Aug. 26, 1958 K. GOTTSCHALK 2,849,632

ARC TUBE SEAL AND MOUNT

Filed Aug. 30, 1956

Fig. 1.

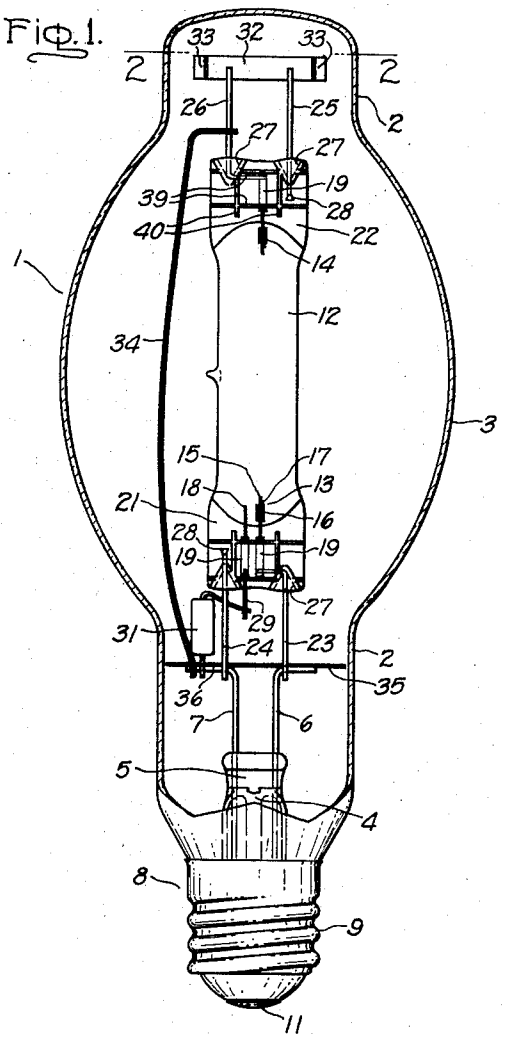


Fig. 2.

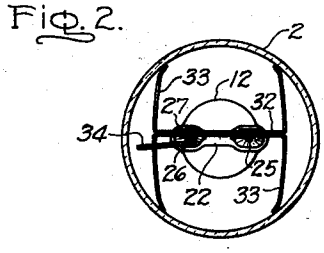
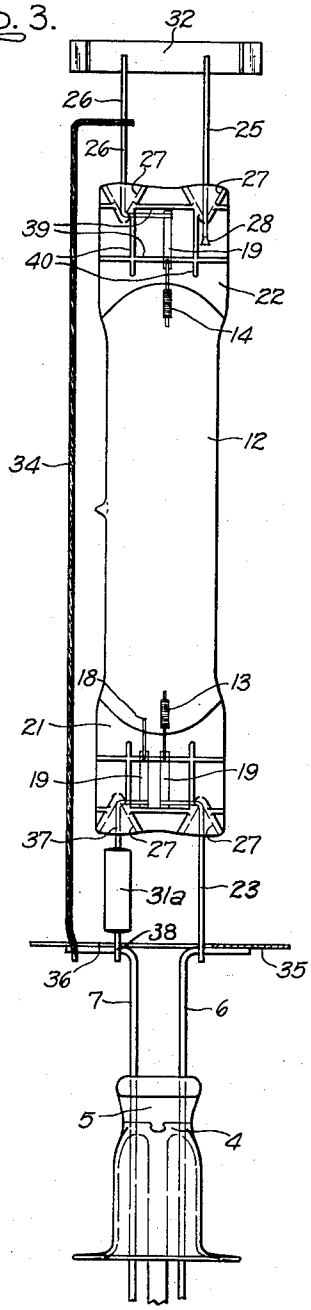


Fig. 3.



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United States Patent Office 2,849,632
Patented Aug. 26, 1958

2,849,632

ARC TUBE SEAL AND MOUNT

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Application August 30, 1956, Serial No. 607,006

6 Claims. (Cl. 313—25)

This invention relates to electric lamps of the high-pressure mercury vapor discharge type having an arc tube mounted in a vitreous outer envelope or jacket. The invention is more particularly concerned with the seal and inlead structure of the arc tube and its mounting in the outer envelope.

A form of commercially available high-pressure mercury vapor discharge lamp comprises a quartz arc tube enclosed in a vitreous outer envelope or jacket provided with a screw base at one end. The arc tube contains a quantity of mercury along with a starting gas and is provided with thermionic electrodes. The space between the arc tube and the outer envelope or jacket is either evacuated or filled with an inert gas such as nitrogen. There is also provided within this space a current limiting resistor which is connected between an auxiliary starting electrode at one end of the arc tube and the main electrode at the other end.

In co-pending application Serial No. 607,004 of Ernest C. Martt et al., filed of even date herewith, entitled "Arc Tube Mount," and assigned to the same assignee as the present invention, there is disclosed a mounting for an arc tube in a jacketed high-pressure mercury vapor discharge lamp which provides dummy leads or support wires secured in the pinch seals and serving as integral mount supports. The dummy leads at the base end of the arc tube are fastened directly to the main lead wires through the stem tube of the outer envelope and those at the outer end of the arc tube have fastened thereto spring members bearing against the outer end of the jacket. There are also provided inleads for the electrodes having foil portions embedded in the pinch seals and outwardly projecting portions connected to the foil portions, additional connections being made from the electrode inleads to the main lead wires of the outer envelope.

The object of the invention is to provide new and improved integral tube mountings for jacketed electric lamps.

A more specific object of the invention is to provide an improved seal structure and integral mount for the arc tube of a high-pressure discharge lamp which is more economical of materials and simpler to manufacture.

In accordance with the invention, one or more of the so-called dummy lead wires or integral support wires is connected within the pinch seal of a quartz tube to the foil section of an electrode inlead conductor. This may be achieved by providing the support wire with a laterally bent portion which is welded to the foil section of the inlead conductor prior to the pinching operation. The need for a separate externally projecting portion welded to the inlead foil and for an external connection from such portion to the main lead wires of the outer envelope is thus eliminated.

For further objects and advantages and for a detailed description of the invention, attention is now directed to the following description and accompanying drawing illustrating preferred embodiments of the invention. The features of the invention believed to be novel will be more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a front elevation view of a high-pressure mercury vapor lamp embodying the invention with the front portion of the outer envelope cut-away to show more clearly the arc tube and its seal and mounting structure.

Fig. 2 is an end view of the lamp through section 2—2.

Fig. 3 is a front elevation view of an arc tube and its mounting for a high-pressure discharge lamp forming another embodiment of the invention.

Referring to the drawing and more particularly to Fig. 1, there is shown a high-pressure mercury vapor lamp 1 comprising an outer vitreous envelope or jacket 2 of generally tubular form modified by a central bulbous portion 3 to achieve cooler operation of the jacket in the immediate vicinity of the arc tube. The jacket is provided at its lower end with a re-entrant stem 4 having a press 5 through which extend main lead wires 6, 7 connected at their outer ends to the contacts of the usual screw type base 8, namely the threaded shell 9 and the insulated center contact 11.

The inner arc tube 12 is made of quartz and has sealed therein at opposite ends a pair of main discharge supporting electrodes 13, 14. As illustrated, each main electrode comprises a core portion 15 which is the inward projection of its inlead into the arc tube. The core portion is made of a suitably refractory metal such as tungsten or molybdenum, and is surrounded by a tungsten wire helix 16. A small elongated piece or sliver 17 of thorium metal inserted between the core and helix serves to reduce the cathode drop at the electrodes during operation. An auxiliary starting electrode 18 is provided at the base end of the arc tube adjacent main electrode 13 and consists of the inward projection of an inlead.

The inleads for electrodes 13, 14 and 18 each comprise a central molybdenum foil section 19 which is bonded to the quartz in pinch seals 21, 22. The foil sections may have a thickness of approximately .0008 inch, and a width of approximately .12 inch in the case of main electrodes 13 and 14, or less in the case of auxiliary electrode 18.

The arc tube has a filling of an ionizable medium consisting of a supply of mercury in sufficient quantity to be completely vaporized with a pressure of the order of one-half to several atmospheres during operation of the lamp, and in addition a small quantity of an inert gas such as argon at a low pressure, for instance 25 mm. pressure, to facilitate starting and warm-up of the tube.

The pinched end portions 21, 22 of the arc tube form wide seals extending the full diameter of the tube. The pinch seals are made by flattening or compressing the circular ends of the arc tube without prior necking down to a smaller diameter. The width of the seals then corresponds to approximately $\pi/2$ times the diameter of the arc tube; in practice it is usually less than the figure obtained by this relationship due to slight necking down of the quartz end by surface tension while heated to a plastic temperature during the sealing operation, but is at least as great as the tube diameter. Thus in a 400-watt lamp designated H400–E1 wherein the arc tube has an outside diameter of approximately 22 mm. and an inside diameter of 20 mm., the pinch seal width may be from 25 to 30 mm.

The arc tube is supported in the outer jacket by means of integral support leads or wires 23, 24 in the lower seal 21 at its base end, and 25, 26 in the upper seal 22 at its outer end. The support wires enter the pinch seals near the corners, that is near the outside lateral edges of the seals, and project axially therefrom, that is, parallel to the longitudinal axis of the arc tube. They provide the entire support for the arc tube within the outer envelope and their disposition near the outside lateral edges of the pinch

seals assures a more rigid assembly which is proof against twisting and warping when the lamp is handled or shipped.

In order to provide against a tendency of the corners of the pinch seals about support leads **23** to **26** to crack off during shipping or handling or after repeated operation of the lamp, inwardly directed conical or funnel-shaped cavities **27** are provided at the points where the support leads penetrate into the folds of the seal formed by fusing together the inner surfaces of the quartz walls of the arc tube. The dummy leads do not engage or contact the quartz except at and beyond the apices of the funnel-like openings, and therefore at points substantially removed from the outer edges of the seal. The feature of funnel-like openings about the support leads is disclosed and claimed in my co-pending application Serial No. 607,096, filed of even date herewith, entitled "Arc Tube Mounting," and assigned to the same assignee as the present invention, and substantially eliminates the problem of the corners of the pinch seals cracking off.

In the embodiment of the invention illustrated in Fig. 1, support wires **24** and **25** perform solely the mechanical function of supporting the arc tube. They project dirrectly into the pinch seals and since they have no extensions into the interior of the arc tube, hermetic seals are not necessary. Their inner ends are preferably expanded in a transverse dimension, for instance by pinching or flattening: the resulting "fish-tail" form shown at **28** serves to key the support leads in the quartz.

In accordance with the invention, integral support leads **23** and **26**, in addition to the mechanical function of supporting the arc tube, perform also the electrical function of the outward projections of the electrode inleads. To this end, support wires **23** and **26** are provided with right angle bends or inwardly turned portions within the pinch seals immediately beyond or about the apices of the funnel-like opening. The ends of the turned portions are welded to the outer ends of the foil sections **19** of the electrode inleads. Thus by combining, in some of the integral support wires, the functions of providing electrical connections to the electrodes in addition to supporting the arc tube, the number of parts embedded in the seals along with the external connections is substantially reduced with resultant savings in manufacturing cost.

Support leads **23** and **24** are fastened respectively, for instance by welding, to the laterally turned ends of main lead wires **6** and **7** projecting inwardly from the stem tube of the jacket. Both support wires provide mechanical support for the arc tube and support wire **23** in addition establishes an electrical connection to electrode **13**. Auxiliary electrode **18** has an outwardly projecting wire portion **29** welded to the outer end of its inlead foil portion **19** and a current limiting resistor **31** is connected between wire portion **29** and lead wire **7** of the outer envelope.

Support leads **25**, **26** at the upper end of the arc tube are fastened to a transverse brace member **32** (Fig. 2) which is provided with integral spring fingers **33** bearing against the outer tubular end of the jacket. A flexible strap or wire **34** connects support wire **26** to the laterally turned end of lead wire **7** of the outer envelope.

A heat reflector disc **35** is mounted transversely to the axis of the envelope immediately above the laterally turned ends of lead wires **6**, **7**. The disc is welded to lead wire **6** and is slotted at **36** about the region of the laterally turned end of lead wire **7** so as to avoid contact with that lead or the connections thereto.

Fig. 3 illustrates the arc tube and its mounting for a high-pressure mercury vapor discharge lamp forming a variant of the invention. Except as specifically pointed out hereafter, this lamp is similar to that of Fig. 1 and similar reference numerals denote corresponding parts. In this embodiment, the outer wire portion **29** of the inlead for auxiliary electrode **18** is eliminated. A current limiting resistor **31***a* is provided having relatively heavy leads of substantially the same stiffness as the support

wires. At least the upper lead **37** of the resistor is made of a suitable refractory metal such as molybdenum. That lead enters pinch seal **21** through a funnel-like aperture **27** and is provided with a right angle bend at or beyond the apex of the aperture, the end of which is welded to foil section **19** of the inlead for auxiliary electrode **18**. It will be appreciated, of course, that the welding of the resistor lead to the foil section is made prior to pinching of the seal. The other lead **38** of resistor **31***a* is welded to the laterally turned end of main lead wire **7** of the jacket. Resistor **31***a* thus fulfills the function of an integral support for the arc tube in addition to its usual function of limiting the current to the auxiliary electrode, thereby further simplifying the seal structure and reducing its cost.

The pinch seals with integral mount supports connected to the foils of the inlead conductors in accordance with the present invention may be made in similar fashion to those described in my co-pending application Serial No. 607,096, filed of even date herewith entitled "Arc Tube Mounting," and assigned to the same assignee as the present invention. The lower ends of the support wires, with the inlead foils and electrodes already welded to their laterally bent upper ends, are supported vertically above the upper face of a mount spindle, being accommodated in suitable apertures therein. The arc tube is positioned immediately above the spindle and surrounding the support wires, inleads, and electrodes. Burners are provided to heat the lower end of the arc tube to plasticity and then a pair of jaws are closed together upon the lower end of the arc tube to collapse its walls together and form the pinch seal.

The shape of the jaw surfaces may be similar to those described in my co-pending application Serial No. 607,005, filed of even date herewith entitled "Quartz Tube Pinch Seal," and assigned to the same assignee as the present invention. The resulting seal is thicker at the center along an axial line than at the lateral edges and is thinner, that is, more highly compressed, at the curved inner edge adjacent the arc tube than at the outer edge. Preferably the jaws are provided with shallow grooves cut across in transverse and axial directions in order to restrict flow of the plastic quartz thereunder at pinching, and resulting in the formation of transverse ridges **39** and axial ridges **40** in the surfaces of the seals: the jaws are also provided with cavities or cutouts at their lower edges conforming to the funnel-like apertures **27** at the outer edges of the seals through which the integral support leads penetrate into the folds of the seals.

While the present invention has been described by reference to specific preferred embodiments of same, the details of construction described are intended as exemplary and not in order to limit the invention thereto except in so far as included in the accompanying claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A vitreous tube having an end sealed by an axially projecting flat pinch seal of width at least substantially as great as the diameter of the tube and having an inlead conductor with an intermediate foil portion hermetically sealed through its central portion, and support wires embedded in the seal near its lateral edges, at least one of said support wires being connected within the seal to said foil portion.

2. A quartz tube having its ends sealed by axially projecting flat pinch seals of width at least substantially as great as the diameter of the tube and consisting of the collapsed walls of the tube fused together, said seals having inlead conductors with intermediate foil portions hermetically sealed through their central portions, support wires embedded in the seals and projecting axially therefrom near their lateral edges and forming integral mount supports for the tube within an enclosing envelope, and at least one support wire in each seal being con-

nected to the foil portion of the inlead conductor therethrough.

3. A quartz tube having its ends sealed by axially projecting flat pinch seals of width at least substantially as great as the diameter of the tube and having inlead conductors with intermediate foil portions hermetically sealed through their central portions, support wires embedded in the seals and projecting axially through funnel-like openings formed in the outer edges of the seal, at least one support wire in each seal having a laterally bent portion within the seal connected to the outer end of the foil portion of the inlead conductor therethrough.

4. An electric discharge lamp of the jacketed high-pressure type comprising a vitreous outer envelope enclosing a quartz arc tube, said tube having at each end an axially projecting flat pinch seal of width at least substantially as great as the diameter of the arc tube with an inlead conductor having an intermediate foil portion hermetically sealed therethrough, a pair of support wires embedded within each seal, one near each lateral edge and projecting axially from the outer end of the seal, at least one support wire in each seal having a laterally bent portion within the seal connected to the outer end of the foil portion of the inlead conductor therethrough, and means within the outer envelope engaging the outer ends of the support wires to provide therethrough substantially the entire mechanical support for the arc tube and electrical connections to the inlead conductors.

5. An electric discharge lamp of the jacketed high-pressure type comprising a sealed vitreous outer envelope enclosing a quartz arc tube, said tube having at each end an axially projecting flat pinch seal of width substantially as great as the diameter of the tube and consisting

of the collapsed walls of the tube fused together, said seals having inlead conductors with intermediate foil portions hermetically sealed through their central portions, and a support wire at each lateral edge of each seal having an end embedded in the seal between the collapsed walls forming same and projecting axially from its outer end, one support wire in each seal having a laterally bent end within the seal connected to the outer end of the foil portion therethrough, a base at one end of the outer envelope, main lead wires sealed through the outer envelope and connected to said base, the support wires at one end of the arc tube being fastened to said main lead wires, spring fingers fastened to the support wires at the outer end of the arc tube and engaging the outer envelope to locate the arc tube securely in place therein, and a connection from the support wire connected to the inlead conductor at the outer end of the arc tube to one of the main lead wires.

6. A lamp as in claim 5 wherein an additional inlead conductor for an auxiliary electrode has an intermediate foil portion hermetically sealed through one of the pinch seals, and the other support wire in said seal consists of a lead wire of a current limiting resistor having a laterally bent end connected to the foil portion of said additional inlead within the seal.

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