GLOW DISCHARGE LAMP

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Application September 29, 1946, Serial No. 698,332

2 Claims. (Cl. 176—122)

1. This invention relates to electric discharge devices of the type employing ionizable mediums, such as gases or vapors, and more particularly to glow discharge devices or lamps and to methods of making the same.

With the present increasing demand for glow discharge lamps, it becomes apparent that there is a decided need for improved constructions and designs of such lamps which are readily adaptable to quantity production and the utilization of automatic equipment. Furthermore, the expanding field of application of glow discharge lamps has indicated that there is need for improved electrode constructions and arrangements with respect to the other lamp parts which afford distinct advantages without sacrificing highly important advantages to the user, such latter advantages including rugged construction, symmetry of design, and low cost.

An object of my invention is to provide a new and improved electrode mount structure for electric discharge devices, such as glow discharge lamps.

Another object of my invention is to provide a new and improved electrode mount structure which may be manufactured and assembled on automatic equipment.

A further object of my invention is to provide a rugged electrode mount structure symmetrical in design and appearance.

A still further object of my invention is to provide new and improved methods of forming or assembling an electrode mount structure for an electric discharge device.

Further features and advantages of my invention will appear from the following description and species thereof.

For a better understanding of my invention reference may be had to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims. Fig. 1 is a side elevation of a glow discharge device incorporating my invention. Fig. 2 is a side elevation, partly in section, of an electrode mount structure for a glow discharge lamp incorporating my invention. Fig. 3 illustrates a modification of the electrode mount structure shown in Fig. 2. Fig. 4 is a top view of Fig. 2. Fig. 5 illustrates a modification of the electrode mount structure shown in Fig. 2. Fig. 6 is a top plan view of one quadrant of the electrode structure illustrated in Fig. 5.

Referring to Fig. 1, there is illustrated one embodiment of my invention as applied to an electric discharge device or glow lamp 1. The lamp 1 comprises a vitreous envelope 2 having sealed into the end thereof a mount comprising a stem 3 (shown in enlarged view in Fig. 2), and which may comprise a stem press or squeeze employed to furnish a mechanical support for lead-in wires 5 and 6 and to fuse and secure these wires through stem 3. Lead-in wires 5 and 6 have their upper ends bent laterally toward each other in aligned and opposed relationship and serve as supports for electrode structure including a pair of spaced electrodes 7 and 8, defining therebetween a gap 9. Although the gap 9 is defined by the opposite edges of the two electrodes, and the length of the gap is determined by the spacing of the electrodes 7 and 8, the gap 9 may be described as having an annular edge of the electrode 7 or 8 shown in Fig. 5. A resistor 10, located within a conventional type base 11, is electrically connected to one end of lead-in wire 5 and forms with lead-in wire 5 a conductive member of predetermined resistance for connection to an external source. In order to reduce the over-all axial or longitudinal dimension of the electrode structure, and to afford concurrently therewith additional mechanical advantages in rigidity, etc., I provide electrodes 7 and 8, preferably constructed of preformed sheet material such as nickel, having a substantial concavity into which the upper part of the stem assembly, or particularly the stem squeeze extends, thereby reducing the axial length of the electrode mount structure and providing mechanical features uniquely adaptable for supporting the electrodes. More specifically, the electrodes, by virtue of the construction or pre-fabrication from workable sheet metal, may be readily attached to the inner extremities of the lead-in wires 5 and 6.

I have found that one way in which a firm support for the electrode may be obtained is by clamping or pinching the electrode material directly to the bent inner or upper ends of the lead-in wires as explained hereinafter. Electrodes 7 and 8 may comprise quadrants of a hollow body, and may be arranged to present jointly a convex outer surface extending substantially completely around the stem squeeze. The electrodes, for example, may comprise quadrants of a hollow sphere and may be arranged to present jointly a hemispherical surface extending substantially completely around the stem squeeze. Along one edge of each quadrant one of the hollow body or sphere and near or adjacent the apex of the hemispherical surface defined by electrodes
3
1 and 8, indentations such as trough-shaped wells 12 and 13 are formed in the concave surface thereof to extend inwardly from the opposed arcuate edges of the electrodes. The bent ends of the lead-in wires 5 and 6 are preferably positioned longitudinally within wells 12 and 13, respectively, and the side walls of the wells are pinched around the said bent ends of the lead-in wires to secure and form electrical contact with the electrodes. In this operation, heat may be supplied to those portions of the electrodes at or near the junctions of the wells 12 and 13, respectively, so that the pinching of the side walls of the said wells around the bent ends of the lead-in wires securely clamp the electrodes 7 and 8 to the wires.

Electrodes 7 and 8 are preferably of nickel and are coated with an alkaline earth metal, such as barium or strontium oxides, or mixtures thereof. The backs or undersides of these electrodes are preferably coated with an insulation coating, such as aluminum oxide, suspended in vinyl acetate and nitrocellulose in order to confine the glow to the outer electrode surfaces. It is obvious, however, that these electrodes may be formed out of a bi-metal such as a bi-metallic composite comprising an outer surface of nickel and an inner surface of aluminum.

An exhaust tube 14 as shown in Fig. 3 is provided for exhaustion and sealing of envelope 2. A suitable atmosphere, such as a gas or a vapor, is provided within the sealed envelope 2. This atmosphere, for example, may consist of argon containing 5 to 20% of nitrogen at a pressure from 6 to 20 millimeters of mercury. A preferable mixture giving exceptionally good results has been found to be neon containing about 0.8 of a percent of argon at a pressure of about 35 millimeters of mercury.

Fig. 3 incorporates the above described corresponding parts of Fig. 2 except lead-in wire 5 is replaced by a composite conductive member which consists of two spaced wires 15 and 16 electrically connected by a resistive element 11. The resistor 11 by virtue of its location within the stem in place of the lamp base (not shown in Fig. 3) renders possible a reduction in the size and cost of a lamp base required therewith.

Fig. 5 incorporates the above described corresponding parts of Fig. 2 except I provide a deformable appendage or flap 18 which is bent downwardly and transverse to the gap length as shown and which controls the minimum discharge path length or gap 9 thereby controlling the electrical starting characteristics of the lamp. More particularly, these deformable appendages afford means readily workable during manufacture for establishing discharge path length, thereby making it possible to construct lamps having uniform starting voltage or breakdown characteristics, and further assuring that each lamp has a predetermined maximum breakdown voltage. In other words, I provide an improved way of assuring predetermined and uniform arc length and incident uniform electrical starting characteristics.

In accordance with my invention described above, I provide a new and improved electrode structure which may be manufactured and assembled on automatic equipment. Accordingly, I provide electrodes shaped so as to lend themselves to automatic assembly methods and retain symmetry in design and appearance without sacrificing mechanical strength or electrical operating characteristics.

Generally speaking I effect these desired results by providing electrodes formed from quadrants of a hollow sphere arranged to present jointly a hemispherical surface and mounted to enclose one end of the stem. In this manner the lead-in wires extending beyond the stem press are short in length and afford a strong structure. In addition to the facility of production, this type of construction has other advantages, one of which is the fact that with hemispherical electrodes the light emitted remains substantially unchanged during operation on either A.C. or D.C. circuits. It is obvious that the electrode structure may also be adaptable to different electrode shapes and sizes.

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

1. In an electric glow lamp, the combination comprising an envelope, a stem press supporting a pair of lead-in wires, and a pair of concave electrodes each having an indentation for receiving one of said wires and each having an appendage for defining a minimum discharge path therebetween.

2. In an electric glow lamp, the combination comprising an envelope, a pair of lead-in wires, and a pair of electrodes comprising quadrants of a hollow body defining thereof an arcuate discharge path, each of said electrodes having therein an indentation for receiving one of said wires and a transverse appendage defining a minimum length of said path.

WILSON DAVIDSON.

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