

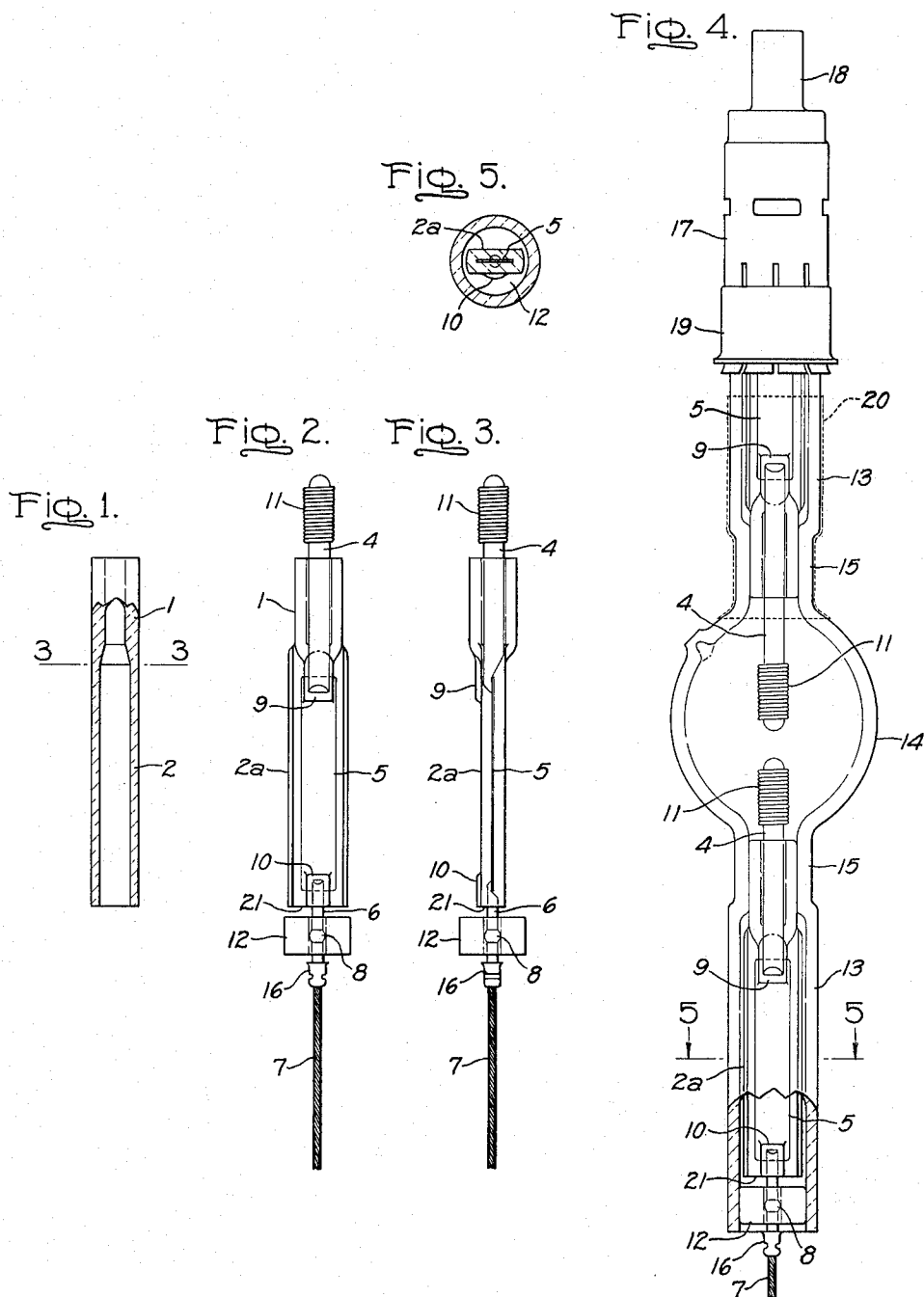
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HIGH-PRESSURE DISCHARGE LAMP INLEAD CONSTRUCTION

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HIGH-PRESSURE DISCHARGE LAMP INLEAD CONSTRUCTION

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This invention relates to a high-pressure discharge lamp, more particularly to a discharge lamp comprising a quartz envelope, with current inleads sealed in quartz and consisting of inlead pin, foil conductor and electrode rod arranged in series.

There are already known such inleads in which the foil, the electrode rod and the current inlead are pinched in a quartz tube of much greater diameter than the width of the foil. It is also well known to preshape a tubular envelope of greater diameter than the foil width by pressing it into a shape adapted to the current inlead. Such arrangements however result in a diameter at the beginning of the seal on which the high internal lamp pressure is exerted. It has also been proposed to make the inlead foil in such a manner that into each end of the quartz tube into which the foil is pinched, a little tube or tubule is placed which is not pressed down at pinching. These tubules are sealed vacuum tight only to the tubular ends of the quartz tube and are not pinched upon the current inleads. In all these constructions, pinching of the current inlead or electrode rod is made over the breadth of the foil seal. As a result, the compressive stress of the current inlead pinches extends across the whole cross section of the foil pinch or envelope tube diameter, so that with higher internal lamp pressures, for instance 10 atmospheres or more, the pinch may crack and become leaky. Therefore, it is an object of the present invention to provide a reliable inlead foil construction suitable for gaseous or vapour discharge lamps of high wattage with operating pressures of more than 10 atmospheres.

The foregoing drawbacks are avoided in high pressure discharge lamps according to the present invention by using a quartz stem press tube which is at least partly preshaped to contain the electrode rod with a close fit before it is sealed into a thick-walled quartz glass tube. Preferably the stem press tube consists of a section of quartz tube of larger inside diameter accommodating the foil and another thick-walled section of smaller diameter accommodating the electrode rod. The stem press tube may be made by joining together two pieces having the desired cross sections. The outside diameter of the cylindrical end of the stem press tube next the electrode is only slightly less than the inside diameter of the sealed-on neck of the lamp envelope. Vacuum tight sealing between stem press tube and lamp envelope neck may easily be made by collapsing the envelope neck onto the cylindrical end of the stem press tube. With high current inleads, a very good mechanical and conductive connection between inlead foil and electrode rod or current inlead pin may be obtained by the use of a brazing tab of a metal from the VIIIth group of the Periodic Table such as iron, cobalt, nickel, etc., or of chromium, rhenium, titanium, zirconium or of an alloy of these metals. A connecting tab of nickel has proven very good. The connecting tab forms a sort of brazed joint with the metal of the electrode rod or the current inlead, respectively, which may consist for instance of tungsten, molybdenum, niobium and tantalum, on the one hand, and with the foil ordinarily consisting of molybdenum, on the other hand. This braze or weld is, suitably, electrically made in a protective or inert gas or in vacuum by current flow in such manner that at first a pre-

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heating of the joint takes place at lower current. Thereby, the alloy which is formed has a higher melting point than the surrounding quartz. It is also desirable to seal the external or base side of the stem presses with a sealing mass such as a glass-like oxide mixture which is liquid under operating conditions of the lamp, or with a temperature-proof silicone resin.

In the drawing wherein like reference characters denote corresponding parts throughout the several figures:

FIG. 1 shows a quartz stem press tube prior to sealing in the inlead assembly.

FIGS. 2 and 3 show, in front and side views respectively, the stem press tube with the current inlead assembly sealed into it.

FIG. 4 shows a high-pressure discharge lamp embodying the invention and provided with the stem press tube assemblies of the preceding figures.

FIG. 5 shows a cross-section through the neck of the lamp along line 5—5 in FIG. 4.

The stem consists of a thick-walled quartz tube 1 and a thinner-walled quartz tube 2 of larger inside diameter joined or sealed together along line 3—3, as shown in FIG. 1. The quartz tube 1 may be blown up to the inside diameter of quartz tube 2 in order to form the joint. The inlead consists of a series arrangement of a tungsten electrode rod 4, a molybdenum foil conductor 5, and a tungsten inlead pin 6. A good mechanical and electric connection of foil 5 with electrode rod 4 or current inlead pin 6, is brought about by means of an electric welding-soldering process in which a little nickel plate or tab of about 30 microns thickness is placed between the foil and the flattened end of the electrode rod or the current inlead pin. Suitably in joining a molybdenum foil of about 60 to 100 microns to a tungsten electrode rod of 2 to 5 mm. diameter, the parts to be connected are pressed together with a pressure of about 5 kilograms exerted by the welding electrodes. Thereupon, they are preheated while scavenged by a protective or inert gas, or alternatively in a vacuum, by current passage at 300 to 400 amps, and then welded or sealed together by momentarily increasing the current up to 600 to 1000 amps. To the current inlead pin 6 there is then suitably butt welded a stranded wire lead 7 by means of a nickel sleeve 8.

As shown in FIGS. 2 and 3, the current inlead fits into the stem 1, 2 in such a manner that the electrode rod 4 is contained in the quartz section 1 with very little play; foil 5 and the current inlead pin 6 project into the quartz section 2 of greater inside width. In pinching, quartz section 2 is flattened and pressed down on the foil, as indicated at 2a, and the transition zone between sections 1, 2 of the stem press tube is also pressed down upon the electrode rod 4 so that no dead space is formed in the quartz. Preferably reliefs are provided at 9, 10 over the weld junctions to the foil. Owing to the fact that the thick-walled quartz section 1 makes a close fit around the electrode rod 4 prior to pinching, the compression stress due to the high vapour or gas pressure of more than 10 atmospheres in the lamp extends only over a relatively narrow width of pinch seam. On such a short seam length there occurs only a slight stress so that cracking of the pinch under high pressure is prevented.

Subsequent to the assembly of electrode body 11, which consists here of a double and oppositely coiled coil, onto the electrode rod 4 and to putting on the quartz guide disc 12, the stem press assemblies are sealed into the tubular necks 13 of the generally spherical envelope 14. They are inserted far enough to bring the front end of stem press tube section 1 approximately even with the inner end of the neck, as illustrated in FIG. 4. A vacuum tight joint is then made by heating the envelope neck in the region 15 to cause it to collapse

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down upon section 1 of the stem press tube but the quartz is not collapsed onto nor fused to electrode rod 4. The pinch to the foil conductor is located clear of the collapsed neck portion 15, nor is the quartz of the neck collapsed onto or fused to flattened section 2a of the stem press tube, as may be seen in FIG. 5. Desirably, the envelope neck is collapsed down upon and sealed to the guide disc 12. The stranded wire lead 7 is not sealed to the guide disc where it passes through it and a tube rivet 16 is provided as a bracing means at the point of emergence.

Both stem press tube assemblies are joined to the lamp in similar fashion. The processing of the lamp, including high frequency heating, baking, exhausting, and filling is then completed in known manner. As illustrated at the upper end of the lamp in FIG. 4, a shell-like base may be attached to the envelope neck comprising a cylindrical portion 17 having a pin cap 18, the slotted inner end of portion 17 being clamped in place by a compression ring 19. A reflective coating indicated at 20 is desirably provided on the upper envelope neck.

It is desirable to exclude air from the outer edge of the seal, particularly from the region where molybdenum foil conductor 5 is welded to tungsten inlead pin 6, in order to prevent oxidation and eventual failure. This may be accomplished by applying to the outer edge of the seal at 21 a glass-like oxide mixture which is liquid or viscous under operating conditions of the lamp, or a high temperature resistant silicone resin. A suitable glass-like oxide is a lead borate glass composition comprising up to 7% by weight fluorides and thallium oxide. A suitable silicone resin is one known under the trade designation DF11/100 which comprises an addition of aluminum bronze and can withstand a continuous temperature of 200 to 230° C. Another suitable silicone resin is one known under the trade designation DF10/25 which comprises an addition of carbon black and graphite and can withstand a continuous temperature from 500 to 600° C. and it is likewise suitable. One may also use a vitreous mixture prepared from 50% selenium, 30% sulphur and 20% arsenic which does not become liquid under operating conditions of the lamp but which remains resilient upon cooling off.

The construction according to the invention permits the use of molybdenum foil conductors at least 60 microns in thickness and 15 millimeters in breadth and of electrode rods at least 5 millimeters in diameter whereby reliable passage of currents of at least 50 amperes is achieved using a single foil. The construction results in a pressure resistant seal and is adaptable to mechanized manufacture thus making possible a superior product at lower cost.

The embodiment of the invention which has been described by way of example is intended as a high pressure mercury vapor lamp but the construction is equally adaptable to vapor or gaseous discharge lamps using other fillings, for instance high pressure, high current xenon discharge lamps.

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

1. A high pressure discharge lamp comprising a quartz

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envelope having tubular necks joined thereto, and a stem press tube assembly sealed into each neck, said stem press tube assembly comprising a current inlead including electrode rod, foil conductor, and outer conductor joined in series, and a quartz stem press tube including a first section accommodating said electrode rod in a close fit and a second section pinched down upon said foil conductor, said first section being hermetically joined to the envelope neck without being collapsed upon said electrode rod.

2. A high pressure discharge lamp comprising a quartz envelope having tubular necks joined thereto, and a stem press tube assembly sealed into each neck, said stem press tube assembly comprising a current inlead including electrode rod, foil conductor, and outer conductor joined in series, and a quartz stem press tube including a thick-walled section of smaller internal diameter accommodating said electrode rod in a close fit and a thinner-walled section of larger internal diameter pinched down upon said foil conductor, said thick-walled section being hermetically joined to the envelope neck without being collapsed upon said electrode rod.

3. A high pressure discharge lamp comprising a quartz envelope having tubular necks joined thereto, and a stem press tube assembly sealed into each neck, said stem press tube assembly comprising a current inlead including electrode rod, foil conductor, and outer conductor joined in series, and a quartz stem press tube including a thick-walled section of smaller internal diameter accommodating said electrode rod extending through it in a close fit and a thinner-walled section of larger internal diameter pinched down upon said foil conductor, said thick-walled section being located in the tubular neck next to its juncture with the envelope and the tubular neck being collapsed upon and fused to said thick-walled section without the thick-walled section being collapsed upon the electrode rod, and said thinner-walled section extending through the neck without being fused thereto.

4. A high pressure lamp as defined in claim 3 and including a sealing mixture applied to the outer edge of the seal where the current inlead emerges from said stem press tube in order to exclude air and prevent oxidation of the current inlead.

5. A high pressure lamp as defined in claim 3 and including a quartz guide disc fused into the outer end of the neck to close it, the current inlead emerging through an aperture in the guide disc.

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