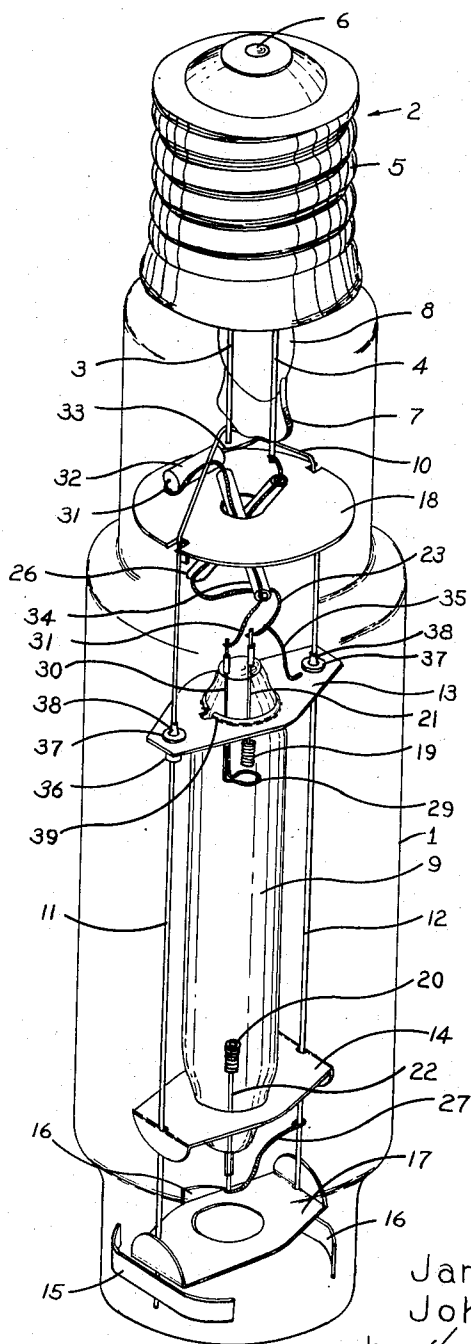


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ELECTRIC DISCHARGE LAMP MOUNT

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ELECTRIC DISCHARGE LAMP MOUNT

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The present invention relates to electric discharge lamps of the high pressure mercury vapor discharge type having a vitreous arc tube mounted in a vitreous outer envelope and more particularly the invention relates to means for supporting the arc tube in the outer envelope.

High pressure mercury vapor discharge lamps of the above type have been known commercially for approximately fifteen years and are made in 400, 250 and 100 watt sizes at present. Supporting the arc tube within the envelope, particularly in the higher wattage sizes, has presented difficulties heretofore due to the elevated temperature of the tube during operation of the lamp and no completely satisfactory support has been available though many types have been proposed. For example, metal support members directly engaging the hot ends of the tube led to electrolysis of the tube material which frequently resulted in cracking of the tube and the seals. Refractory insulating materials, such as mica, having the necessary flexibility to avoid rupturing the tube when the lamp parts expanded and contracted during service frequently became charred and distorted in shape before the lamp had reached the end of its useful life. Further, mica supports give off undesirable water vapor at the high operating temperature of the lamp and thus frequently caused early lamp failure.

The principal object of the present invention is to provide support means for the arc tube of high pressure mercury vapor discharge lamps of the above type which avoids the above disadvantages. Another object of the invention is to provide a high pressure lamp of the above type which has a long useful operating life. Still further objects and advantages of the invention will be apparent to those skilled in the art from the following detailed description of species thereof and from the appended claims.

In the drawing accompanying and forming part of this specification a high pressure mercury vapor discharge lamp having an arc tube support embodying the present invention is shown in a perspective view as seen from above.

As shown, the lamp comprises a sealed outer envelope 1 of glass having the usual screw type of base 2 attached to one end thereof. Electric leading-in wires 3 and 4 are attached to the threaded shell 5 and the insulated center contact 6 of the base 2, respectively, and pass through the press part or pinch 7 of the reentrant stem tube 8 of the outer envelope 1. The sealed arc tube 9, of quartz or hard glass, contains the usual starting gas and a measured amount of

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mercury sufficient to produce an unsaturated, high pressure vapor atmosphere at the operating temperature of the tube 9.

The tube 9 is supported within the outer envelope 1 by a harness made up of a substantially U-shaped, stiff metal wire support having the portion 10 connecting its straight legs 11 and 12 welded to the inner end of said leading-in wire 3 and a pair of lateral, perforated, thin, plate-like, flexible metal supports 13 and 14 secured to the legs 11 and 12 of the wire support and engaging the tapered ends of the arc tube 9 to hold the tube therebetween.

Metal spring fingers 15 and 16 are welded to the free ends of the legs 11 and 12 and press against the wall of the envelope 1 to provide lateral support for the end of the arc tube mount. A metal tie plate 17 is also attached to and between the free ends of the legs 11 and 12 to increase the rigidity of the mount. A heat shield in the form of a perforated metal disc 18 is also attached to the legs 11 and 12 between the stem press 7 and the arc tube 9 to protect the glass plate-like members 14, 17 and 18 are welded to the legs 11 and 12.

The arc tube 9 is provided with a pair of main discharge supporting electrodes 19 and 20 mounted on current leading-in wires 21 and 22 respectively extending through opposite ends of the tube 9 and constituting the tube terminals. The lead-in 21 of the upper main electrode 19 is connected to the current lead 4 extending through the stem press 7 by a flexible conductor 23 passing through the opening in the heat shield 18 and is insulated from said shield by a glass tube 26. A flexible conductor 27 connects the lead-in 22 for the opposite main electrode 20 to the leg 12 of the U-shape support which is connected, through its part 10, to the lead-in wire 3 extending through the stem press 7. The main discharge current is supplied to the discharge path between the main electrodes 19 and 20 by the above described leads and connections.

To facilitate the starting of the main discharge, an auxiliary starting electrode 29 in the form of a metal wire loop is supported in front of the upper main electrode 19 by the inlead 30 extending through the upper or starting electrode end of the arc tube 9. When the arc tube 9 is of quartz, the inleads 30, 21 and 22 are hermetically united therewith by glass seal bodies, as is well known. The starting electrode 29 is electrically connected to the lower main electrode 20 through the said inlead 30, the flex-

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ible conductor 31 attached to one end of a suitable resistor 32 which is supported slightly above the heat shield 18 by the stiff conductor 33 attached to the mid-portion 10 of the U-shaped mount to which the lower main electrode 20 is electrically connected as described above. The portion of the flexible conductor 31 passing through the opening in the metal heat shield 18 is electrically insulated therefrom by the glass tube 34.

The auxiliary starting electrode 29 is preferably of the type disclosed and claimed in our copending application Serial No. 152,904, filed March 30, 1950 and assigned to the assignee of the present application, that is, the electrode 29, of tungsten, for example, is of small thermal mass and is mounted in the arc stream between the electrodes 19 and 20 to assume substantially the potential of the adjacent main electrode 19 during operation of the lamp and thus eliminate electrolysis of the vitreous material between the inleads 30 and 13 of the electrodes 29 and 19, respectively. Of course, the starting electrode 29 is at the potential of the remote main electrode 20 before the discharge between the main electrode 19 and 20 starts.

In the past, the upper plate-like support 13 engaging the tapered end of the arc tube 9 has been made of metal and fastened directly to legs 11 and 12 of the U-shaped support. The said plate-like support was thus charged to the potential of the lower main electrode 20 with the result that current flowed between the plate 13 and the inner elements of the arc tube 9 through the wall of the arc tube causing electrolysis of the tube material with consequent weakening and eventual break down of this portion of the tube wall before full operating life of the lamp had been attained. The electrolysis and eventual break down took place not only at the parts of the tube engaged by the support but also at the glass seals between the inleads and the tube. Attempts to solve the problem by using an electrically insulating support of similar shape instead of a metal support 13 for the end of the arc tube were not completely satisfactory because the otherwise suitable material, mica, charred and warped under the high temperature to which it was subjected during operation of the lamp to end the life of the lamp prematurely by failing to properly support the arc tube 9 in the outer envelope 1. Also, as stated above, mica supports gave off water vapor during operation of the lamp and thus caused lamp failures.

The novel structure of the lamp of the present invention completely avoids the prior difficulties by using a metal plate support 13 and by charging the said metal plate support to the same potential as the upper main electrode 19 and the auxiliary electrode 29 during operation of the lamp. The metal plate 13 does not give off water vapor, is not subject to charring and warping as is a mica plate, for example, and the charge of equal potential on the plate 13 and on the upper electrodes 19 and 29 avoids electrolysis of the arc tube material and the glass seals. The useful operating life of the lamp is thus increased substantially.

To impress a suitable charge on the metal support plate 13 the plate is electrically connected by the flexible conductor 35 to the conductor 23 of the upper main electrode 19 and is electrically insulated from both legs 11 and 12 of the U-shaped support by a pair of insulating ferrules 36 of steatite for example, having flanges 37

around the legs 11 and 12 and passing through openings in the ends of the support 13. The flanges 37 on the ferrules 36 are held down against the top surface of the support plate 13 by metal pieces 38 on the legs 11 and 12 to hold the arc tube 9 between the support plates 13 and 14.

The sides 39 of the opening in the supports 13 and 14 are slightly rounded in cross section as shown at the broken portion of support 13, to avoid presenting a sharp edge to the end of the arc tube 9 while retaining a line contact between the tube 9 and the supports 13 and 14. A sharp metal edge engaging the arc tube 9 is not desirable because it frequently digs into the tube and weakens it, but a line contact obtained with such an edge is desirable because it minimizes the transfer of heat from the tube 9 to the supports 13 and 14. The rounded edge 39 of the supports 13 and 14 thus avoids the undesirable feature of a sharp edge but retains the advantages thereof.

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

1. An electric discharge lamp comprising in combination, an electric discharge tube of vitreous material having main discharge supporting electrodes mounted on electric terminals sealed into and extending from its ends and a starting electrode mounted on an inlead extending through one end of the tube and supported thereby in the discharge path between said main electrodes and adjacent the main electrode at the said tube end, an enclosing vitreous envelope therefor having current inleads sealed therein at one end thereof and means within said envelope to support said tube, said means comprising a substantially U-shaped metal wire support and a pair of transverse metal supports mounted on the legs of said U-shaped support and engaging opposite ends of said tube, the electric terminal at the end of said tube remote from said starting electrode being connected to one of said inleads through said U-shaped support and the electric terminal at the starting electrode end of said tube being connected to another of said inleads through a conductor electrically insulated from said U-shaped support, the transverse metal support engaging the starting electrode end of said tube being electrically insulated from said U-shaped support and being electrically connected to the terminal at said end and said starting electrode being of small thermal mass so as to assume substantially the potential of the adjacent main electrode during operation of the discharge whereby said transverse support, said starting electrode and the adjacent main electrode are at the same potential during operation of the lamp and electrolysis of the arc tube material at the starting electrode end of the tube is minimized, said transverse supports having openings to receive the ends of said arc tube, said arc tube ends being tapered and the sides of the openings in said supports being rounded whereby a line contact with no sharp edges is established between said tube ends and said supports.

2. An electric discharge lamp comprising in combination, a sealed electric discharge tube of vitreous material having main discharge supporting electrodes mounted on electric terminals at its ends and a starting electrode mounted on an inlead extending through one end of the tube and supported thereby in the discharge path between said main electrodes and adjacent the main electrode at the said tube end, an enclosing

5 vitreous envelope for said tube having current inleads sealed therein at one end thereof and means within said envelope to support said tube, said means comprising a substantially U-shaped metal wire support and a pair of transverse metal supports mounted on the legs of said U-shaped support and engaging opposite ends of said tube, the electric terminal at the end of said tube remote from said starting electrode being connected to one of said envelope inleads through 10 said U-shaped support, the electric terminal at the starting electrode end of said tube being connected to another of said envelope inleads through a conductor electrically insulated from 15 said U-shaped support, the inlead for said starting electrode being connected through a resistance to said U-shaped support, the transverse metal support engaging the starting electrode end of said tube being electrically insulated from said U-shaped support and being electrically connected to the terminal at said tube end and said starting electrode being of small thermal mass so as to assume substantially the potential of

the adjacent main electrode during operation of the discharge whereby said transverse support, said starting electrode and the adjacent main electrode are at the same potential during operation of the lamp and electrolysis of the vitreous material at the starting electrode end of the tube is minimized.

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