. 1 and 3 embodiments.

The embodiments of FIGS. 6 and 7 are similar in that they provide for circumferential seals **20**. The FIG. 6 starting electrode is constructed from a pair of flanged tantalum or niobium disks which are brazed together as at **56** to give the appearance of brazed together L's in cross section. In the embodiment of FIG. 7, the starting electrode **68** is a double flanged niobium or tantalum ring giving a T-shaped appearance in cross-section and again provides for the circumferential seals at **20** as opposed to butt seals. In each of the embodiments of FIGS. 4, 6 and 7, the ceramic envelope **12** is hermetically sealed by a refractory metal end cap **14**.

The operation of the starting electrode and the circuit therefor is substantially identical with that employed in conventional high-pressure, mercury-vapor discharge lamps. Of particular suitability is the starting circuit disclosed in copending application, Ser. No. 379,109, now Patent No. 3,307,069, filed June 30, 1964 by H. D. Fraser and M. C. Unglert for "Discharge Lamp" which application is owned by the assignee of the present invention. As is the general practice an arc is initially established between the starting electrode **28** and an adjacent operating electrode **29** until sufficient heat is generated within the arc tube. At a preselected temperature, the starting electrode is deactivated with the current previously flowing thereto now flowing to the other operating or primary electrode **27** and the arc is accordingly transferred from between the starting electrode **28** and operating electrode **29** to from between operating electrode **27** and operating electrode **29** without the requirement for an extremely high voltage application. The above-referred to copending application performs this function by employing a self-resistance heated thermal electric element which at rest is in electrical connection with the starting electrode but upon reaching a predetermined heated level deforms to break contact with the starting electrode circuit and establish contact with the circuit of the other operating electrode.

Since numerous changes may be made in the above-described apparatus 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 lamp comprising:

(a) an elongated light transmitting ceramic envelope confining a discharge sustaining filling;

(b) closure means sealed to and sealing off each end of said ceramic envelope,

(c) a discharge sustaining electrode and a lead-in conductor secured to each of said closure means, said electrodes extending axially within said envelope and said lead-in conductors extending exteriorly of the sealed lamp; and

(d) a refractory metal starting electrode sealed through the wall of said envelope adjacent to and surrounding one of said discharge sustaining electrodes.

2. A ceramic discharge lamp according to claim **1** wherein said envelope comprises two separate tubular parts and said starting electrode comprises a refractory metal ring sealed between said tubular parts and extending both externally and internally of said envelope.

3. A ceramic discharge lamp according to claim **2** wherein said starting electrode is a niobium ring having a tantalum strap secured to the innermost edge thereof.

4. A ceramic discharge lamp according to claim **2** wherein said starting electrode is a niobium ring having a tantalum ring secured thereto proximate its innermost edge.

5. A ceramic discharge lamp according to claim **2** wherein said starting electrode is a stepped refractory metal ring sealed to one of said tubular parts along its inner circumference and sealed to the outer periphery of the other of said tubular parts.

6. A ceramic discharge lamp according to claim **2** wherein said refractory metal starting electrode is a refractory metal ring having at least one flange thereon,

said flange being sealed to the outer periphery of at least one of said tubular parts and the inner end projecting adjacent one of said discharge sustaining electrodes.

7. A ceramic discharge lamp according to claim 2 wherein said refractory metal ring has a plurality of serrations along its inner edge.

References Cited

UNITED STATES PATENTS

2,416,661	2/1947	Lawton	313—208 X
2,416,927	3/1947	Kingdon et al.	313—198 X
2,449,113	9/1948	Fruth	313—217 X
2,508,114	5/1950	Jenne	313—198
2,919,369	12/1959	Edgerton	313—198 X
3,229,146	1/1966	Linkroum	313—197 X
3,243,635	3/1966	Louden et al.	313—220 X

JAMES W. LAURENCE, Primary Examiner

RAYMOND F. HASSFELD, Assistant Examiner

U.S. Cl. X.R.

313—216, 218, 220