April 13, 1954 M. C. UNGLERT ET AL 2,675,496

HIGH-PRESSURE DISCHARGE LAMP AND SEAL THEREFOR

Filed Aug. 31, 1949 2 Sheets-Sheet 1

Fig. 1.

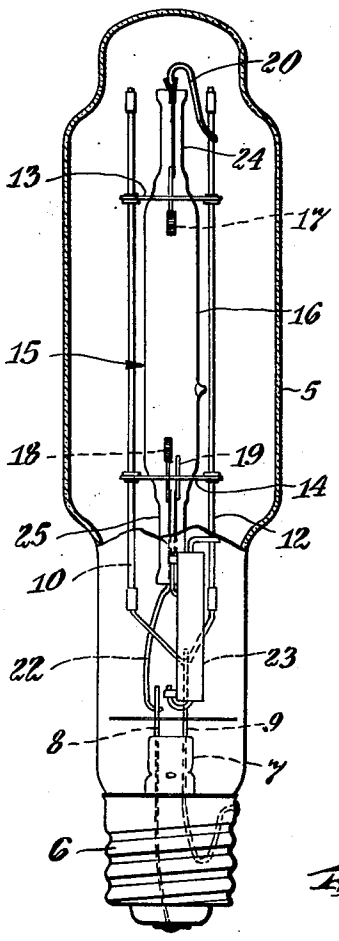


Fig. 2.

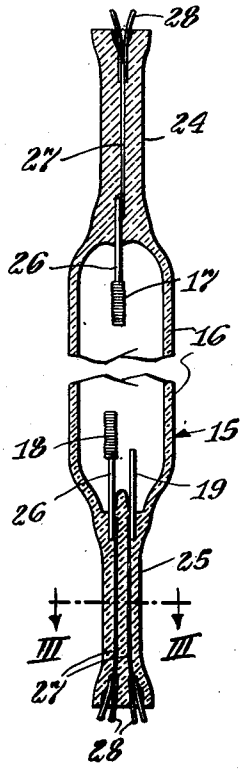


Fig. 13.

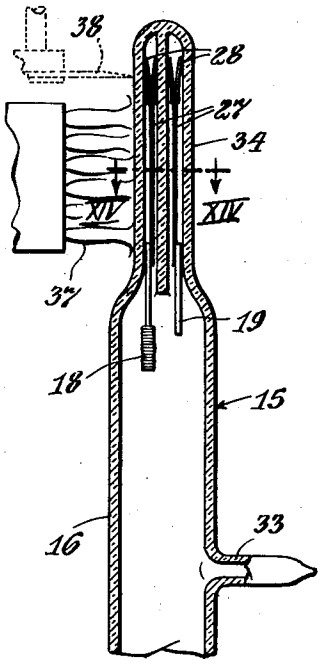


Fig. 3.

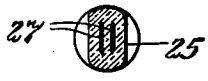


Fig. 14.

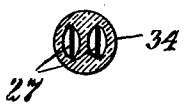
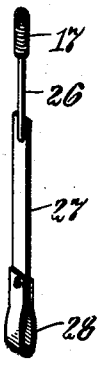


Fig. 4.



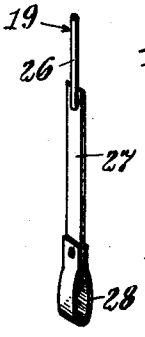


Fig. 5.

INVENTORS
H. D. FRASER
M. C. UNGLERT.
BY
ATTORNEY

April 13, 1954 M. C. UNGLERT ET AL 2,675,496

HIGH-PRESSURE DISCHARGE LAMP AND SEAL THEREFOR

Filed Aug. 31, 1949 2 Sheets-Sheet 2

Fig. 6.

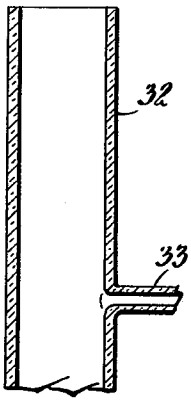


Fig. 7.

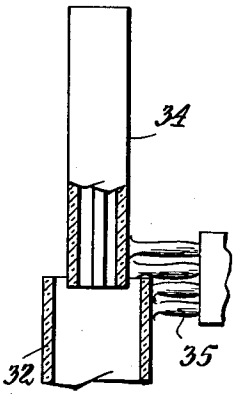


Fig. 8.

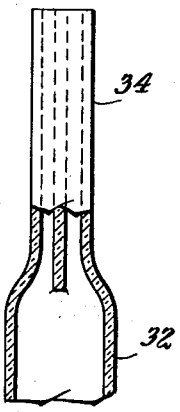


Fig. 9.

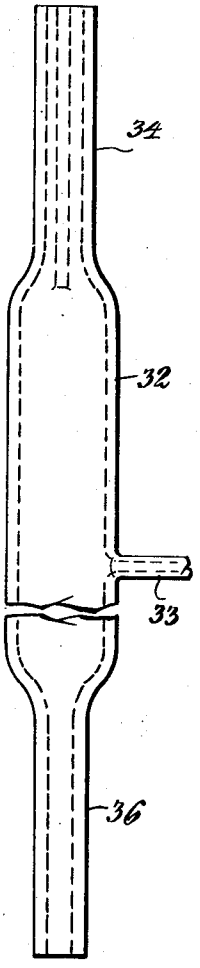


Fig. 10.

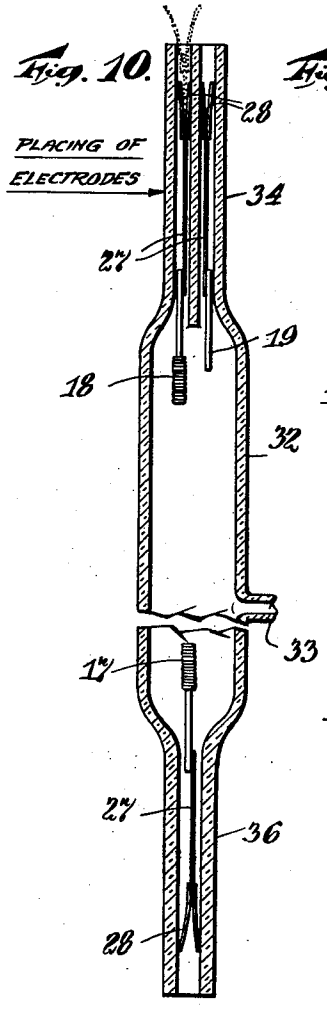


Fig. 11.

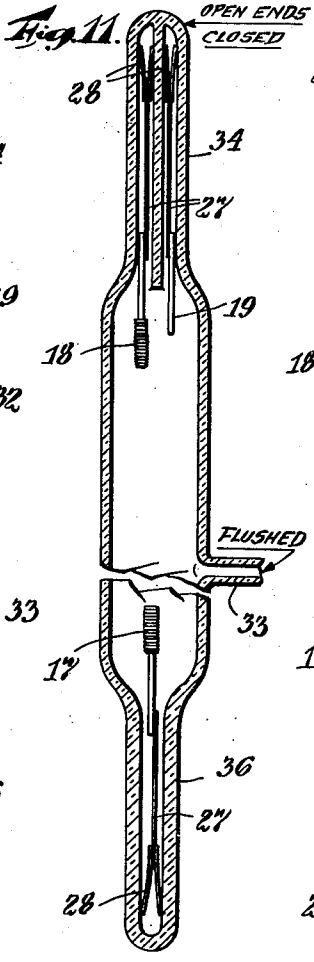


Fig. 12.

INVENTORS
H. D. FRASER
M. C. UNGLERT.
BY
ATTORNEY

Patented Apr. 13, 1954

2,675,496

UNITED STATES PATENT OFFICE

2,675,496

HIGH-PRESSURE DISCHARGE LAMP AND SEAL THEREFOR

Melvin C. Unglert, Long Island City, N. Y., and Hugh D. Fraser, Verona, N. J., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application August 31, 1949, Serial No. 113,444

2 Claims. (Cl. 313—290)

1

The present invention relates to electric devices of the gaseous conduction type, and more particularly to gaseous discharge lamps of the high pressure mercury type and to the provision of seals therefor.

Devices of this type are now well known to the art wherein the envelope is formed of a high melting point vitreous material such as quartz capable of withstanding the high temperature and pressure to which the device is subjected during operation. Inasmuch as these devices are provided with electrodes between which the discharge occurs, with leading-in and supporting conductors passing through the envelope wall of the device, a serious problem has always been existent in forming an hermetic seal between the metallic leading-in conductor and the quartz envelope. Heretofore, it has been the customary procedure to employ either a costly graded seal, or in later practice to fuse a vitreous bead to the leading-in and supporting conductors and, after insertion of these beaded conductors in the tubular extension portions of the vitreous envelope, melt the tubular extension down to the vitreous beads to thus form a fused vitreous mass embedding the leading-in conductors.

Although this structure has proven relatively satisfactory in high voltage devices requiring no starting electrode and where comparatively low operating temperature conditions exist, it has been proven in practice that in connection with high pressure mercury vapor lamps, that where such lamps operate in enclosed fixtures or at high temperatures, a crack develops in the seal adjacent the area where the beaded leads are sealed into the envelope and especially at the end where the two parallel leading-in and supporting conductors for the starting electrode and the adjacent main electrode pass through the fused vitreous mass. The cause of these seals failing under high heat conditions and after extended burning hours has not been definitely determined, but one cause is thought to be due to oxidation of the leading-in conductor by oxygen driven out of the glass bead at elevated temperature.

It is accordingly the primary object of the present invention to provide a high pressure discharge lamp having an hermetic seal that will not crack over a long useful life of such lamp.

Another object of the present invention is the provision of a seal for high pressure mercury discharge lamps capable of withstanding high operating temperatures and pressures without

2

destruction of such seal throughout a long useful life of such lamp.

Another object of the present invention is the provision of a method of fabricating an hermetic seal for a high pressure mercury discharge lamp which is economical to practice and which produces a seal capable of withstanding high temperatures and pressures without cracking of such seal.

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

Fig. 1 is an elevational view partly in cross-section of a completed high pressure mercury vapor lamp provided with an hermetic seal in accordance with the present invention;

Fig. 2 is an enlarged fragmentary cross-sectional view of the discharge lamp per se and provided with hermetic seals in accordance with the present invention;

Fig. 3 is a cross-sectional view taken on the line III—III of Fig. 2;

Fig. 4 is a perspective view of the leading-in and supporting conductor for the main electrode as used in the discharge lamp of the present invention;

Fig. 5 is a perspective view identical to that of Fig. 4, but showing the leading-in and supporting conductor for the starting electrode employed in the lamp of Figs. 1 and 2;

Fig. 6 is an elevational view showing the tubing from which the main envelope of the lamp per se is fabricated;

Fig. 7 is an elevational view showing the manner in which the tubular extension portion for the leading-in and supporting conductors of Figs. 4 and 5 is secured to the main envelope;

Fig. 8 is an elevational view showing the completely joined tubing forming one end of the envelope;

Fig. 9 is an elevational view of the fabricated lamp envelope;

Fig. 10 is an elevational view of the fabricated lamp envelope of Fig. 9 with the leading-in and supporting conductors inserted in the tubular extension portions of the lamp envelope;

Fig. 11 is an elevational view of the lamp envelope as it appears on the exhaust system with its tubular ends closed and during flushing of the envelope;

Fig. 12 is an elevational view identical to that of Fig. 11, but with the lamp exhausted and tipped off from the pump;

Fig. 13 is an elevational view similar to Fig. 12,

but showing the envelope in position where the sealing fires collapse the tubular portions around the leading-in and supporting conductors to form the seal after which the closed ends are cut off; and

Fig. 14 is a cross-sectional view taken on the line XIV—XIV of Fig. 13, prior to collapse of the tubular extension.

Referring now to the drawing in detail, a gaseous discharge lamp of the high pressure vapor type is shown in Fig. 1, which comprises an envelope 5 of vitreous material pervious to light such as glass or, if desired, it may be pervious to ultra-violet by utilizing well known ultra-violet transmitting glass. Secured to the envelope is a base 6 to enable the lamp to be screwed into the customary socket. The envelope 5 has a reentrant stem press 7 to which is sealed a pair of leading-in conductors 8 and 9. A pair of rod-like supports 10 and 12 are secured to one of the leading-in conductors 9 which after branching outwardly, extend parallel to each other longitudinally of the envelope 5. A pair of bridges 13 and 14 of suitable material which may be of mica or metal extend between the supports 10 and 12 and form a rigid support for the high pressure mercury vapor lamp 15. As can be more readily seen from Fig. 2, this lamp 15 is provided with an envelope 16, capable of withstanding high operating temperatures and pressures of several atmospheres, such as quartz or "Vycor" glass. Oppositely disposed within the envelope 16 are main discharge supporting electrodes 17 and 18 and at one end of the lamp, adjacent one of the main electrodes 18, is a starting electrode 19. The main electrodes 17 and 18 are connected by flexible conductors 20 and 22 to the support rod 12 and leading-in conductor 8, respectively, while the starting electrode 19 is connected through a resistance element 23 to the rod 12 and hence electrically to the opposite main electrode 17.

So far as the lamp thus far described is concerned, it is well known in the art, but by reference more particularly to Fig. 2, it will be noted that the respective electrodes 17, 18 and 19 are supported by leading-in and supporting conductors of identical construction, which form an hermetic seal with the elongated tubular portions 24 and 25 of the envelope 16. As shown in Figs. 4 and 5, the electrodes proper are provided with a short rod of refractory material 26 of tungsten or the like, which is welded to a strip or ribbon 27 of tantalum or molybdenum about .0006" in thickness, and to the opposite end of which a loop 28 of tantalum or molybdenum about .004 thickness is likewise secured, as by welding. After fixing the loop 28 to the ribbon or strip 27, the loop is cut so as to provide a V-shaped end having a spring tension, as hereinafter more fully pointed out.

The high pressure mercury vapor lamp 16 is fabricated by first taking a piece of heavy wall quartz tubing 32 for the bulb portion and tubulating it with a smaller diameter piece of tubing 33, as shown in Fig. 6. While the tubing for the bulb portion 32 is held in a vertical position, a heavy wall partitioned quartz tubing 34 of smaller diameter is inserted a short distance in the end of the bulb tubing 32. The adjacent ends of the tubing 32 and 34 are then heated as by fires 35 from a gas burner, until the open upper end of the bulb tubing 32 falls around the tubing 34 and the fusion worked until a sealed joint is formed as shown in Fig. 8. Although not shown, the single bore tubing 36 for the opposite end of the lamp is joined in the same manner, thus forming the envelope as shown in Fig. 9.

Next in order is the insertion of the electrode assemblies, as shown in Figs. 4 and 5, into the proper passageways or bore in the envelope tubing. By reference to Fig. 10, it will be noted that one of the main electrodes 17 is inserted in the single bore tubular end 36 the desired depth and held securely in place by the spring tension of the V-shaped end formed by cutting the loop 28. In a similar manner the opposite main electrode 18, together with the starting electrode 19 are inserted the desired depth in the separate bores of the partitioned tubular end 34 where they likewise are retained securely by the tension of their respective ends 28. The partially fabricated envelope of Fig. 10 is then connected to a gas system at the tubulation 33 and flushed with an inert gas. The open ends of the tubing 32 and 36 are then closed by melting down under a gas-oxygen flame with a slight flow of inert gas to prevent oxidation of the metallic ribbons until such end appears as shown in Fig. 11. The envelope is then evacuated by connecting to an exhaust system and exhausted until a good vacuum is obtained after which it is tipped-off at the elongated tubulation 33 as shown in Fig. 12.

The envelope of Fig. 12 is next placed in a vertical sealing machine, glass lathe, or similar apparatus, and the tubular end 34, with the leading-in and supporting conductors therein as seen in Fig. 14, is heated by the sealing fires 37 shown in Fig. 13, until the tubulation collapses, forming a fused mass of quartz embedding the lead-in conductor strips 27 therein as shown in Figs. 1, 2 and 3. It is thus obvious from the foregoing that during actual sealing of the leading-in conductor strips they are subject to a vacuum and hence no oxidation of the metal can occur which apparently has contributed to seal failure along with the entrapped oxygen in the glass bead, where beaded leading-in conductors are sealed to the envelope.

Upon completion of the sealing of the partitioned tubular end 34, the lamp is reversed in the sealing apparatus and the opposite tubular end 36 sealed to the leading-in conductor 27 for the electrode 17. Upon completion of the sealing of the ends 34 and 36, the ends of the tube are cut off by means of a wet cutting wheel 38, care being taken not to cut the moly ends 26. Once this is completed, the lamp is again connected to the exhaust system by breaking open the elongated tubulation 33 and after sealing the latter to the exhaust pump, the envelope is filled with the usual monatomic starting gas and a small quantity of mercury and finally sealed-off at the tubulation 33 close to the lamp as shown in Fig. 1. Although the final exhaust and gas filling may follow immediately, the sealing operation of Fig. 13, it has been found preferable to allow the sealed envelopes to stand overnight. They can thus be tested the next day to determine if any leakers have developed prior to further fabrication which materially reduces salvage costs. The completed discharge lamp per se, as shown in Fig. 2, is then ready for mounting in the outer envelope 5 and its manufacture completed to produce the marketable lamp illustrated in Fig. 1.

It thus becomes obvious to those skilled in the art that a high pressure mercury vapor discharge lamp has been provided by the present invention wherein a seal is employed comprising a fused quartz mass embedding the leading-in

and supporting couductors therein with such conductors being free of oxidation. Due to the fused quartz mass being reduced in an inert gaseous atmosphere from a partitioned tubing at one elongated end of the lamp, not only are the leading-in conductors for the starting electrode and the adjacent main electrode maintained in parallel relation with each other, but the thickness of the fused quartz embedding such leading-in conductors is substantially uniform thereabout throughout the length of the elongated envelope end. Moreover, the seal of the present invention is fabricated by a novel method which enables proper positioning of the electrodes in the envelope and their retention therein during the fusing step while the utilization of a partitioned tubing prevents accidental contact between adjacent parallel leading-in and supporting conductors at any point along their length.

Although a specific embodiment of the present invention has been herein shown and described, it is to be understood that still further modifications thereof may be made without departing from the spirit and scope of the appended claims.

We claim:

1. A ribbon type seal leading-in and supporting conductor assembly for sealing into a high melting point material single bore tubing of a high pressure discharge lamp envelope comprising a short rod of refractory material, an electrode on one end of said rod, a non-oxidized refractory metal ribbon on the other end of said rod and a looped strip of refractory metal affixed to the other end of said ribbon, the closed end of said loop being cut to provide a V-shaped end having spring tension for positively positioning said assembly in a desired position within

said tubing during sealing and to later form an external terminal connection therefor.

2. The method of fabricating and sealing a leading-in and electrode supporting conductor assembly within a high melting point vitreous single bore tubing of a high pressure discharge lamp envelope comprising, securing a short rod of refractory metal to one end of a refractory metal ribbon, affixing the open end of a refractory metal loop to the other end of said ribbon, cutting the closed end of said loop to provide a V-shaped end portion thereof having a spring tension, mounting an electrode on the inner end of said rod, maintaining the refractory metal leading-in and electrode-supporting conductor under tension within the tubing of said envelope by means of the V-shaped end of said loop, and sealing said conductor assembly to said bore.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,018,957	Hyde	Oct. 29, 1935
2,123,015	Marden	July 5, 1938
2,215,300	Ryde	Sept. 17, 1940
2,241,968	Suits	May 13, 1941
2,273,437	Dunn	Aug. 25, 1942
2,283,189	Cox	May 19, 1942
2,308,350	Blackburn	Jan. 12, 1943
2,322,421	Cox	June 22, 1943
2,353,668	Hinman	July 18, 1944
2,549,328	Nelson	Apr. 17, 1951

FOREIGN PATENTS

Number	Country	Date
554,678	Great Britain	July 14, 1943