June 21, 1938. E. LEMMERS 2,121,638

ELECTRIC DISCHARGE DEVICE

Filed Oct. 19, 1937

Fig. 1.

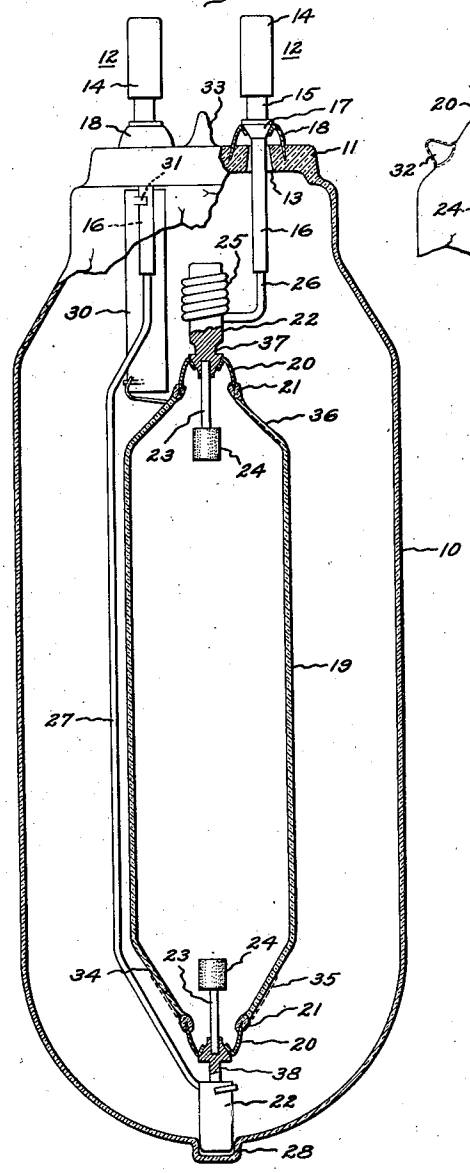


Fig. 2.

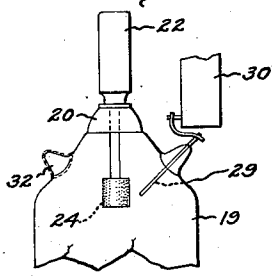


Fig. 5.

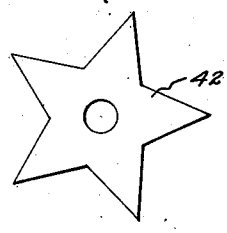


Fig. 4.

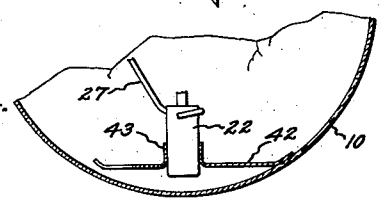


Fig. 6.

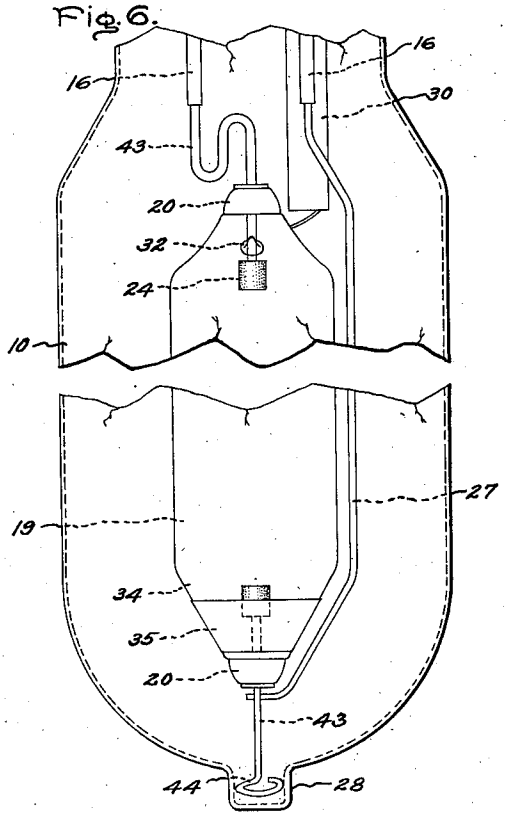
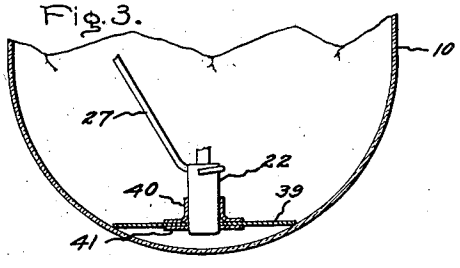


Fig. 3.



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UNITED STATES PATENT OFFICE

2,121,638

ELECTRIC DISCHARGE DEVICE

Eugene Lemmers, Cleveland, Ohio, assignor to General Electric Company, a corporation of New York

Application October 19, 1937, Serial No. 169,329

5 Claims. (Cl. 176—122)

My invention relates to electric discharge lamps generally. More particularly my invention relates to discharge lamps of the type comprising an inner and an outer container or envelope and to structural features of the inner envelope and means for supporting it in the outer container.

One of the objects of my invention is to provide a discharge lamp of the type referred to above having a rigid and simplified structure for supporting the inner envelope in the outer container. Another object is to provide an inner envelope having rigid leads or prongs sealed to the ends of the envelope through the medium of flexible metallic end members to produce a strong seal and permit supporting of the inner envelope directly by its said leads or prongs. Another object is to provide a lamp of the above type having its leads so proportioned as to balance or offset the heat loss occasioned by the said metallic end members thereby permitting the lamp, during starting, to warm up to its operating temperature in a reasonably short time. Still another object is to provide a lamp having the inner envelope so shaped as to impart stability to the arc.

Further objects and advantages of my invention will appear from the following description of species thereof and from the drawing in which Fig. 1 is an elevation, in section, of a discharge lamp comprising my invention; Fig. 2 is an elevation at right angles to Fig. 1, of a portion of the inner envelope or lamp proper; Figs. 3 and 4 are elevations, partly in section, of modified support structures for one end of the inner envelope; Fig. 5 is a plan view of the supporting member shown in Fig. 4; and Fig. 6 is a plan view of another modification.

Referring to Figs. 1 and 2, the lamp shown therein is adapted to be operated in a base-up position with its longitudinal axis vertically disposed and comprises an outer glass container 10 sealed at its neck to a pressed glass cup-shaped closure or base member 11 which has a pair of terminal and mounting prongs or posts 12—12 extending through openings 13 therein. The prongs 12—12 are of the type disclosed and claimed in application Serial No. 57,196, D. K. Wright, filed January 2, 1936, and have enlarged outer end portions 14, reduced portions 15 and reduced inner end portions 16 forming shoulders 17. The said prongs 12 are secured to the glass end closure 11 through the medium of thin flexible metallic cups or flares 18 which are brazed to the shoulders 17 on said prongs 12 and have their edges sunk and fused into the thickness of the glass closure 11 around the openings 13 therein. The prongs 12 may be made of cold rolled steel, while the cups 18 are made of a metal or alloy which may be joined satisfactorily to the glass closure 11, the said cups 18 being preferably made of an iron-nickel-cobalt alloy known as "Fernico" when the glass closure 11 is made of a hard glass such as "Pyrex."

The lamp proper illustrated in the drawing is of the high intensity type of mercury lamp operating with a constricted arc discharge and comprises a tubular inner envelope 19, preferably of a hard or high melting point glass such as that manufactured by the Corning Glass Works and known as "172 AJ." The ends of the envelope 19 are preferably sealed by thin flexible metallic cup-shaped closures 20—20 like the cups 18. The said cup-shaped end closures 20—20 may also be made of Fernico, in which case intermediate rings or beads of "Pyrex" glass 21—21 are preferably sealed to the edges thereof, the ends of the envelope being sealed to said rings 21—21. The outer leads in this instance consist of axially extending prongs 22—22 which are similar to the outer end portions of the terminal prongs 12—12 and are brazed to the cup-shaped closures 20—20 to form a hermetic seal. The inner leads 23—23 consist of a refractory wire, preferably tungsten, and are secured, preferably by brazing, in bores in the inner ends of the outer leads 22—22. The electrodes 24—24 are preferably of the type comprising a sintered or welded body of coarse tungsten particles impregnated with an electron emissive material such as barium oxide, as described in application Serial No. 148,488, filed June 16, 1937, by the inventor herein and G. M. Carpenter. The ends of the leads 23—23 are embedded in and welded to the said electrodes.

The upper prong 22 is held in the coiled end portion 25 of a comparatively heavy and rigid support and current lead-in wire 26, the opposite end of which is telescoped in a bore in the end of the inner end portion 16 of the right-hand prong 12 and is preferably clamped or welded therein. Another support and current lead-in wire 27 is similarly secured to the left-hand prong 12 and extends longitudinally of the lamp, the lower end thereof being secured, preferably by welding, to the lower prong 22. Additional support may be provided by a well or protuberance 28 at the tip of the outer container 10 which receives the end of the lower prong 22.

The lamp may be provided with an auxiliary electrode 29 (Fig. 2) to facilitate starting, said electrode extending through the upper portion of

the envelope 19 adjacent to the upper electrode 24 and being connected through a high resistance encased in a tube 30 of refractory insulating material, and through lead-in 27 to the lower electrode 24. The resistance member 30 is supported by and electrically connected to the left-hand prong 12 by a metal strip 31 embedded in the casing and welded to the inner end portion 16 of the said prong 12 (Fig. 1).

The inner envelope 19 is evacuated at 32 (Fig. 2) and has a filling of a starting gas, preferably a rare gas such as argon, at a pressure of about 6 to 8 mm. of mercury. The said envelope also contains a controlled quantity of mercury so as to provide a pressure of preferably about two atmospheres during operation, all of the mercury being vaporized during operation of the lamp. The evacuating tip 32 is preferably coated with a heat reflecting material, such as platinum paint. The outer envelope may be evacuated at 33 and may have a filling of nitrogen or air at a pressure of about one atmosphere.

The lower end of the envelope 19 is tapered, as shown at 34, being of approximately conical shape to assist in heating the lower end of the lamp. To further assist in heating the said lower end of the lamp, the said end portion 34 has a coating 35 thereon of heat reflecting material, preferably platinum paint. However, care should be taken that the metallic paint 35 does not make contact with the metallic end closure 20 since this would cause it to act as an anode thereby attracting electrons to the glass wall of the envelope and causing an electrolytic action to take place therein. The upper end of the envelope is preferably shaped in at 36 to raise the temperature sufficiently to impart stability to the arc.

The cup-shaped end closures 20—20 provide a very strong seal while still having a sufficient degree of flexibility to avoid cracking the glass when strains are applied to the prong leads 22—22. However, the said closures 20—20 because of their high heat conductivity, make it necessary to properly proportion the inner leads 23—23 and the outer leads 22—22 in order to balance or offset the heat lost by radiation and conduction from the said closures so that, during starting, the ends of the lamp may warm up sufficiently to start in a reasonable length of time. The inner leads 23—23 are therefore made large enough to conduct a sufficient amount of heat from the electrodes to the ends of the envelope 19. The coating 35 on the lower end of said envelope 19 further assists in this warming-up process. Moreover, the outer leads 22—22 should not be so large as to conduct the heat away too rapidly. Therefore the comparatively heavy lower lead 22 is preferably undercut or reduced considerably at 38 since the lower end of the lamp tends to run cooler than the upper end. The upper lead 22 is shown as undercut at 37 a small amount although this is not essential.

As a specific illustration, for a 400 watt high intensity mercury lamp, the inner envelope 19 may be 35 mm. in diameter and approximately 120 mm. long with an arc gap of 100 mm. and may be filled with about 6 to 8 mm. of argon and sufficient mercury (about .018 cc.) so that the lamp operates at a pressure of about two atmospheres when all of the mercury is vaporized. To balance the heat loss occasioned by the metallic cups 20—20, the inner leads 23—23 may in this case be made of 70 mil tungsten wire, while the reduced portion 38 of the lower outer lead 22 may be of 50 mil diameter. The proper proportioning of the leads is an important factor since inner leads 23—23 of, for example, 30 mil diameter in a lamp of this size would be too small to permit warming up of the ends of the lamp to an operating temperature.

In the modification shown in Fig. 3, the well 28 of Fig. 1 is omitted and the lower outer lead 22 is held by a disc 39 of suitable material, such as mica, engaging the end wall of the outer container 10 and secured to said lead 22 by a metal eyelet 40 and a metal washer or ring 41 located on opposite sides of said disc 39 and secured thereto preferably by indenting or perforating the said eyelet and washer.

The supporting means of Figs. 4 and 5 is somewhat similar to that of Fig. 3 and consists of a star-shaped member 42 of resilient or springy metal having a tubular flange portion 43 engaging the lead 22 and secured thereto, preferably by welding. The points of the star-shaped member 42 press against the end wall of the outer container 10 and are bent back thereby.

In the modifications shown in Fig. 6, the prongs 22—22 of Fig. 1, are replaced by rigid wire leads 43—43, the end of the upper lead 43 being secured to the inner portion 16 of one of the terminal prongs 12 and the lower lead 43 terminating in a loop 44 which engages the well 28 at the tip of the outer container 10. For the 400 watt lamp described above, the said leads 43—43 may be made of steel of, for example, 50 mil diameter.

The constructions described above provide a lamp which is mechanically strong and simple in construction due to the mounting of the inner envelope directly from its leads without the usual spring members for engaging the bulb wall.

Although I have described specifically certain species of my invention, it will be obvious that various changes may be made therein without departing from the scope of my invention. For example, the electrodes 24—24 may be of various types other than that shown, such as a coil of wire coated with electron emissive material. The lamp may also, of course, be readily adapted for operation in a base-down position by reversing the position of the outer container 10 and terminals 12—12, the inner envelope 19, however, remaining in the position shown.

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

1. An electric discharge lamp comprising an outer container and an inner envelope, said inner envelope being closed at its ends by thin metallic closure members sealed at their edges directly to the ends of said envelope, inner leads extending inwardly of said envolpe from said end closure members and having electrodes secured thereto, rigid outer leads extending outward from said end closure members and means in said outer container for supporting said inner envelope directly from said outer leads, said inner leads being of sufficiently large size to transfer enough heat to the ends of said inner envelope to balance the heat lost by radiation from said metallic end closures and thereby permit the lamp to heat up, during starting, to its operating temperature.

2. An electric discharge lamp comprising an elongated outer container having a pair of rigid terminal prongs extending through one end thereof, an elongated inner envelope closed at its ends by thin metallic closure members sealed at their edges directly to the ends of said envelope, inner leads extending inwardly of said envelope from said end closure members and having electrodes secured thereto, rigid outer leads extending

outward from said end closure members, a pair of rigid conductive supports each extending from one of said terminal members to one of said outer leads to support said inner envelope, the outer lead at the opposite end of said container from the terminal prongs being additionally supported from the walls of said container.

3. An electric discharge lamp comprising a tubular envelope having inwardly tapering ends closed by thin metallic closure members having their edges sealed directly to the ends of said envelope, and leads extending through said end closure members axially of said envelope and carrying electrodes at their inner ends, the portions of said leads within the envelope being of sufficiently large size to transfer enough heat to the ends of said envelope to balance the heat lost by radiation from said metallic end closure members and thereby permit the lamp to heat up, during starting, to its operating temperature.

4. An electric discharge lamp adapted to be operated with its longitudinal axis vertically disposed and comprising a tubular envelope having inwardly tapering ends closed by thin metallic closure members having their edges sealed directly to the ends of said envelope, and leads extending through said end closure members axially of said envelope and carrying electrodes at their inner ends, the portions of said leads within the envelope being of sufficiently large size to transfer enough heat to the ends of said envelope to balance the heat lost by radiation from said metallic end closure members and thereby permit the lamp to heat up, during starting, to its operating temperature, and the lower end of said envelope having a coating of heat reflecting material thereon to further conserve the heat thereat.

5. An electric discharge lamp adapted to be operated with its longitudinal axis vertically disposed and comprising a tubular envelope having inwardly tapering ends closed by thin metallic closure members having their edges sealed directly to the ends of said envelope, and leads extending through said end closure members axially of said envelope and carrying electrodes at their inner ends, the portions of said leads within the envelope being of sufficiently large size and the portions of said leads adjacent the outer sides of said end closure members being of sufficiently small size to balance the heat lost by radiation from said metallic end closure members and thereby permit the lamp to heat up, during starting, to its operating temperature.

EUGENE LEMMERS.