Nov. 7, 1939. W. L. KRAHL 2,178,837

MOUNT SUPPORT FOR ELECTRON-DISCHARGE TUBES

Filed Feb. 12, 1938 2 Sheets-Sheet 1

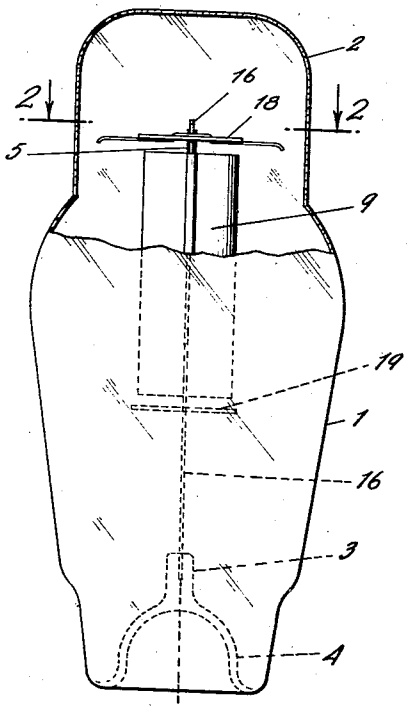


Fig. 1.

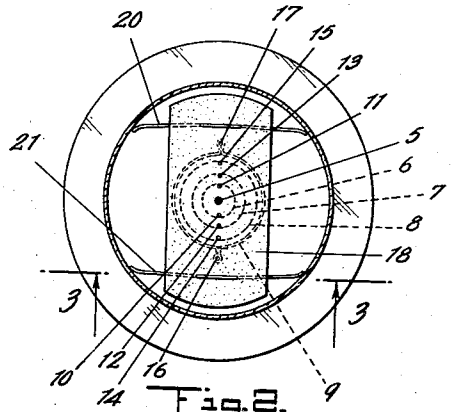


Fig. 2.

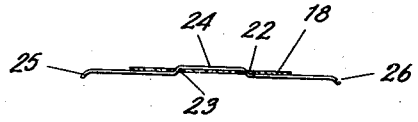


Fig. 3.

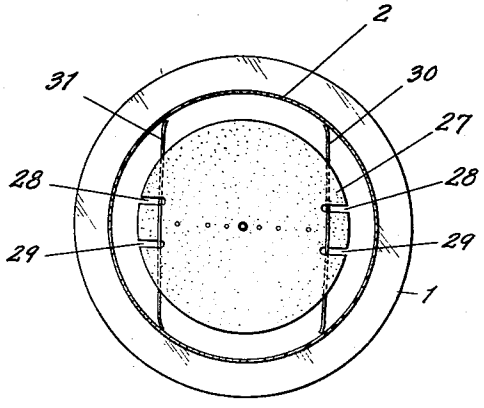


Fig. 4.

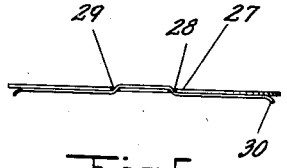


Fig. 5.

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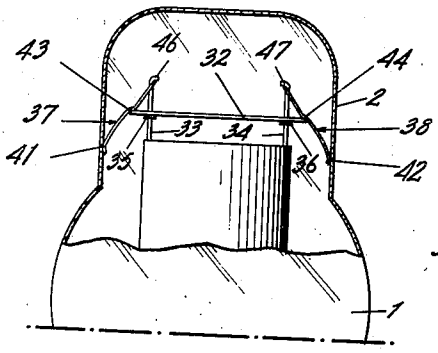
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ATTORNEY

Nov. 7, 1939. W. L. KRAHL 2,178,837

MOUNT SUPPORT FOR ELECTRON-DISCHARGE TUBES

Filed Feb. 12, 1938 2 Sheets-Sheet 2

Fig. 6.



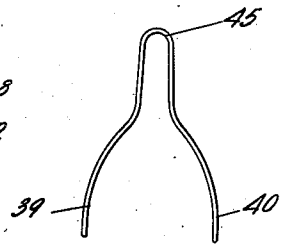


Fig. 7.

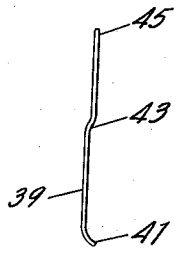
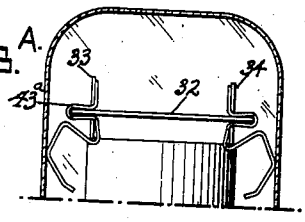


Fig. 8.

Fig. 8. A.



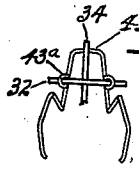


Fig. 8. B

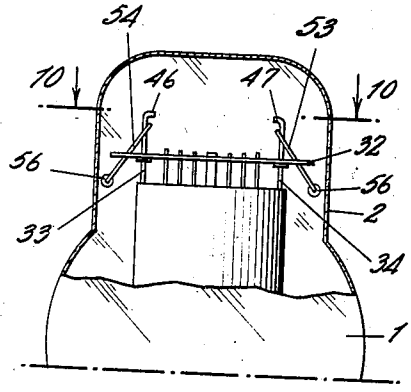


Fig. 9

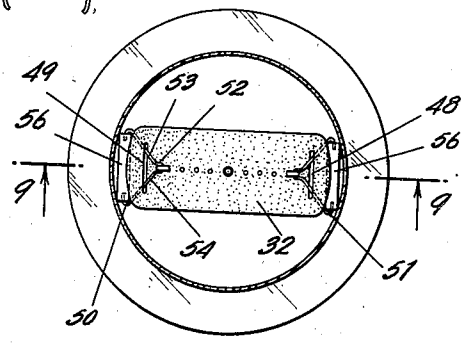


Fig. 10.

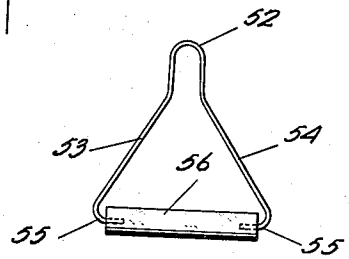


Fig. 11.

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UNITED STATES PATENT OFFICE

2,178,837

MOUNT SUPPORT FOR ELECTRON-DISCHARGE TUBES

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Application February 12, 1938, Serial No. 190,203

13 Claims. (Cl. 250—27.5)

This invention relates to electric discharge devices and with particularity to devices generally referred to as radio tubes, vacuum tubes, or the like.

An object of the invention is to provide novel means for supporting the electrode assembly of an electron discharge tube or the like.

Another object is to provide a novel device for resiliently supporting an electrode assembly interiorly against the wall of an enclosing envelope or the like.

In radio tubes generally, and more especially in the modern types of tubes, it is imperative that the various electrodes of the electrode assembly be maintained accurately in predetermined spatial relations, both with respect to one another and also with respect to the wall of the enclosing envelope. The necessity for maintaining the electrodes in fixed relation to the envelope is occasioned by the undesirable effects of changes in capacitance between the electrodes of the tubes and surrounding shields or other conductors. Furthermore, it is often impracticable to secure the elements of tubes in fixed relation to one another by interposing an insulating spacer between them and it is more convenient to minimize relative motion between the electrodes by supporting, those elements which are most inclined to move, against the inner walls of the envelopes. Supporting the end of the structure further from the press by bracing it against the envelope, minimizes the tendency for the supporting wires to be bent or the glass adjacent these wires to be cracked when the tube is submitted to severe shock. If the means for supporting the electrodes against the envelope are non-resilient, the normal variations in the dimensions of the envelopes will result in small clearance between the supports and the larger envelopes and annoying rattles due to intermittent collision between the supports and the envelopes will be occasioned by sound waves or other vibrations. The supports bearing against the envelope should therefore be flexible, but must be sufficiently rigid to prevent motion of the electrodes when subjected to normal vibration which would otherwise result in microphonic disturbances in the output of the tube when the latter is in use.

Accordingly, one of the principal objects of this invention is to provide a radio tube, lamp or similar device, wherein the filament or electrode assembly is supported both from the press as well as from the upper end of the envelope, whereby variations in the characteristics of the tube are substantially prevented even when the tube is subjected to heavy jars or vibrations.

Another object of the invention is to provide a so-called single-press tube with means for supporting the electrode assembly against tilting movement with respect to the press, without at the same time materially increasing the assembly cost or assembly time.

A feature of the invention relates to a radio tube of the so-called "dome" envelope type in conjunction with a novel form of resilient spacer.

There is disclosed in Patent No. 2,049,164, a resilient spacer consisting of a specially shaped strip of mica or other resiliently deformable material, which is fastened to the electrode assembly. As disclosed in said patent, the mica spacer member is adapted to engage the inner wall of a radio tube in such a way that the strip tends to conform to the curvature of said wall. Thus in the case of tubes having cylindrical domes, the spacer strip or strips tend to assume the shape of a cylindrical sector, with the vertical edge portions of the strip substantially parallel the axis of the tube. In certain instances, the use of spacers such as disclosed in said patent, renders comparatively difficult the assembling of the electrode unit in the bulb, since the vertical lateral edge portions of the spacer strips must conform to the curvature of the tube wall, and the relative movement between the envelope and electrode unit must be parallel to the vertical axis of the tube.

Accordingly, another feature of the present invention relates to a resilient spacer which provides the necessary resilient support to the electrode unit, and one which more readily adapts itself to tube envelopes of different shapes and sizes. In carrying out this feature of the invention, there is preferably employed a spring wire such as phosphor bronze or the like, which is threaded through, or otherwise interlocked with, a special top mica disc, in such a manner that the end or ends of the spring are flexed by engagement with the bulb wall.

Another feature relates to a flexible steadying support for a radio tube mount, in the form of a bifurcated spring wire which in addition to steadying the mount, acts to lock the top mica of the mount in place.

Another feature relates to a flexible steadying support for a radio tube mount in the form of a spring wire carrying an insulator member at its free end to heat insulate the wire at the region of contact with the bulb wall.

Other features and advantages not specifically enumerated will be apparent after a considera-

tion of the following detailed descriptions and the appended claims.

While the invention will be disclosed herein as embodied in certain specific form, and as embodied in an enclosing bulb of one particular type, it will be understood that this is done merely for explanatory purposes and not by way of limitation. Accordingly in the drawings:

Fig. 1 is a vertical elevational view, partly in section, of a typical radio tube embodying features of the invention.

Fig. 2 is a sectional view of Fig. 1 taken along the line 2—2 thereof.

Fig. 3 is a sectional view of Fig. 2 taken along the line 3—3 thereof.

Fig. 4 is a view similar to Fig. 2 illustrating a modification of the invention.

Fig. 5 is a right-hand edge view of the top mica and spring support of Fig. 4.

Fig. 6 is a partial view of a radio tube incorporating another embodiment of the invention.

Fig. 7 is a side elevational view of one of the spring support members of Fig. 6.

Fig. 8 is a front edge view of the spring support member shown in Fig. 6.

Figs. 8*a* and 8*b* are a modification of Fig. 6.

Fig. 9 is another modification of Fig. 6.

Fig. 10 is a sectional view of Fig. 9 taken along the line 10—10 thereof.

Fig. 11 is an enlarged view of one of the spring support members of Fig. 9.

Referring to Fig. 1, there is shown an evacuated enclosing envelope 1 of glass or other material, having a substantially cylindrical dome portion 2 at its upper end. Supported within the envelope by means of wires sealed into the press 3 of reentrant stem 4, is any well known form of electrode assembly. Merely for purposes of illustration, the electrode assembly shown in Fig. 2 comprises a central indirectly heated tubular cathode sleeve 5; a series of surrounding wire grids 6, 7, 8, and a tubular metal plate or anode 9. The usual side-rod supports for grid 6 are designated 10, 11. The side-rod supports for grid 7 are 12, 13; the side-rod supports for grid 8 are 14, 15; and the side-rod supports for plate 9 are 16, 17. In the well known manner, the electrodes may be assembled between upper and lower mica disc 18, 19, which are provided with perforations to receive the cathode and the ends of the various side-rods. For a detailed disclosure of a typical mount of this type, reference may be had to Patent No. 1,950,456.

As is well known in manufacturing tubes such as that disclosed, the electrode assembly is carried by the reentrant stem 4 on which it is assembled as a sepaarte unit and when completely assembled, the stem and electrode assembly are referred to as a mount. This mount is then telescoped within the lower end of the envelope 2, and when it is in its final position, the flexible supports must be such as to extend into flexible engagement with the inner surface of dome 2. During the sealing of the reentrant stem 4 to the envelope 1, the latter is held in a fixed vertical position and the mount is subjected to a pulling operation. Consequently, the flexible supports for the mount must be such as not to interfere unnecessarily with this pulling operation and must not be dislocated during the pulling operation. I have found that by employing a pair of free-ended spring members 20, 21, which are threaded through or interlocked with the mica 18 as shown in Figs. 1, 2 and 3, that the above conditions are met.

As shown in Figs. 1, 2 and 3, the mica disc 18 is provided adjacent each opposite edge with a pair of aligned openings or slits 22, 23, through which is passed a flexible spring wire such as the wire 20 or the wire 21. The median portion of each of these wires is off-set as indicated by the numeral 24 so as to lie against the upper face of disc 18 and the free-ends 25, 26, are bent downwardly at an angle so as to extend beyond disc 18 to engage the wall of the envelope as shown more clearly in Fig. 2. Thus each flexible wire is threaded through the mica disc and is held in place by the shoulders formed by the off-set portion 24 which engage the ends of the slits 22 and 23. The disc 18 may be provided with metal eyelets through which the upper ends of the plate support rods 16 and 17 pass and to which they may be welded or otherwise fastened. If desired, the tips of wires 20, 21, where they engage the dome 2, may be coated with heat insulating material such as glass, mica or the like. If desired, the free-ended wires 20, 21 may be attached to one or more of the electrodes instead of being removably interlocked with the disc 18 as shown. In this arrangement, the upper end of the mount extends into the dome portion 2 and is supported flexibly at four points by the tips of wires 20, 21 which flexibly engage the wall of the dome. The mount therefore is supported flexibly against tilting in all directions, and without interfering with the pull-down operation during sealing-in of the mount to the envelope.

Instead of providing the top mica with slits 22, 23, it may be provided with elongated notches in its opposite edges. Thus, there is shown in Figs. 4 and 5, a modification wherein the top mica 27 is circular in shape and is provided on opposite edges with pairs of slots 28, 29, to receive the metal springs 30, 31, which are similar to springs 20, 21 (Fig. 2). The embodiment of Fig. 4 has the advantage that the springs are more readily assembled and removed from the mica. In other words, in the embodiment of Fig. 2, the springs must be threaded through the slots 22 and 23, whereas in the embodiment of Fig. 4, the springs may be slid into the slots 28, 29, and the engagement of the ends of the springs with the dome 2 prevents the springs from slipping out of place.

Referring to Figs. 6, 7 and 8, there is shown another modification wherein the top mica 32 is assembled over the plate side-rods 33, 34, and the latter may be swaged or provided with lugs 35, 36, to prevent the mica sliding downwardly on the side-rods. The electrode assembly or mount is supported at its upper end within the dome 2 by a pair of bifurcated metal spring members 37, 38, one of which is shown in an enlarged form in Figs. 7 and 8. Preferably, the prongs 39, 40 of each member are slightly curved inwardly at their ends where they engage the dome 2 as indicated by numerals 41, 42. Preferably also, the springs 39, 40, are shouldered at 43, 44, where they abut against the upper face of the mica disc 32. The looped end 45 of each member is fastened to the upper end of the associated support rod 33 or 34, as for example by welding. If desired, the upper ends of each of the support rods may be slightly hooked inwardly as indicated by numerals 46, 47, so that the loops 45 of the spring members may be snapped or sprung thereunder, thus avoiding the necessity of welding at this point. By reason of the shoulders 43, and the fastening of the loops 45 to the side-rods 33, 34, and by reason of the flexing of the prongs 39

and 40 where the latter engage dome 2, the mica 32 is held firmly in place on the side-rods. Thus members 37 and 38 serve the double purpose of acting as flexible supports for the mount and also as fastening means for the top mica, and when the hooked arrangement 46, 47 is employed, they are readily assembled in place and the flexure locks them in place without the necessity of welding.

Figs. 8a and 8b show a modification of Fig. 6 whereby the bifurcated spring members also function to locate the insulator disc or strip on the side-rods thus avoiding the necessity of the eyelets or swagings 36. In this embodiment each spring member is provided with a loop 45a which is welded to the associated side-rod 33, 34, and each spring is provided intermediate its ends with offsets 43a to receive the ends of the disc 32 whereby the said disc is located vertically on the side-rods against upward and downward movement. The ends of each spring are preferably bent as shown, to engage the dome 2. The springs therefore perform the double function of dome pads and as supports for the transverse insulator spacer strip 32.

Instead of having the bifurated arms 39 and 40 engage the edge of the mica disc 32, these arms may pass through the disc. Such an arrangement is illustrated in Figs. 9, 10 and 11, wherein parts corresponding to those of Figs. 1 and 6, bear the same designation numerals. As shown more clearly in Fig. 10, the mica disc 32 is provided at opposite ends with two transverse slots 48, 49, through which the bifurcated metal spring members 50, 51, pass at an angle to the vertical axis of the mount. The looped ends 52 of each of the bifurcated members is hooked over the associated mount support rods 33, 34, to which they may be welded. The ends of the prongs 53, 54, are bent inwardly towards each other as indicated by the numeral 55 (Fig. 11) and a glass tube 56 is fitted over the ends 55. The glass tubes 56 serve to heat insulate the ends 55 from the dome 2 while at the same time enabling the bifurcated spring members to flex, thus providing the necessary flexible support for the upper end of the mount. If desired, the upper ends of the support rods 33, 34, may be hooked inwardly for purposes described above in connection with Fig. 6. Likewise, if desired, the prongs 53 and 54 may be shouldered where they engage the mica 32.

While certain specific embodiments have been disclosed, various changes and modifications may be made therein without departing from the spirit and scope of the invention.

This application is a continuation-in-part of application Serial No. 721,286, filed April 19, 1934 and application Serial No. 129,993, filed March 10, 1937.

What I claim is:

1. In combination, an enclosing envelope having a dome portion at one end, an electrode unit mounted within said envelope, an insulating spacer member extending across one end of said unit, openings in said insulator spacer, a free-ended wire threaded through said openings and having an offset portion intermediate its ends to interlock said wire and said spacer, the free ends of said wire resiliently engaging the wall of the dome to steady the electrode unit within said envelope.

2. An electron discharge device comprising an envelope having a tubular portion, a mount enclosed by said envelope and comprising an electrode assembly positioned to be at least partially within said tubular portion, a mica plate secured to the mount to extend transversely of the tubular portion of the envelope, oppositely disposed apertures in the marginal portions of said mica plate and a metallic spring element threaded thru said apertures so as to lie substantially parallel to the plane of said mica plate and having its ends 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.

3. An electron discharge device provided with an envelope having a tubular portion, a mount comprising an electrode assembly positioned in said envelope and extending within said tubular portion, an insulator spacer disc carried by the upper end of the mount, a pair of metallic springs attached to said disc, each of said springs having an offset portion intermediate its ends whereby it is attached to the disc, so as to be substantially free from heat and electrical conductive connection with the mount, the free ends of each spring being slightly bent to engage said tubular portion of the envelope to firmly and resiliently support the mount in a predetermined position within the extended tubular portion of the envelope.

4. In combination, an enclosing envelope having a dome portion at one end, an electrode unit mounted within said envelope, an insulating spacer member extending across one end of said unit, a pair of flexible wires carried on opposite sides of said disc each of said wires having its free ends extending beyond the disc into engagement with the wall of the dome, each of said wires having an offset portion intermediate its end whereby it is fastened to said disc.

5. In combination, an enclosing envelope, an electrode assembly supported at its lower end from the lower end of said envelope, and means to support the upper end of the assembly adjacent the upper end of the envelope, the last-mentioned means including an insulator member extending transversely across the upper end of the assembly, said insulating member having openings at a margin thereof, and a flexible spring wire passing through said openings and having its median portion disposed opposite one face of said insulator member and its end portions disposed opposite the other face of said insulator member, said end portions extending into flexible engagement with the wall of the envelope to steady the assembly at its upper end.

6. In combination, a radio tube mount having an insulator spacer member extending transversely across the upper end thereof, a spring wire extending across said insulator member with its ends extending beyond the boundary thereof, and means to fasten said spring wire to said insulator member including an offset portion intermediate the ends of the wire.

7. An electron discharge tube, having an enclosing envelope with a tubular portion, a mount enclosed by said envelope and including an electrode assembly positioned to extend into said tubular portion, a spacer member of insulating material secured to the end of the mount to extend transversely of said tubular portion, and metallic spring spacers extending for the greater part of their length substantially parallel to said insulating spacer member each provided intermediate its ends with an offset portion passing through an opening at a margin of said spacer member and having end portions extending be-

yond the edges of said spacer member and engaging the wall of said tubular portion to support the mount resiliently within said tubular portion.

8. A device according to claim 7 in which each of said offset portions in the spring member defines a shoulder engaging the edges of the opening in the spacer member to interlock said spring and spacer member.

9. An electron discharge device, having an enclosing envelope with a tubular portion, a mount enclosed by said envelope and including an electrode assembly positioned to extend into the tubular portion, a mica disc secured to the mount to extend transversely of said tubular portion, openings in the marginal portions of said mica disc, metallic springs positioned within said openings and each having an offset portion intermediate its ends, the offset and the end portions of each spring being disposed on opposite sides of the mica disc to secure said springs to said disc with the ends of the springs extending beyond the edge of the disc to contact the walls of said tubular portion to steady the mount resiliently within said tubular portion.

10. An electron discharge device, having an enclosing envelope with a tubular portion, and comprising an electrode assembly positioned in said envelope and extending within said tubular portion, a plurality of resilient free-ended metal supports connected to the mount and having their ends extending within the tubular portion of the envelope, and insulating means carried by the free-ends of said metallic supports to engage the wall of the tubular portion of the envelope to firmly and resiliently support the mount in a predetermined position within said tubular portion.

11. An electron discharge device, having an enclosing envelope with a tubular portion, a mount enclosed by said envelope and including an electrode assembly positioned to extend into said tubular portion, an insulator disc fastened to and extending transversely across the upper end of said assembly, an opening in said disc adjacent at the end portion thereof, a wire spring extending transversely through said opening, so as to have a portion lying above the disc and a portion lying below the disc, the portion lying above the disc being offset whereby it is fastened to the assembly, and the portion below the disc extending outwardly beyond the disc and resiliently engaging the wall of said tubular portion to steady the mount therein.

12. An electron discharge tube having an enclosing envelope with a dome portion at its upper end, a mount enclosed by said envelope and including an electrode assembly and a mica disc fastened thereto and extending transversely across the upper end thereof, and means to steady the mount at its upper end, the last-mentioned means including a pair of wire springs each having an offset portion fastened to opposite ends of the disc so as to be substantially free from heat conductive connection with the mount and with the spring ends extending beyond the disc into flexible engagement with the dome wall.

13. A spacer member for supporting a vertically disposed radio tube mount within an enclosing envelope, comprising a flexible wire having its middle portion offset separably interlocked with the mount and the tips of the wire portion extending laterally beyond the mount and being bent at the points where they engage the wall of the envelope, said wire being substantially perpendicular throughout its length to the vertical axis of the mount.

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