May 20, 1941. J. D. BRUMLEY 2,242,774

SEAL FOR DISCHARGE LAMPS

Filed Oct. 12, 1938

Fig. 1.

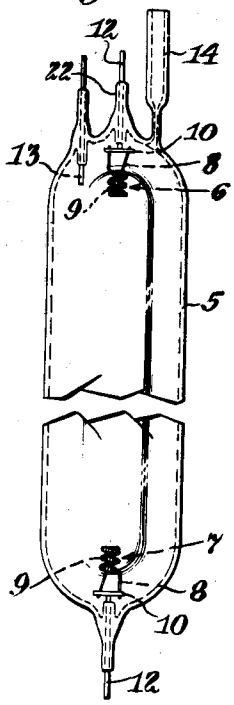


Fig. 2.

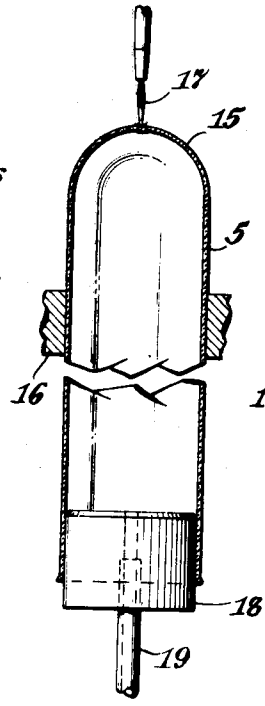
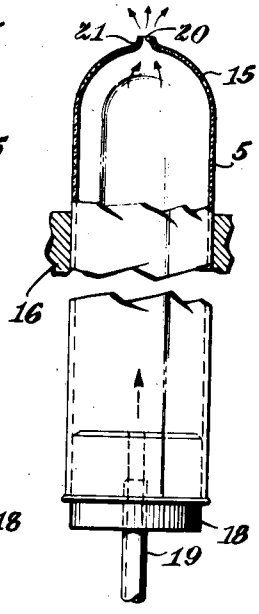


Fig. 3.



AIR PRESSURE

Fig. 4.

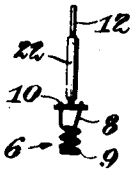


Fig. 5.



Fig. 6.

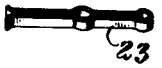


Fig. 7.

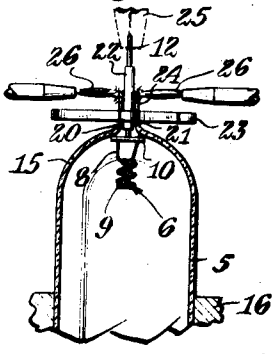


Fig. 8.

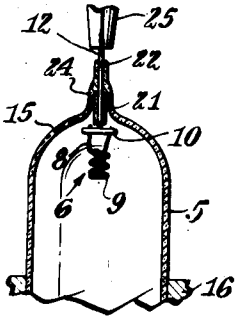


Fig. 9.

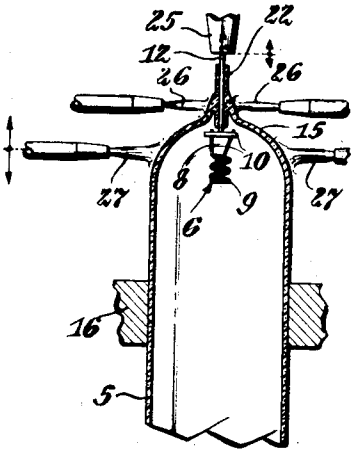
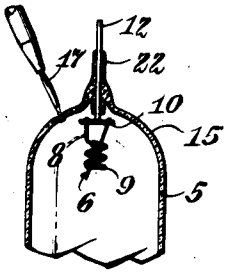


Fig. 10.



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SEAL FOR DISCHARGE LAMPS

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Application October 12, 1938, Serial No. 234,561

5 Claims. (Cl. 49—78)

The present invention relates to electric apparatus and more particularly to electric discharge apparatus subject to considerable heat generated by the high pressure gaseous discharge between the electrodes, and the method of sealing the leading-in wires for the electrodes to the vitreous envelope.

In the prior art various types of seals and methods of forming have been employed wherein the leading-in conductors for supplying the electrical energy to the electrodes or filament within the envelope are sealed through the vitreous envelope. Since the vitreous envelope is, as above noted, subject to considerable heat, it must necessarily be of a high melting point glass such as quartz, hard glass, borosilicate glass, or the like. In sealing a metallic leading-in conductor to the envelope the problem of providing a seal and method of forming, such that the coefficient of expansion of the metallic leading-in conductor approximates that of the vitreous envelope, so as to prevent cracking of the seal with attendant loss of vacuum or gaseous medium, has long been recognized.

The customary construction has been to provide the leading-in conductor with a section of metal having an analogous coefficient of expansion to that of the vitreous envelope with the remainder of the leading-in conductor being of a less expensive metal or of a refractory metal capable of withstanding high temperatures. This method of sealing, however, has been objectionable particularly in the case of high pressure discharge lamps because of the limitation to the current carrying capacity of the leading-in wire. A still further method known to the art is the provision of what is termed a graded seal wherein one or more glass compositions are employed intermediate the metallic leading-in conductor and the vitreous envelope which have a gradually varying coefficient of expansion between that of the metallic leading-in conductor and the envelope. This latter type of seal is expensive in that it requires several operations which constitute a considerable limitation on quantity production of gaseous discharge lamps and requires a more or less skilled operator for fabrication of the seal.

It is accordingly an object of the present invention to provide an electric discharge device particularly of the high pressure type employing a gaseous medium wherein the leading-in conductor forms an integral seal with the vitreous envelope of the device which will not be deleteriously affected by the high temperatures of operation of the device nor by the high pressure of the gaseous medium contained within the envelope.

Another object of the present invention is the provision of a seal for a vitreous envelope wherein the leading-in conductor is sealed to the envelope in such manner as to provide an integral seal capable of withstanding the high temperatures and pressures of operation of the device and of carrying the requisite electrical currents during operation.

Another object of the present invention is the provision of a method of forming a seal between a metallic leading-in conductor and a vitreous envelope which requires a minimum of operations, thus hastening fabrication of the completed electric discharge device.

A further object of the present invention is the provision of a method of forming a seal between a metallic leading-in conductor and a vitreous envelope which does not require the services of a skilled operator and wherein the seal may be readily formed in a simple and expeditious manner.

Still further objects of the present invention will become obvious to those skilled in the art by reference to the accompanying drawing wherein:

Fig. 1 is an elevational view of a completely fabricated high pressure discharge lamp ready for tipping off and provided with a seal for the leading-in wires in accordance with the present invention;

Fig. 2 is an elevational view, partly in section showing the bulb in position for the first operation of the method of forming a seal for the leading-in wires in accordance with the present invention;

Fig. 3 is an elevational view, partly in section showing another step in the present method of forming a seal;

Fig. 4 is an elevational view showing the construction of the electrode as employed in the lamp of Fig. 1;

Fig. 5 is a cross-sectional view of the tubing as used in the forming of a seal according to the method of the present invention;

Fig. 6 is a perspective view of a clamp used to hold the leading-in wire with its attached electrode in place during one step of the method;

Fig. 7 is a view, partly in section with parts of the lamp broken away and showing the position thereof during another phase of forming the seal in accordance with the present invention;

Fig. 8 is a view, partly in section showing the

lamp after completion of the step of the method shown in Fig. 7;

Fig. 9 is a view, partly in section showing the final step of sealing-in the leading-in conductor in accordance with the present invention; and

Fig. 10 is a view, partly in section showing the completed seal made in accordance with the present invention.

Referring now to the drawing in detail, in Fig. 1 an electric gaseous discharge lamp of the high pressure type is shown. As is customary in lamps of this type, the envelope 5 is of a vitreous material having a high melting point, such as quartz or a borosilicate glass of different compositions and known to the art under the trade names of "Nonex," "Pyrex," or "Corex." The envelope 5 is provided at opposite ends with electrodes 6 and 7 of identical construction which, as shown, may consist of a refractory wire core 8 such as tungsten, molybdenum or the like, upon which is spirally wound a fine tungsten wire 9.

This spiral may be welded to the tungsten core with the electrode coated, if desired, with an appropriate electron emitting material, such as barium or strontium oxide, which gives off a copious flow of electrons when heated. The ends of the core 8 are secured to a cross-piece 10, such as by welding or the like, and this cross-piece is in turn similarly secured to a leading-in conductor 12. In addition to the two main electrodes 6 and 7, a starting electrode 13 is sealed through the wall of the envelope in juxtaposition to one of the main electrodes to facilitate starting, and after fabrication of the completed lamp, it is first exhausted through an exhaust stem 14 and then filled with an ionizable vapor such as mercury, sodium or the like, at a pressure ranging from several hundred millimeters to several atmospheres, to which may be added an inert gas such as argon, neon, etc., to facilitate the initiation of a discharge between the electrodes, after which the exhaust stem is sealed off.

In practicing the present method of sealing-in the electrodes to the vitreous envelope the tubing from which the envelope 5 is customarily made, is provided with a bulbous end 15. As shown in Fig. 2 the envelope 5 is first disposed in a suitable support 16 which may be part of a rotating head such as used in glass working operations and an intense flame 17 played upon the bulbous end at the axis of the envelope. At the same time, a plunger 18 is inserted into the open end of the envelope which forms a comparatively tight fit therewith. The plunger rod 19 is hollow and communicates with a source of air pressure (not shown) which blows an outwardly flaring opening 20 in the bulbous end as the same is melted by the intense flame 17 to thus form an annular ring 21, as can be seen in Fig. 3.

The leading-in conductor 12 as shown in Fig. 4 is provided with a vitreous bead 22, which may be of the same composition as that of the envelope 5, fused directly thereto and being of a hard glass has a coefficient of expansion simulating that of the metallic leading-in conductor 12. The electrode 6, with its integral glass bead, is then inserted through the open end of the envelope 5 into the opening 20 upon removal of the plunger 18 therefrom, and a clamp somewhat in the form of a hairpin 23, as shown in Fig. 6, is clamped about the glass bead 22 to retain the electrode 6 in the desired position relative to the envelope. Next, a small piece of tubing 24 (Figs. 5 and 7) of preselected size or mass is slipped over the end of the leading-in conductor 12 and the integral glass bead 22. The end of the leading-in conductor 12 is then grasped by a pair of clamping jaws 25, also forming a part of the rotating head, enabling the hairpin clamp 23 to be removed and the vitreous tubing to slide along the beaded wire 12 into contact with the outwardly flared opening.

With the electrode thus held in position within the envelope, a pair of sharp pointed sealing fires 26 are directed against the tubing 24 and glass bead 22 which fuses the same together. At the same time, the end of the tubing abutting the ring 21, formed by the outwardly flaring opening 20, flows into contact with the latter, resulting in the formation of a ring seal to the stage shown in Fig. 8. The seal is then ready for the final step of firmly uniting the lower portion of the small tubing. To this end the flames 26 are again directed against the seal simultaneously with a further pair of flames 27 which are directed against the bulbous end to prevent too great a temperature differential which would otherwise cause cracking of the seal. During the period of heating, the clamping jaws 25 are gradually raised and lowered to assist the vitreous material, while in plastic state, to firmly unite so that the glass bead 22, tubing 24 and envelope 5 are merged into a completed integral seal as shown in Fig. 10. Since the tubing 24 is of preselected size, it completely fuses to form the seal of desired dimensions eliminating waste and cutting off of excess tubing, as has frequently been the case in the prior art.

Upon completion of the seal for one of the main electrodes, the bulbous end 15 is again heated by the flame 17 which is directed to one side of the main electrode and after an opening is provided therein similar to the opening 20, the starting electrode 13 is sealed into the envelope in the same manner as that just described relative to the electrode 6. The starting electrode having been sealed in, a further opening is provided to which the exhaust stem 14 is sealed, thus conditioning the envelope for sealing in of the opposite electrode 7.

After depositing the electrode 7 in the envelope 5, a flame is then directed against the open end thereof and a bulbous end like that of the end 15 is formed thereon. An opening similar to the opening 20 is next formed in this bulbous end with the exhaust stem 14 being connected to the source of air pressure in lieu of the plunger rod 19. The electrode 7 with its integral glass bead being then worked through such opening and the hairpin clamp 23 secured thereto to hold it in place, the same procedure as above described relative to forming the seal for the electrode 6 is followed in its entirety.

All of the requisite seals having been formed, the desired degree of evacuation of the envelope 5 is obtained and the appropriate gaseous medium or vapor forming metal is introduced into the envelope through the exhaust stem 14 after which the lamp is tipped off in the usual manner known to the art.

It thus becomes obvious to those skilled in the art that a seal for a high pressure discharge lamp and the method of forming is herein provided which can be so simply performed as to not require the services of a skilled operator. Moreover, by surrounding the beaded leading-in conductor with the small tubing of preselected size upon its being fused with the beaded lead-in and the envelope, a seal of preselected size is accordingly formed eliminating wastage in the

form of excess tubing known as a cullet. Also, because of the simplicity of the present method, approximately twice as many seals can be made in a given period of time than formerly possible with present type tubulating sealing methods.

Although one specific embodiment of the present invention has been shown and described, other modifications thereof may be made without departing from the spirit and scope of the appended claims.

I claim:

1. The method of sealing a leading-in wire in a tubular glass vessel which comprises providing an outwardly flaring opening in the wall of said vessel, positioning a leading-in wire having a vitreous bead fused thereto in the opening, disposing a hollow vitreous tubing of preselected mass over the beaded leading-in wire exteriorly of the vessel and in contact with the edge of the outwardly flared portion thereof, fusing the hollow tubing to the beaded leading-in wire, and thereafter fusing the mass thus formed to the vessel.

2. The method of sealing a leading-in wire in a tubular glass vessel which comprises providing an outwardly flaring opening in the wall of said vessel, positioning a leading-in wire having a vitreous bead fused thereto in the opening, disposing a hollow vitreous tubing of preselected mass over the beaded leading-up wire exteriorly of the vessel and in contact with the edge of the outwardly flared portion thereof, fusing the hollow tubing to the beaded leading-in wire and at the same time forming a ring seal between the hollow tubing and the vessel, and gradually moving the leading-in wire back and forth while the preselected mass is plastic to completely fuse the mass to the vessel and form an integral seal of predetermined dimensions therewith.

3. The method of sealing a leading-in wire in a tubular glass vessel which comprises providing an outwardly flaring opening in the wall of said vessel, positioning a leading-in wire having a vitreous bead fused thereto in the opening, surrounding a portion of the wire and its integral bead with a hollow vitreous tubing of a preselected mass slidable therealong into contact with the edge of the outwardly flaring opening in the wall of said vessel, fusing the hollow tubing to the beaded leading-in wire, and thereafter fusing the mass thus formed to the vessel.

4. The method of sealing a leading-in wire in a tubular glass vessel which comprises heating the end thereof, directing air under pressure into said vessel to form an outwardly flaring opening at the heated end of said vessel, supporting a leading-in wire having a vitreous bead fused thereto in said opening, surrounding a portion of the leading-in wire and its integral bead with a hollow vitreous tubing of preselected mass, sliding the hollow tubing along said beaded wire into contact with the edge of the outwardly flaring opening in the end of the vessel, heating the tubing to fuse the same with the beaded leading-in wire and to form a ring seal between the tubing and the vessel, and thereafter heating the tubing and vessel at the ring seal therebetween to completely fuse the same and form a seal of preselected mass.

5. The method of sealing a leading-in wire in a tubular glass vessel which comprises heating the end thereof, directing air under pressure into said vessel to form an outwardly flaring opening at the heated end of the vessel, supporting a leading-in wire having a vitreous bead fused thereto in said opening, surrounding a portion of the leading-in wire and its integral bead with a hollow vitreous tubing of preselected mass, sliding the hollow tubing along the beaded wire into contact with the edge of the outwardly flaring opening in the end of the vessel, heating the tubing to fuse the same with the beaded leading-in wire and to form a ring seal between the tubing and vessel, thereafter heating the tubing and vessel at the ring seal therebetween, and simultaneously moving the leading-in wire gradually back and forth as the mass becomes plastic to eliminate the ring seal and form a completed fused seal of preselected mass.

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