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SEAL AND LEAD-IN CONDUCTOR ASSEMBLY
FOR GASEOUS DISCHARGE LAMPS
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3,351,803

FIG. 1.

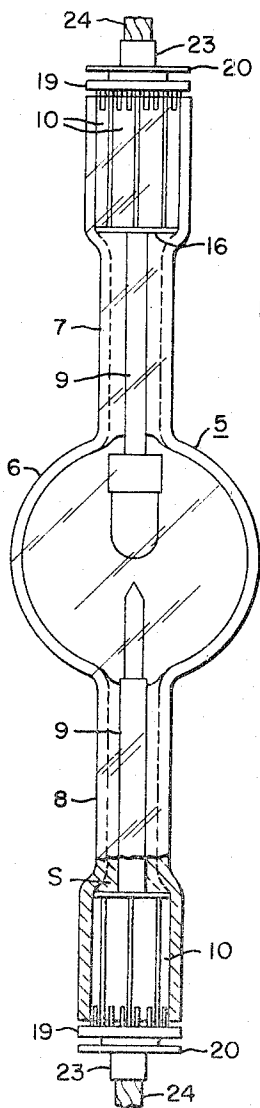


FIG. 3.

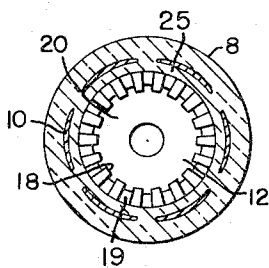


FIG. 2.

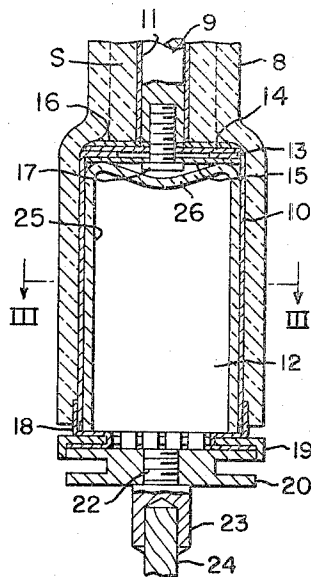


FIG. 4.

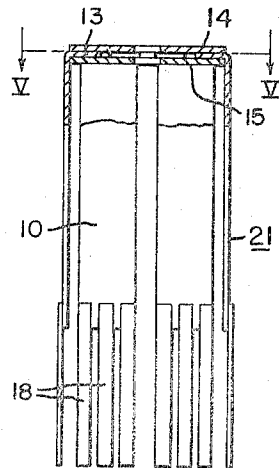
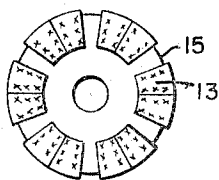


FIG. 5.



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SEAL AND LEAD-IN CONDUCTOR ASSEMBLY FOR GASEOUS DISCHARGE LAMPS

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ABSTRACT OF THE DISCLOSURE

A short-arc type electric discharge lamp having a plurality of metal ribbon conductors that are hermetically sealed in the outer ends of the envelope arms and are joined to the sealed-in ends of the respective electrodes by a disc-like structure and a threaded fastener. The disc-like structures are hermetically enclosed within but are not sealed to the respective envelope arms and thus relieve contraction and expansion stresses in the seals when the lamp is operated.

The present invention relates to high-pressure gaseous discharge lamps and, more particularly, to an improved seal and lead-in conductor assembly for a short-arc lamp.

Heretofore in the art ribbon type seals have been employed in high current short-arc discharge lamps to provide sufficient current carrying capacity and at the same time form a hermetic seal with the vitreous material of the lamp envelope. The previous type seals, however, have presented a serious problem in that the inner ends of the metallic ribbons are customarily fastened directly to the electrode supporting rod, either by a band of metal foil or wire, or by notching the rod and heat-clamping the ends of the ribbons in the notches. Due to the thermal expansion and contraction of the various components during the life of the lamp the ribbons frequently work loose from the rod resulting in a high resistance juncture and excessively high operating temperatures and strains in the seal area. It has also been found that the heat from the clamping operation embrittles the metals at the juncture and further weakens the connection.

It is accordingly an object of the present invention to provide a short-arc electric discharge lamp having a hermetic seal between the lead-in conductors and the vitreous envelope and wherein a positive and durable electrical connection is formed between the sealed lead-in conductor assembly and the electrode support interiorly of the vitreous envelope.

Another object of the present invention is the provision of a hermetic seal for a high current short-arc discharge lamp wherein such seal is formed of a plurality of metallic ribbons embedded in the wall of the vitreous envelope with the inner ends of such ribbons forming a positive electrical and mechanical connection with the electrode support under all operating conditions of the lamp.

The foregoing objects of the present invention, together with other advantages which will become obvious to those skilled in the art from the following description, are achieved by providing a hermetic seal formed by a plurality of longitudinally extending metallic ribbons embedded in the wall of the vitreous envelope of the high current short-arc discharge lamp. The inner ends of these metallic ribbons are bent to extend laterally from the envelope wall and are sandwiched between two metal discs and evenly spaced around the periphery thereof and spot welded thereto. A third disc is superimposed on the welded disc-assembly to relieve stresses produced by the contraction and expansion of the immediately adjacent portion of the vitreous envelope, and the electrode support rod is

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secured to the sealed-in conductor assembly by means of a threaded bolt connection.

The present invention can be readily understood by reference to the accompanying drawing, wherein:

FIGURE 1 is an elevational view of a high current short-arc discharge lamp provided with hermetic seals in accordance with the present invention;

FIG. 2 is a fragmentary enlarged cross-sectional view of the hermetic seal and terminal structure at each end of the lamp of FIG. 1;

FIG. 3 is a cross-sectional view of the hermetic seal portion of the lamp taken on the line III—III of FIG. 2;

FIG. 4 is an elevational view, partly in cross-section, of the lead-in conductor assembly prior to its insertion into the arm of the envelope; and

FIG. 5 is a cross-sectional view of the assembly taken on the line V—V of FIG. 4.

Referring now to the drawings in detail, the high current short-arc discharge lamp 5 shown in FIG. 1 may be of the well known mercury or xenon type having an envelope 6 of suitable vitreous material that is capable of withstanding the relatively high operating temperature, such as quartz or the like. The envelope has a bulbous portion of substantially spherical configuration and a pair of oppositely disposed electrode supporting arms 7 and 8 of the same vitreous material that extends outwardly from the spherical portion and are of tubular configuration. Anchored within these arms 7 and 8 with their inner ends projecting into the spherical portion of the envelope 6 are discharge-supporting electrodes 9 of refractory metal, such as tungsten, molybdenum or the like. As clearly shown in FIGS. 1 and 2, the vitreous electrode supporting arms 7 and 8 are collapsed into intimate air-tight contact with vitreous sleeves S that are sealed to the rod-like portions of the refractory metal electrodes 9, which portions are wrapped with molybdenum foil 11 or the like, and at their outmost ends such electrodes are secured to a hermetic seal assembly, in accordance with the present invention. Since such seal assembly is identical at each end of the lamp, only one such assembly will hence be described in detail.

By reference now more particularly to the enlarged cross-sectional views of FIGS. 2 and 4, it will be noted that the lead-in conductor portion of the seal assembly comprises a plurality of longitudinally extending metallic foil ribbons 10. These ribbons are fabricated from a metal having a coefficient of expansion approximating that of the vitreous envelope 6, as for example from molybdenum or the like, and are sufficient in width and number to carry the current for which the specific lamp is designed. Prior to the sealing-in operation, the metallic foil ribbons 10 are held in proper position within the envelope arm 8 by a hollow cup 25 of quartz or the like that has a dished end wall 26, as shown in FIG. 2. After the cup 25 is inserted into the vitreous supporting arm 8, the latter is heated and fused to the cup, thereby forming a chamber 12 at the outer end of the arm. In the finished lamp 5 the ribbons 10 are, accordingly, embedded in the vitreous wall formed by the fused arm 8 and the vitreous cup 25 (as shown in FIG. 3) and provide an hermetic seal with the vitreous envelope 6. Immediately above the end chamber 12 the ends 13 of these foil ribbons 10 project laterally toward the axis of the supporting arm 8. The bent-over ends are slit and interleaved peripherally between an upper metallic disc 14 of molybdenum, or similar refractory metal, and an identical lower metallic disc 15 and conform to the curved contour thereof, with such discs and the laterally extending ends of the ribbons 10 being joined together by spot welding or the like, as seen more clearly from FIGS. 2 and 5. The aforesaid conjoined discs and ribbons form an integral elongated lead-in conductor assembly 21, as shown in FIG. 4.

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A third refractory metal disc 16 (see FIG. 2) is superimposed on the upper metallic disc 14 with such third disc 16 thus being in contact with the end of the collapsed vitreous wall of the supporting arm 8 and fused vitreous sleeve S that is sealed to the foil-wrapped portion of the refractory metal electrode 9. This third refractory metal disc 16 is held in place between the lead-in conductor assembly and adjacent end of the electrode 9 by a threaded stud bolt 17 of molybdenum or the like which passes through central openings provided in the respective discs 14, 15 and 16 and engages a threaded recess in the lower end of the electrode, as can be more readily seen in FIG. 2. The head of the bolt 17 is disposed in the cavity formed by the dished end wall 26 of the cup 25. This third or top metallic disc 16 is held in place solely by the bolt 17 and is thus free to move slightly under contraction and expansion during operation of the lamp without causing strains or cracks in the quartz or other vitreous material forming the envelope 6. Moreover, since all three discs are of the same metal and of substantially uniform configuration and ohmic resistance, they tend to distribute the heat more evenly in seal area and thus provide additional protection against strains and premature lamp failure.

Each of the molybdenum foil sealing ribbons 10 adjacent its outer end is provided with a plurality of narrower heavier gauge molybdenum tabs 18 welded thereto, as shown in FIG. 4, which tabs extend exteriorly of the hermetically sealed portion of the arm 8. These tabs 18 are then laterally bent around the peripheral edge of the cup 25 and over the flat upper surface of a metal ring 19 of molybdenum or the like and, after passing through an annular opening in such ring 19 (as seen particularly in FIGS. 2 and 3), the ends of these tabs 18 are again laterally bent to lay on the under recessed side of this ring 19 to which they are silver soldered. Thereafter, a metallic disc 20 having a diameter corresponding to that of the under recessed side of the ring 19 is positioned in such recess and silver soldered thereto. This metallic disc 20 is engageable by a terminal 23 affixed to a conductor lead 24 for transmitting electrical energy to the respective electrodes 9 carried by each arm of the lamp 5.

It should thus become apparent to those skilled in the art from the foregoing that a high current short-arc discharge lamp having a hermetic seal between the ribbon lead-in conductors and the vitreous envelope is provided wherein a positive and very reliable electrical connection is formed between the ribbon portions of the seal and the respective electrodes, which connection not only carries the necessary electrical energy but is inherently adapted to withstand the ensuing contraction and expansion resulting from the high operating temperature of the lamp. Moreover, a hermetic seal is provided utilizing a plurality of metallic ribbons extending from between a pair of metallic discs with such ribbons embedded in the envelope wall and the metallic discs forming a support and electrical connector for the lamp electrodes.

Although one specific embodiment of the present invention has been herein shown and described, it is to be understood that still further modifications thereof may be made without departing from the spirit and scope of the appended claims.

I claim:

1. A high-pressure high-current electric discharge lamp comprising;
 - (a) a sealed vitreous envelope having a bulbous portion and an outwardly extending elongated end portion,
 - (b) a refractory metal electrode anchored in said elongated end portion and extending therefrom into the bulbous portion of said envelope,
 - (c) a lead-in assembly for said electrode comprising a plurality of spaced longitudinally extending refractory metal conductors hermetically sealed within the end portion of said envelope with the inner ends of

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said conductors projecting laterally inward toward the axis of said end portion and secured to a movable refractory metal member that is located within said end portion proximate the anchored end of said electrode, and

- (d) means mechanically coupling said movable refractory metal member to the proximate end of said electrode and providing a positive electrical and stress-relieving connection between said sealed-in conductors and said electrode.

2. A high-pressure high-current electric discharge lamp comprising;

- (a) a sealed vitreous envelope having a pair of outwardly extending tubular end portions,
- (b) a pair of oppositely disposed refractory metal electrodes anchored in and extending longitudinally of said tubular end portions into the envelope proper and adapted to support a discharge between their adjacent ends during the operation of said lamp,
- (c) a hermetic seal and lead-in assembly for each of said electrodes comprising a plurality of peripherally disposed longitudinally extending refractory metal ribbon conductors embedded in the respective tubular end portions of said vitreous envelope with the inner ends of said conductors projecting laterally toward the axes of said tubular end portions and secured to a movable refractory metal disc-like member located proximate the anchored ends of the respective electrodes,
- (d) a fastener engaging the respective disc-like members and the proximate ends of said electrodes and providing a positive electrical and stress-relieving connection between said lead-in assemblies and the associated electrodes, and

- (e) an electrical contact terminal connected to the ends of said lead-in assemblies projecting exteriorly of said sealed envelope.

3. A short-arc electric discharge lamp comprising;

- (a) a sealed vitreous envelope having outwardly extending tubular end portions,
- (b) a pair of oppositely disposed refractory metal electrodes embedded in and extending longitudinally of said tubular end portions for supporting a discharge between their adjacent ends during operation of said lamp,

- (c) a hermetic seal and lead-in assembly at the remote end of each said refractory metal electrode comprising a plurality of peripherally disposed longitudinally extending refractory metal ribbons embedded in the walls of the respective tubular end portions with the inner ends of said ribbons projecting laterally of said end portions, and a pair of metallic discs having the laterally projecting ends of said ribbons interposed therebetween and spaced about the periphery of said discs with the juncture thus formed between the ribbon ends and said discs being permanently joined together,

- (d) means engaging the metallic discs and the embedded ends of the respective electrodes to form a mechanical and electrical connection between said lead-in assemblies and electrodes, and

- (e) an electrical contact terminal connected to the ends of said lead-in assemblies projecting exteriorly of said sealed envelope.

4. A high current short-arc discharge lamp comprising;

- (a) a sealed vitreous envelope having a pair of outwardly extending tubular end portions,
- (b) a pair of oppositely disposed refractory metal electrodes embedded in and extending longitudinally of said tubular end portions for supporting a discharge between their adjacent ends during operation of said lamp,
- (c) a hermetic seal and lead-in assembly at the remote end of each said refractory metal electrode comprising a plurality of peripherally disposed longitudinally

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extending refractory metal ribbons embedded in the tubular end portions of the sealed vitreous envelope with the inner ends of said ribbon projecting laterally inward of said end portions, and a pair of metallic discs having the laterally projecting ends of said ribbons interposed therebetween and spaced about the periphery of said discs with the juncture thus formed between the ribbon ends and said discs being permanently joined together,

(d) a bolt passing through said metallic discs and engaging the embedded end of the proximate electrode to form a mechanical and electrical connection between the respective lead-in assemblies and said electrodes, and

(e) an electrical contact terminal connected to the ends of said lead-in assemblies projecting exteriorly of said sealed envelope.

5. A lead-in assembly adapted to be sealed into the tubular arm portion of a vitreous envelope for a short-arc discharge lamp comprising;

(a) a plurality of elongated refractory metal conductors having laterally extending ends,

(b) a pair of superimposed refractory metal disc-like members rigidly fastened in overlapping relation with the laterally extending ends of said conductors and holding said conductors in spaced apart longitudinally extending relationship, and

(c) means for connecting the electrode of said lamp to said disc-like members.

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6. A lead-in assembly adapted to be sealed into the tubular arm portion of a vitreous envelope for a short-arc discharge lamp comprising;

(a) a plurality of longitudinally extending refractory metal ribbons,

(b) a pair of refractory metal discs having a laterally extending end of said ribbons interposed between said discs and disposed in spaced relation about the periphery thereof with the juncture thus formed between the ribbon ends and said discs being welded together.

(c) a third disc of refractory metal superimposed on the uppermost disc of said pair, and

(d) aligned openings in all said discs for the passage of a bolt therethrough to connect the disc-ribbon assembly to the end of the electrode of said lamp.

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