May 3, 1938. T. A. STERNBERG 2,116,224

MOUNT FOR ELECTRON DISCHARGE DEVICES

Filed Aug. 28, 1937

Fig. 1

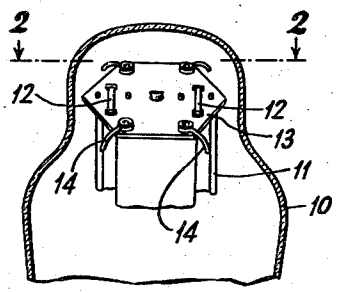


Fig. 2

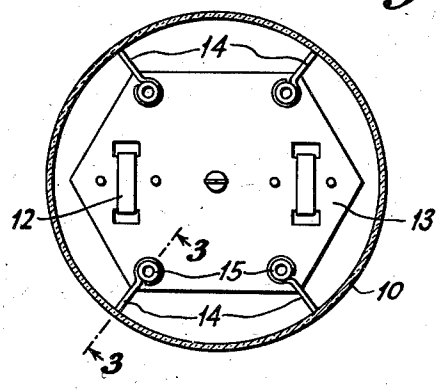


Fig. 3

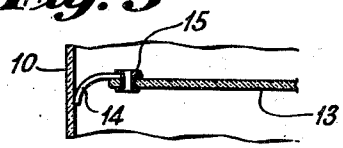


Fig. 4

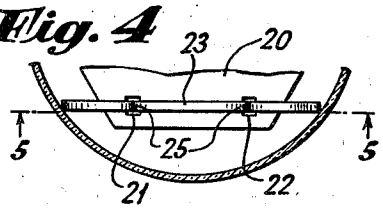


Fig. 5

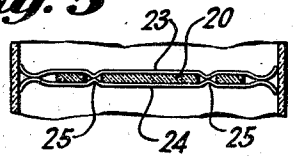


Fig. 6

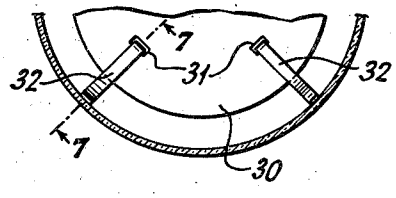


Fig. 7

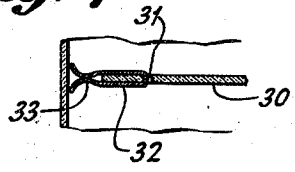


Fig. 8

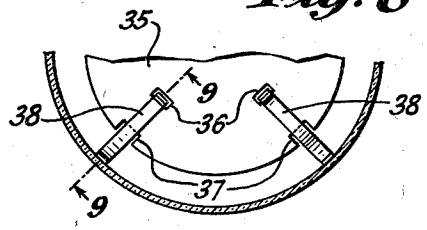


Fig. 9

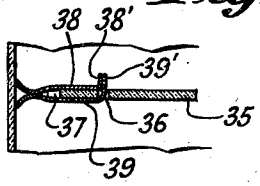
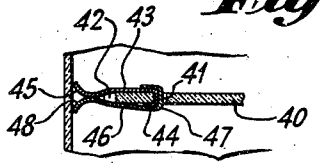


Fig. 10



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ATTORNEY.

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UNITED STATES PATENT OFFICE

2,116,224

MOUNT FOR ELECTRON DISCHARGE DEVICES

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Application August 28, 1937, Serial No. 161,378

5 Claims. (Cl. 250—27.5)

My invention relates to improvements in electron discharge devices and more particularly to improved means for firmly and accurately positioning the electrode mount within the envelope of a tube.

The present application is a continuation in part of my co-pending application, Serial No. 732,553, filed June 27, 1934 and assigned to the same assignee as the present application.

In modern tubes such as tubes having dome type bulbs or envelopes, it is found desirable to hold the electrode assembly firmly in place in the envelope to prevent transverse movement of the mount. To this end the dome or other constricted portion of the tube is utilized to steady the electrode assembly against transverse movement and to keep the assembly more firmly established in position than when the assembly is supported and steadied only from the stem press. The mount should be steadied sufficiently to avoid noises, such as clicking, due to contact between the electrode assembly and the envelope when the tube is jarred or vigorously vibrated. The steadying means or mount spacer should be sufficiently resilient to avoid the stresses and distortion of the mount assembly produced when a mount with a rigid steadying means is forced into a bulb dome smaller than usual. Metallic spring spacers are resilient and easily made and attached to the mount, but the use of such metallic springs to steady the mount has not heretofore been favored because strain checks and cracks were often produced in the glass bulb during exhaust at the points where the metal touched the glass. It is the usual practice to attach to the mount, the mica mount spacers either in the form of a plate or disc extending transversely of the dome portion of the envelope or in the form of vertical oblong shaped micas attached to the mount intermediate their ends and with their ends in contact with the walls of the bulb. Mica mount spacers also have some disadvantages, as commercial mica varies from .008" to .020" in thickness and the resiliency of the mica mount spacers varies considerably with the result that the mounts are not always positioned centrally of the bulb. Attaching the vertical micas to the mount is sometimes difficult and various ways of attaching the mica have been devised. Furthermore, mica may split under stress and sometimes blisters during the high frequency heat treatment. A metallic spring mount spacer would in many cases be preferable to a mica spacer if it could be used without harm to the bulb or to the tube.

The principal object of my invention is to firmly and accurately position the free end of an electrode mount within the bulb of an electron discharge device by metallic springs secured to the mount and engaging the interior wall of the bulb without injury to the mount during assembly or to the bulb during exhaust.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will best be understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 is a partial view in perspective of one form of an electron discharge device embodying my invention; Figure 2 is an enlarged horizontal cross section taken along line 2—2 of Figure 1; Figure 3 is an enlarged partial vertical section taken along lines 3—3 of Figure 2; Figure 4 is a partial plan view of a modification of an electron discharge device embodying my invention and Figure 5 is a vertical section taken along line 5—5 of Figure 4, and Figures 6 to 10 show other modifications of my invention.

The electron discharge device shown in Figure 1 has a dome type of bulb 10, which is provided with the usual stem press and base not shown. The mount 11 comprises the usual electrode assembly and extends into the tubular portion or dome of the bulb 10. The mount has secured to its upper end by straps 12, welded to the mount, a sheet insulator or electrode spacer 13, preferably of mica, which may be of any shape but is shown as a hexagonally shaped plate in Figures 1, 2 and 3 and which extends transversely of the mount and of the tubular portion or dome of the envelope 10.

In view of the fact that the envelopes are not all of exactly the same diameter, rigid mount spacers on the upper end of the mount to fit snugly in the dome are not feasible. If the mount spacers are rigid and fit the largest envelope the mount will be stressed and distorted when a smaller envelope is placed over the mount assembly, while if the spacer fits the smaller envelope it will be loose in the large envelope and clicking will result.

In accordance with my invention I provide the mica plate 13 with resilient metallic spring spacers or fingers 14, which are fastened to and extend radially from the edge of the plate 13 into contact with the inner wall of the dome of the envelope 10 to resiliently support and steady the mount and center it in the envelope.

These metallic spring fingers, which may be

made for example of tungsten or molybdenum wire, may be fastened as best shown in Figure 3 at their inner ends to the mica, for example, by means of rivets 15 which extend through the mica spacer 13. These spring fingers are formed with bowed outer ends which engage the interior wall of the tubular portion of the envelope. When the bulb is placed over the mount the spring fingers are flexed downwardly to an extent dependent on the inner diameter of the dome of the bulb. These fingers resiliently center the mount from the walls within the envelope and prevent clicking of the tube.

I have obtained very good results with tungsten wire of 10 mil diameter measuring about 5 mm. in length from the point at which it was fastened to the mica to the bowed end portion which may be from 2½ to 3 mm. in length. The wire was riveted to the mica at from 2½ to 3 mm. from its edge. The mica was formed to provide a clearance of from 2 to 3 mm. between the edge of the mica and the wall of the envelope.

While I do not wish to be restricted to any particular theory, I believe that the success of the metal spring fingers made in accordance with my invention is due to the fact that they are of very small mass and do not absorb very much heat and are heat insulated by means of the mica plate to prevent conduction of heat to and from the mount. As a result the temperature of the spring fingers is always so nearly the same as the temperature of the envelope that the temperature differential between the two is practically negligible, thus preventing the checks and cracks in the glass envelope which are apt to occur when metallic spring spacers are used. A large temperature differential is likely to occur when heat is rapidly conducted from the metallic spring mount spacers to the mount when heating the envelope, or by conducting heat to the spring spacers from the mount during the high frequency heat treatment of the mount.

As shown in the modification in Figures 4 and 5 the mica plate 20 may be provided with oppositely disposed apertures 21 and 22 into which portions of the metallic spring elements or mount spacers 23 and 24 extend and are fastened together preferably by welding at points 25 and 26. The ends of the springs which extend over the edges of the mica and into contact with the wall of the bulb may also be welded together.

In Figures 6 and 7 is shown a modification of my invention. The mica spacer 30 is provided with apertures 31 extending around the edge as shown in Figure 6. Metal ribbon spring members 32 extend through the apertures 31 and have their outside tongues welded together at 33. This maintains the spring members in contact with the opposite sides of a mica and locked in position, the outer ends extending beyond the mica, contacting the wall of the envelope of the tube in the same manner as the modification shown in Figure 5.

In Figures 8 and 9 I show a still further modification. The mica 35 is provided with apertures 36 and slots 37. Spring member 38 provided with an up-turned tongue 38' and spring member 39 provided with up-turned tongue 39' extending through the aperture 36 are welded, the outer ends of the spring members being welded together to maintain the ribbon springs in contact with the opposite sides of the mica spacer.

In Figure 10 I show a still further modification. Mica 40 is provided with apertures 41 and slots 42. On one side is provided spring member 43 having tongue portion 44 extending through the aperture and an outwardly formed tip 45. On the other side is provided another spring member 46 having a tongue portion 47 extending through aperture 41 and tip 48. The tips or outwardly extending ends of the spring members are preferably welded together to maintain the springs on the mica.

These metallic spring fingers are capable of providing for wider variations of bulb diameters than the usual type of mica spacer and are usually more easily made and attached to the mount and retain their resiliency during the sealing and high frequency treatment of the mount during the exhaust operation.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

What I claim as new is:

1. An electron discharge device including an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to extend into the tubular portion, an insulating plate secured to the mount to extend transversely of the tubular portion of the envelope, said insulating plate having apertures near the edges, metallic spring elements disposed on both sides of said plate to lie flat against the surfaces of the plate and having portions extending into said apertures, said spring elements having registering ends extending beyond the outer edge of the insulating plate in contact with the walls of the tubular portion of the envelope to resiliently steady said mount from the walls of the tubular portion of the envelope, the registering ends being welded together to maintain the spring elements in contact with opposite sides of the plate and in position on said plate.

2. An electron discharge device including an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to extend into the tubular portion, an insulating plate secured to the mount to extend transversely of the tubular portion of the envelope, said insulating plate having apertures near the edges, metallic spring elements disposed on opposite sides of said plate and registering with each other, the spring elements on one side of said plate having a portion extending through said aperture, said metallic spring elements lying in contact with the opposite sides of the plate with registering ends extending beyond the edges of said insulating plate in contact with the walls of the tubular portion of the envelope to resiliently steady said mount from the walls of the tubular portion of the envelope, the registering ends of the spring elements being welded together to maintain said spring elements in position on said plate.

3. An electron discharge device including an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to extend into the tubular portion, an insulating plate secured to the mount to extend transversely of the tubular portion of the envelope, said insulating plate hav-

ing apertures near the edges, metallic spring elements disposed on and in contact with opposite sides of said plate and registering with each other, each of the springs on one side of said plate being provided at their inner ends with a tongue extending through the apertures in said plate and registering with the inner ends of the springs on the other side of the plate, the outer ends of said springs extending beyond the edges of the insulating plate in contact with the wall of the tubular portion of the envelope to resiliently steady said mount from the walls of the tubular portion of the envelope, the outer and inner registering ends of said springs being welded together to maintain said springs in position on said plate.

4. An electron discharge device including an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to extend into the tubular portion, an insulating plate secured to the mount to extend transversely of the tubular portion of the envelope, said insulating plate having apertures near the edges, and metallic spring elements disposed on and in contact with opposite sides of said plate and registering with each other and having portions extending into said apertures, said portions overlapping each other, the other ends of said springs extending beyond the edges of said plate to contact the walls of the tubular portion of the envelope to resiliently steady the mount within the tubular portion of the envelope, the registering ends extending beyond the edges of the insulating plate being welded together to maintain said springs in position on said plate.

5. An electron discharge device including an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to extend into the tubular portion, an insulating plate secured to the mount to extend transversely of the tubular portion of the envelope, said plate having oppositely disposed apertures near the edges, metallic spring elements disposed on opposite sides of said plate and having portions extending into said apertures, said portions being fastened to each other to secure said metallic spring elements to said plate with the ends of said spring elements extending beyond the edges of said mica plate to contact the walls of the tubular portion of the envelope to resiliently steady the mount within the tubular portion of the envelope.

THEODORE A. STERNBERG.