

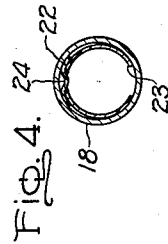
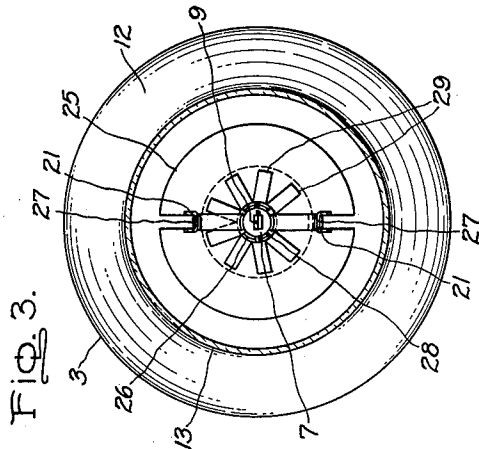
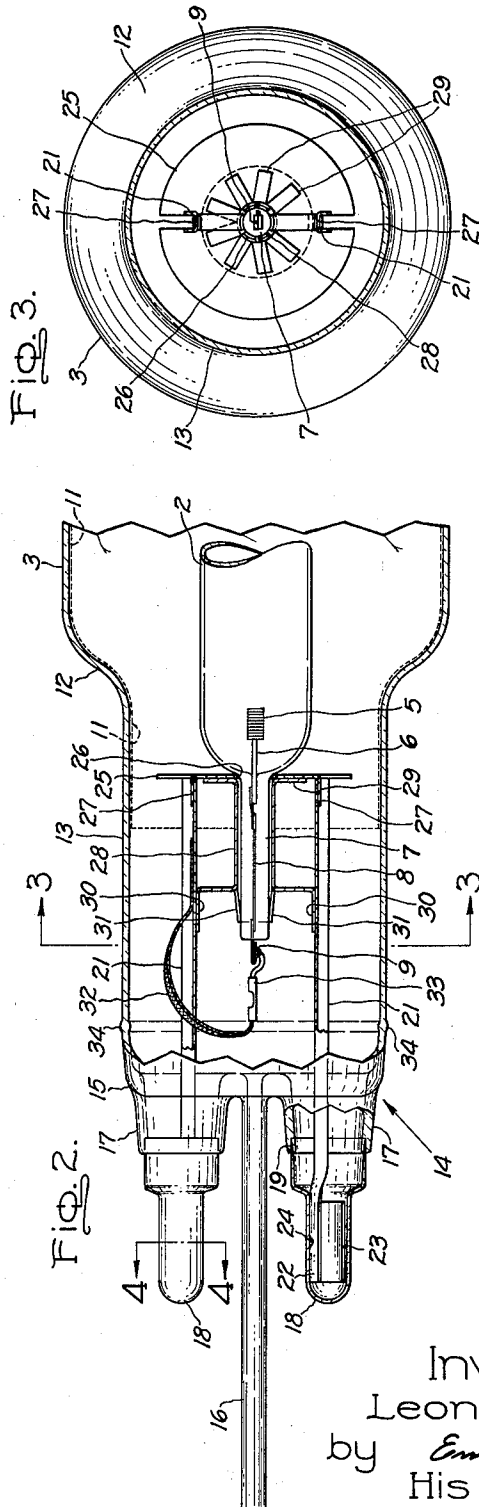
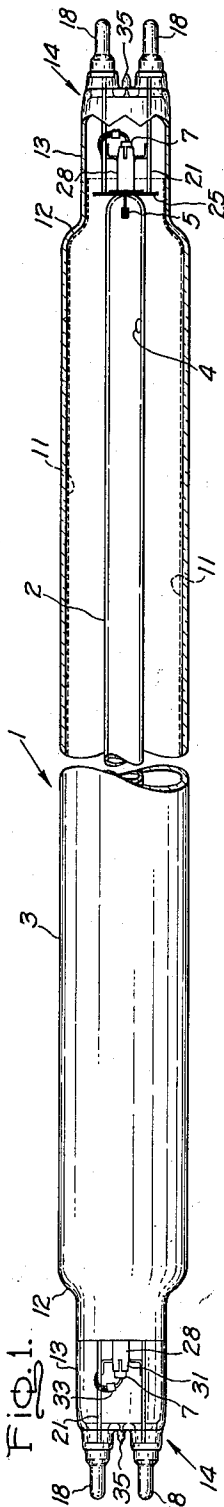
April 9, 1963

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3,085,171

DOUBLE-ENDED JACKETED ARC LAMP MOUNTING

Filed April 10, 1961



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**3,085,171
DOUBLE-ENDED JACKETED ARC LAMP
MOUNTING**

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Filed Apr. 10, 1961, Ser. No. 101,795
6 Claims. (Cl. 313-25)

This invention relates to elongated double-ended jacketed arc lamps having bases at both ends for engagement in spaced sockets or lamp holders. The invention is more particularly concerned with structural features of the jacketed assembly and with the mounting arrangement by which the arc tube is supported within the jacket and through which electrical connections are made to the electrodes.

The demand for more powerful light sources for outdoor lighting applications, such as for instance the lighting of sports stadiums, parking lots and public places, has led to increasing use of double-ended high-pressure mercury vapor arc lamps. Such lamps have elongated quartz envelopes with an arc chamber length several times the internal diameter and operating at mercury vapor pressures of one atmosphere or more, for instance in the range of 1 to 10 atmospheres. These lamps are efficient sources of ultraviolet radiation and are used extensively in photo-chemical applications. They are also efficient sources of visible radiation but when used for general illumination, they must be enclosed in fixtures provided with suitable glass or plastic transparent covers for cutting out the ultraviolet radiation which is harmful to the eyes.

A problem encountered with elongated high-pressure mercury vapor arc tubes is that of preventing oxidation of the inleads through the seals at both ends. A solution which has been proposed is to mount the quartz arc tube within an outer glass jacket which is then evacuated or filled with an inert gas to prevent oxidation of the seals and leads. Such an arrangement has the further advantage that the outer jacket serves as an ultraviolet filter so that the fixture is relieved of this duty. In addition, the outer jacket may be coated internally with a phosphor which gainfully converts the ultraviolet radiation into visible light; the phosphor may be selected either with a view towards improving the over-all lumen per watt efficiency of the combination, or toward improving the color rendition by supplying a red component of which the visible mercury spectrum is short.

The general object of the invention is to provide a jacketed double-ended arc lamp with a new and improved mounting arrangement for supporting the arc tube within the jacket.

More specific objects and corresponding features of the invention may be stated as follows: the mounting support must be rugged and sturdy yet flexible enough to absorb any shock or vibration which the lamp may receive during shipment or while mounted in a fixture without causing fracture of the relatively fragile quartz or glass parts; also the mounting arrangement must provide for ease of assembly and must permit adjustment for normal variations in arc tube and jacket length. The mounting arrangement according to the invention meets all of these requirements and in addition is simple to manufacture and low in cost.

In accordance with the invention, the arc tube is supported within the jacket by engagement of its ends in apertured springy plates transversely mounted within the jacket and receiving their support from terminals sealed through the closures at the ends of the jackets. A preferred embodiment of the invention in the form of a double-ended jacketed arc lamp utilizes a quartz arc tube

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within a phosphor coated hard glass outer envelope or jacket. Pin-type terminals are sealed into the vitreous closure members at the ends of the jacket, and support members extending axially inward from these terminals have a flexible radiation-reflective plate mounted transversely on their inner ends. The plates are apertured and the axial seals of the arc tube are passed through apertures so that the rim of the aperture bears springly against the rounded end of the arc tube. A metal sleeve is fastened to each plate and encircles the aperture while extending axially outward from the plate. The outer end of the sleeve is slotted and the segments bent inwardly in order to grip the axial seal in a resilient fashion. A flexible lead connects the inlead to the mounting structure and thereby to the jacket terminals.

For further objects and advantages and for a better appreciation of the features of the invention, attention is now directed to the following description and accompanying drawing illustrating a preferred embodiment. 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 side view, partly sectioned and foreshortened, of a high-pressure double-ended mercury vapor arc lamp provided with a phosphor coated jacket and embodying the invention.

FIG. 2 is a fragmentary side sectional view of one end of the lamp showing the mount structure.

FIG. 3 is a cross-sectional view of the end of the lamp taken along line 3-3 of FIG. 2.

FIG. 4 is a cross-sectional view through one of the pin terminals taken along line 4-4 of FIG. 3.

Referring to the drawing and more particularly to FIGS. 1 and 2, the illustrated lamp 1 comprises an inner arc tube 2 coaxially mounted within an outer envelope or jacket 3. The arc tube is a cylindrical quartz tube filled with an inert gas such as argon at a low pressure, for instance 25 millimeters of mercury, and a quantity of mercury sufficient when vaporized to develop a vapor pressure in the range of 1 to 10 atmospheres, for instance 2 to 4 atmospheres, the mercury being indicated by the droplet 4. At each end of the lamp there is provided a thermionic electrode 5 mounted on a support rod 6 and to which current connections are made through an inlead which extends through a generally cylindrical, axially projecting quartz seal body 7. Each inlead comprises a thin metal foil portion 8, commonly made of molybdenum, with a thicker tab 9 emerging from the end of the seal body 7. The central portion 8 of the inlead is a very thin foil, for instance less than one mil in thickness, so that it yields under tension to the quartz during cooling and does not rupture nor crack the quartz, thereby preserving a hermetic seal. The illustrated seal is generally known as a vacuum seal because vacuum is used to collapse the originally hollow quartz seal body 7 onto the inlead 8 threaded therethrough while the quartz is heated to a softening temperature.

The outer envelope or jacket 3 consists of a hard glass such as a borosilicate glass. It is coated internally with a phosphor layer indicated by dotted line 11. Where maximum luminous efficiency is the prime consideration, an orthophosphate phosphor may be used; where quality is more important and improved color rendition is desired, a magnesium germanate phosphor having a substantial red emission may be used. The ends of the jacket are necked down at 12 into reduced diameter tubular extensions 13. The end of the tubular extension 13 is closed by a cup-shaped closure member 14 which is termed a bi-post flare. The bi-post flare is made as a separate assembly and comprises a shallow cup-like member 15 of hard borosilicate glass provided with a central exhaust tube

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16 and a pair of outwardly projecting teat-like extensions 17. A pair of hollow copper pins or posts 18 are sealed peripherally into the extensions 17, whence the name bi-post flare. The posts 18 are closed at the outer end and, are enlarged at the inner end with a feathered edge 19 which is sealed to the flare by embedding it in the lip of the projecting teat 17. Due to the thinness of the metal at the edges of the post body where it is sealed to the glass, a hermetic joint is achieved which can withstand substantial temperature variations.

The mounting structure proper for supporting the arc tube within the jacket comprises a pair of rods 21 of channel-shaped cross section which are supported from the pins 18 and extend inwardly therefrom, that is towards the middle of the lamp, through the reduced diameter portion 13 of the jacket. The rods 21 are fastened within the hollow posts 18 by re-forming the end of the rod at 22 approximately to the curvature of the inner wall of the post and clamping it in place by means of a C-shaped springy band 23 which serves to press the portion 22 against the inside wall of the post. The portion 22 is provided with an inwardly directed boss 24 which engages in a corresponding hole in band 23 in order to lock the members together, as illustrated in FIG. 4.

A thin springy metal disc or plate 25 having a central circular aperture 26 therein is fastened to the ends of the channel rods 21 by means of tabs 27 bent over and spot-welded. Disc 25, in addition to its support function, is a radiation reflector and to this end is preferably reflectively coated, for instance by nickel plating. A thin metal sleeve 28 is fastened to the rear face of disc 25 in a manner to encircle aperture 26 by means of radially struck tabs 29 spot welded to the disc. At its rear end, (nearest the bi-post flare) sleeve 28 is provided with a pair of laterally offset tabs 30 which are spot welded to channel-shaped rods 21 to provide additional support. In addition the outer end of sleeve 28 is slotted to provide segments 31 which are bent inwardly in order to grip resiliently the end of the seal body 7 of the arc tube. A braided flexible metal ribbon 32 is welded at one end to one of the rods 21 and is provided with a female connector 33 at its other end which engages a corresponding male connector attached to tab 9 projecting from the end of seal body 7.

In the assembly of the lamp, jacket 3 is first coated internally with phosphor and then lehrd by heating at a temperature in excess of 600° C. to decompose and drive out the organic binders used in applying the phosphor coating. The jacket is then mounted in a glass lathe, the arc tube threaded therethrough, and a bi-post flare positioned at each end. The seal bodies 7 of the arc tube are accommodated in the sleeves 28 of the mounting structure and the parts of electrical connectors 33 are interengaged. The bi-post flares are held in auxiliary chucks of the glass lathe so that the two flares and the jacket can be rotated in unison while axis alignment is maintained. Fires are played on the mating edges of the reduced extensions 13 of the jacket with those of the bi-post flare body and as the glass reaches the softening point, the parts are worked together, that is pressed inwardly and then drawn apart repeatedly in order to work the glass and provide a sound juncture. With skill, the parts may be joined together leaving a barely visible juncture line as indicated at 34. In the final positioning of the parts, the bi-post flare assemblies are pressed inwardly so that the rim of aperture 26 in disc 25 presses against the curved end or shoulder of the arc tube. The inter-envelope space between the arc tube and outer jacket is filled with a non-oxidizing gas such as nitrogen and the exhaust tubes 16 are then tipped off as shown at 35 in FIG. 1.

The above-described arrangement provides a mounting which is low in cost and economical to manufacture. It is strong and will not distort under the weight of the arc tube yet has sufficient resiliency that the shocks en-

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countered in shipping and during operation will not damage the assembly. The tubular seal body extensions 7 at the ends of the arc tube are not very strong and would not of themselves provide sufficient support to the lamp. However by pressing the resilient discs 25 so that the apertures therein engage directly the rounded end of the arc tube, adequate support is achieved. The discs 25 being relatively light-gauge and flexible can bend to take care of any variations during manufacture and also to accommodate expansion of the arc tube during operation. At the same time they reflect light and radiant heat back towards the center of the lamp and thereby assist in keeping the ends cool. The sleeves 28 with the resilient segments 31 at the outer end provide additional support through the seal bodies and compensate by flexing for lack of true axial alignment of the seal bodies. The channel-shaped support rods 21 have sufficient flexibility to allow elastic displacement of the support point of the end of the arc tube in a direction transverse to the axis of the lamp, thereby providing a shock resistant mounting.

As an example of a high power lamp actually constructed in accordance with the illustration of the drawings and tested, the following data apply.

Jacket dimensions-----	59¼" over-all length x 4" diameter.
Arc tube dimensions----	48" over-all length x 28 mm. diameter.
Electrical -----	6000 watts, 1000 volts, 6.6 amperes.
Light output-----	330,000 lumens.

The preferred embodiment of the invention which has been described herein is intended by way of example and not in order to limit the invention thereto. The scope of the invention is to be determined by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A double-ended jacketed arc lamp comprising an inner arc tube having projecting seal bodies at opposite ends, a tubular light-transmitting jacket surrounding said arc tubes, and a mounting structure supporting said arc tube within said jacket, said structure comprising closures at the ends of said jacket having terminals sealed therethrough, support members extending axially inwards from said terminals, flexible plates mounted at the inner ends of said support members in planes transverse to the axis of said lamp, each plate having an aperture therethrough, the seal bodies of said arc tube being passed through said apertures and said flexible plates pressing against the ends of said arc tube.

2. A double-ended jacketed arc lamp comprising an elongated inner arc tube having axially projecting seal bodies at opposite ends, a tubular light-transmitting jacket surrounding said arc tube, and a mounting structure coaxially supporting said arc tube within said jacket, said structure comprising closures at the ends of said jacket having terminals sealed therethrough, support members extending axially inwards from said terminals, flexible radiation-reflective plates mounted at the inner ends of said support members in planes transverse to the axis of said lamp at each end, each plate having an axial aperture therethrough, a sleeve fastened to the plate about the aperture and extending axially, said sleeves accommodating the axially projecting seal bodies and said flexible plates pressing against the ends of said arc tube.

3. A double-ended jacketed arc lamp comprising an elongated inner quartz arc tube having axially projecting seal bodies at opposite ends, a tubular vitreous jacket surrounding said arc tube and coated internally with luminescent material, and a mounting structure coaxially supporting said arc tube within said jacket, said structure comprising vitreous closures at the ends of said jacket having terminals sealed therethrough, support

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members of channel-shaped cross-section extending axially inwards from said terminals, flexible radiation-reflective metal plates mounted at the inner ends of said support members in planes transverse to the axis of said lamp at each end, each plate having an axial aperture therethrough, a metal sleeve fastened to the plate about the aperture and extending outwardly, said metal sleeves accommodating the axially projecting seal bodies and said metal plates pressing against the ends of said arc tube to provide resilient support thereto, and a non-oxidizing gas filling the interenvelope space.

4. A double-ended jacketed arc lamp comprising an elongated inner arc tube having axially projecting seal bodies at opposite ends, a tubular light-transmitting jacket surrounding said arc tube, and a mounting structure coaxially supporting said arc tube within said jacket, said structure comprising closures at the ends of said jacket having terminals sealed therethrough, support members extending axially inwards from said terminals, flexible radiation-reflective metal plates mounted at the inner ends of said support members in planes transverse to the axis of said lamp at each end, each plate having an axial aperture therethrough, a metal sleeve fastened to the plate about the aperture and extending axially, the seal bodies of said arc tube being passed through said apertures and accommodated in said sleeves, and the rims of said apertures in said metal plates pressing against the ends of said arc tube to support it in place.

5. A double-ended jacketed arc lamp comprising an elongated inner arc tube having generally tubular axial seals at opposite ends with inlead wires passing therethrough, a tubular vitreous jacket surrounding said arc tube, and a mounting structure coaxially supporting said arc tube within said jacket, said structure comprising at each end of said lamp a vitreous closure for said jacket having terminals sealed therethrough, support members extending axially inwards from said terminals, a flexible radiation reflective metal disc mounted at the inner ends of said support members in a plane transverse to the axis of said lamp, said disc having a central aperture there-

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through, a metal sleeve fastened to said disc and encircling said aperture and extending axially outwards from said disc, said metal sleeve accommodating the seal of said arc tube and having a resilient outer end bearing against said seal with a springy fit, and a flexible connection between the inlead emerging from said seal and said mounting structure at each end of said lamp.

6. A double-ended jacketed arc lamp comprising an elongated inner arc tube having generally tubular axially projecting seal bodies at opposite ends with inleads passing therethrough, a tubular vitreous jacket surrounding said arc tube, and a mounting structure coaxially supporting said arc tube within said jacket, said mounting structure comprising at each end of said lamp a vitreous closure for the end of said jacket, a pair of hollow post terminals sealed into said closure and projecting axially therefrom, support rods fastened into said terminals and extending axially inwards therefrom, a flexible radiation-reflective disc mounted at the inner ends of said support rods in a plane transverse to the axis of said lamp, said disc having a central aperture therethrough, a metal sleeve fastened to the rear of said disc and encircling said aperture and extending axially outwards from said disc, said metal sleeve accommodating the seal body of said arc tube and being slotted at its outer end with inwardly turned segments pressing springily against said seal body, said disc bearing against the end of said arc tube at the rim of the aperture therethrough to provide resilient support for said arc tube and serving also as a heat shield for the inlead and mounting structure, and a flexible connection between the inlead emerging from the end of said seal body and said mounting structure whereby to provide circuit continuity from said pin terminals to said inlead at each end of said lamp.

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