Jan. 19, 1937. J. L. COX 2,068,596

VAPOR DISCHARGE DEVICE

Filed Dec. 20, 1934

Fig. 1.

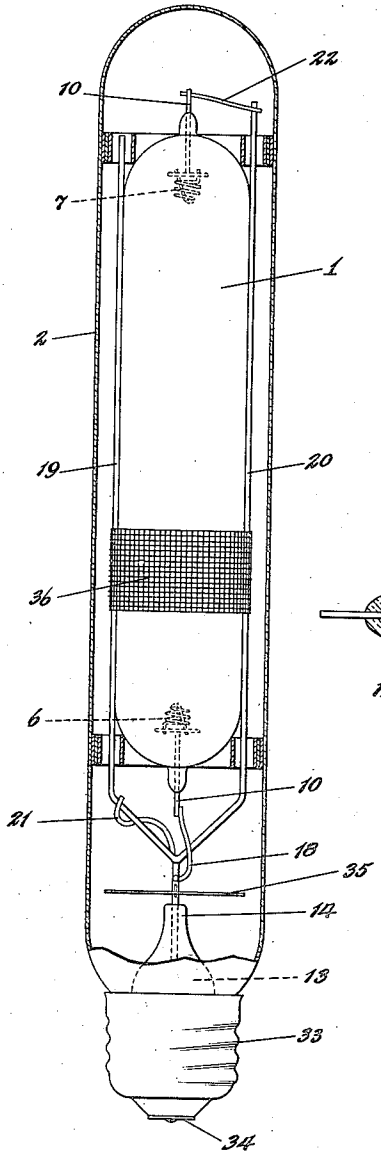


Fig. 2.

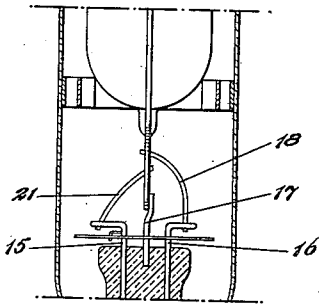
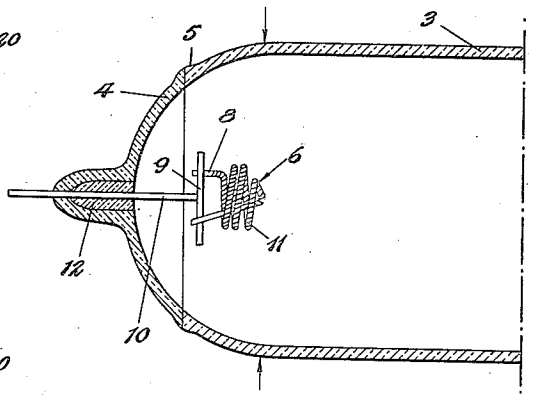


Fig. 3.



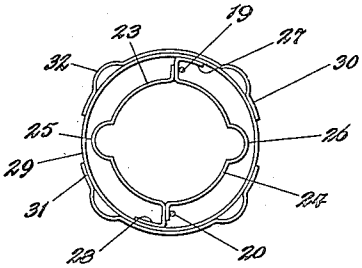


Fig. 4.

James L. Cox
INVENTOR

BY John J. Regan
ATTORNEY

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VAPOR DISCHARGE DEVICE

James L. Cox, Danvers, Mass., assignor to Hygrade Sylvania Corporation, Salem, Mass., a corporation of Massachusetts

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2 Claims. (Cl. 176—126)

This invention relates to vapor discharge devices and more particularly to a device adapted to produce light by reason of an electric discharge through a vapor or similar ionizable medium.

An object of the invention is to provide an improved form of vapor discharge lamp.

A further object is to provide a lamp of the luminous vapor type wherein the parts are proportioned and arranged to enhance the operating efficiency and to increase the useful life of the lamp.

Another object is to provide a high pressure mercury vapor lamp which is capable of withstanding high vapor pressures and high temperatures.

A feature of the invention relates to a vapor lamp of the high pressure mercury arc type, having an enclosing envelope of refractory tubing sealed to end-cap portions of relatively soft glass, and so designed that the heat of the arc will not destroy the seal.

Another feature of the invention relates to a tubular high pressure mercury arc lamp having end-caps of specially chosen glass which are shaped and sealed to the body of the lamp so that the normal heat of the electrodes and the arc prevents undesired condensation of the mercury in back of the electrodes but without deleteriously affecting the seal.

A further feature relates to a high pressure mercury vapor lamp having electrodes mointed at opposite ends, the main body portion of the lamp being of refractory transparent material such as combustion tubing, joined through a series of graded glasses to the electrode lead-in wires.

A further feature relates to a high pressure mercury arc lamp having a main body portion of combustion tubing and having hollow end or cap portions of uranium glass.

A still further feature relates to the novel organization, arrangement and relative location of parts which go to make up an efficient mercury vapor arc lamp substantially free from dangers of cracked seals.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims.

In the drawing Fig. 1 is an elevational view, partly in section, of a lamp embodying features of the invention.

Fig. 2 is a partial side elevational view showing more clearly certain details of Fig. 1.

Fig. 3 is an enlarged view, showing the arrangement of the seal according to the invention.

Fig. 4 is a detailed plan view of one of the spacer and support members shown in Fig. 1.

While the invention will be described herein as embodied in a lamp employing a filling of mercury vapor at relatively high pressure as the luminous medium for example in the range between 100 mms. and 3,000 mms., it will be understood that certain aspects of the invention are desirable in other types of lamps, such as gas-filled lamps or low pressure vapor lamps. However the invention is primarily concerned with high pressure vapor lamps wherein the luminous efficiency depends to a certain extent on the vapor pressure within the lamp and wherein the luminosity is primarily caused by arc phenomena between the electrodes through the vapor. It has been found that when this type of lamp is operating at the desired luminous efficiency, relatively high temperatures obtain in the main body portion of the lamp as well as in the portion of the lamp where the electrodes are positioned. Indeed it has been found that in order to produce a commercially practical lamp of the high pressure mercury type substantially all of the mercury within the lamp must, during the operation of the lamp, be maintained in a vaporized state. However, the temperature conditions of the lamp are materially restricted at certain portions of the lamp, particularly where a lamp having a body portion of refractory glass is employed, because in such lamps it is necessary to employ a softer grade of glass between the body portion and the lead-in wires. I have found that unless the position of the seal between the softer grading glass or grading glasses and the main body portion is carefully chosen, there is considerable danger that the heat of the luminous arc may destroy the seal. According to the present invention the main body portion of the lamp can be of glass such as combustion tubing which may be sealed through a series of graded glasses to the lead-in wire in such a way that the arc may be maintained at very high temperatures to achieve the desired luminosity and the temperature adjacent the electrodes may be such as to prevent the condensation of the mercury filling but without destroying the seal.

Referring to the drawing the lamp, as shown for purposes of illustration, comprises an inner tubular envelope 1 and an outer tubular envelope 2. The inner envelope 1 comprises a main body portion 3 of refractory transparent tubing such as combustion tubing or the like. This body por-

tion has sealed thereto hollow end or cap portions 4 of a softer grade of glass for example uranium glass. Preferably, although not necessarily, the cap portions 4 are butt-sealed to the tubular body portion 3 as indicated by the numeral 5. Sealed into the portions 4 are the electrodes 6 and 7. Preferably, although not necessarily, each of these electrodes consists of a refractory wire core such as tungsten, molybdenum or the like which is coiled to the shape shown in detail in Fig. 3. Wound spirally around the tungsten core 8 is a fine tungsten wire 11 the ends of which may be welded to the tungsten core 8. The ends of the core 8 are welded or otherwise fastened to a cross-piece 9 of similar refractory metal which is mounted upon the end of the lead-in wire 10. Thus each electrode consists of a spiralled tungsten wire which is mounted on a refractory wire core 8 preferably, although not necessarily, as described in detail in application Serial No. 752,016, filed November 8, 1934. Before sealing the wire 10 into the portion 4 the said wires are provided with beads 12 of a suitable glass having substantially the same coefficient of expansion as the wire 12. For example, these beads may consist of so-called "Nonex" glass or other similar boro-silicate glass.

One of the important features of the present invention resides in the location of the above-described electrodes in the electrode chambers. As indicated by the arrows in Fig. 3 each electrode chamber is substantially hemispherical in shape and includes the uranium glass portion 4 and also a portion of the combustion tubing 3. I have found however that in order to prevent the hot gases of the arc from attacking and destroying the seal 5, this seal should preferably be positioned in back of the associated electrode. Thus as shown in Fig. 3 the uranium end-cap 4 is in the form of a shallow cup and the associated electrode 6 is mounted outside the seal between the cup 4 and the end of the combustion tubing 3. However, it will be noticed that the said electrode 6 is positioned within the hemispherical end of the device. With this arrangement therefore the heat of the arc, while it may diffuse outwardly from each electrode, does not reach a sufficiently high temperature at the seal 5 to destroy the same. I have found that while the gases of the arc between the electrodes, when the lamp is operating, are at a very high temperature because of their thermal velocity as neutral molecules and also because of their velocity as ions in an electric field, nevertheless outside of the true arc space the temperature drops relatively rapidly and in accordance with the present invention therefore, the seal 5 is so positioned that it is located in a non-destructive temperature field. On the other hand the electrode 6 is so positioned and designed with respect to the radius of the hemispherical end-portion of the lamp that sufficient heat is retained in this end-portion to prevent any condensation of mercury in back of the electrode while the lamp is operating. While the electrode 6 is mounted preferably with its entire length in advance of the seal 5 certain advantages of the invention may be achieved even though a portion of a length of said electrode extends in back of the seal 5 provided no more than approximately one-half of the length of said electrode is in back of the said seal. In any event the electrode is preferably so mounted with respect to the seal that the arc gases are never at a sufficiently high temperature in the neighborhood of the seal to destroy the same.

In order to increase the efficiency of the lamp, the envelope 1 is surrounded by the enclosing envelope 2 of any desired transparent material this envelope being evacuated or filled with any desired gas. As shown in Fig. 1, the envelope 2 is provided at its lower end with a re-entrant stem 13 terminating in a press 14 into which are sealed the lead-in wires 15, 16 and the support wire 17. The wire 16 is connected by the strap 18 to the lower lead-in wire 10. The central wire 17 supports a wire frame consisting of parallel uprights 19, 20, terminating at their lower end in a V which is welded to the said wire 17. The wire 15 is connected by a strap 21 to the said frame and the upright 20 of said frame is connected by a strap 22 to the upper lead-in wire 10. Fastened to the uprights 19 and 20 adjacent the upper and lower ends of the envelope 1, are a pair of resilient spacer members for spacing the inner envelope 1 from the outer envelope 2. As shown more clearly in Fig. 4, these spacer members comprise two substantially concentric rings of spring metal the inner ring comprising the semi-circular members 23 fastened to a similar semi-circular 24. The member 23 is provided with a projection 25 diametrically opposite to a similar projection 26 on the member 24 to allow for expansion and contraction of the said ring. Each of the members 23 and 24 is provided with a lug 27, 28, which is welded to the outer ring 29. Fastened to the outer periphery of the ring 29 are members 31 each of these latter members being fastened or welded at their ends to the ring 29, the intermediate unfastened portion of each of the members 30 and 31 being provided with bumps 32 which are adapted to bear against the inner wall of the envelope 2. The inner and outer rings may be of any suitable metal such as nickel ribbon while the cushioning spring members 30 and 31 may be of spring steel or the like.

The above-described spring cushions are welded to the uprights 19 and 20 so that the edges of the inner rings engage the curved ends of the envelope 1 to center the same within the outer envelope 2, while the spring projections 32 provide a somewhat resilient support against tilting movement with respect to the envelope 2.

The lower end of envelope 2 may be provided with any well-known type of contact base and while the drawing shows a contact base comprising a threaded metal shell 33 and a contact button 34 of the conventional mogul type, it will be understood that the invention is not limited to this particular type of base. If desired a heat and bombardment shield 35 of mica or other similar material may be mounted between the press 14 and the lower end of the envelope 1. In order to facilitate starting of the lamp a piece of wire mesh 36 may be wrapped around the envelope in electrical contact with the uprights 19 and 20. If desired this mesh may be replaced by a wire wound spirally around the envelope 1 with the ends of the spiral welded to the uprights 19 and 20.

While certain specific materials have been mentioned in connection with the illustrative embodiment, various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What I claim is:

1. A high pressure vapor arc lamp comprising an enclosing envelope of high melting point glass, said envelope being in the form of a tubular body portion terminating at each end in a substantially hemispherical portion, said hemi-

spherical portion containing a bead of borosilicate glass, a lead-in wire sealed through said bead, a very small section of glass softer than that of the main body of the envelope, said softer glass section forming a closure member between said bead and said envelope, said lead-in wire carrying an electrode positioned materially in advance of the softer glass section, said electrode comprising a coiled tungsten wire.

2. A high pressure vapor arc lamp comprising an enclosing envelope of high melting point glass, said envelope being in the form of a tubular body portion terminating at each end in a substantially hemispherical portion, said hemispherical portion containing a bead of borosilicate glass, a lead-in wire sealed through said bead, said lead-in wire carrying an electrode comprising a helically wound refractory wire having another refractory wire helically wound thereon, and a metal cross-piece connecting the ends of the core wire.

JAMES L. COX.