

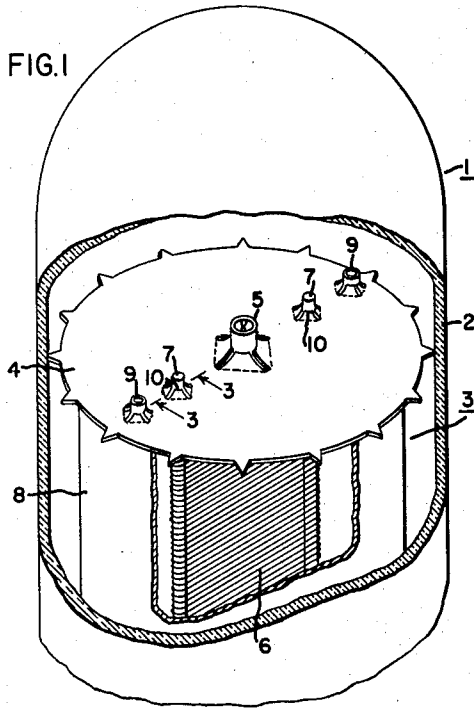
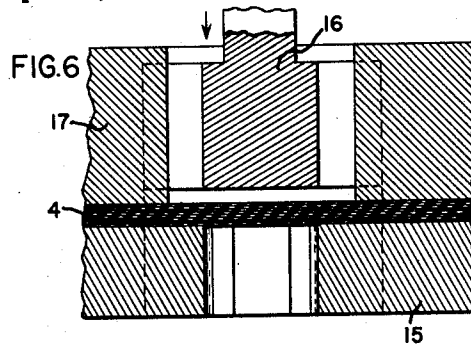
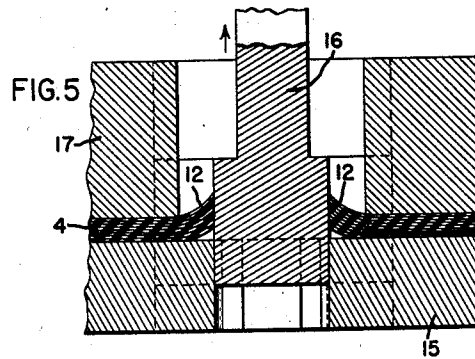
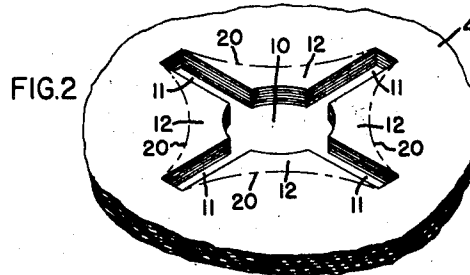
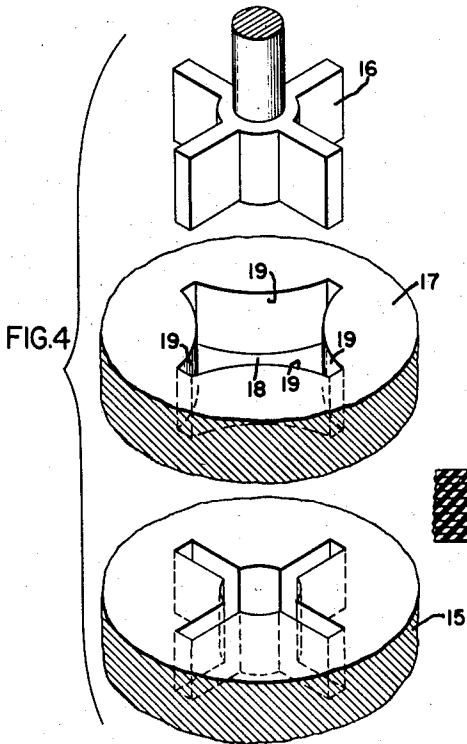
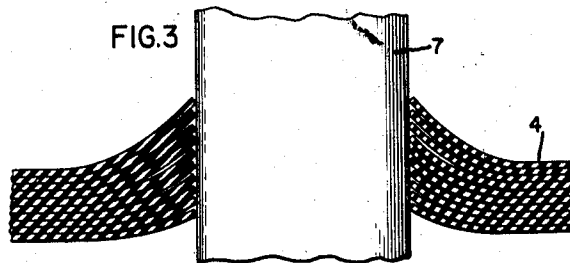
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2,837,682

ELECTRIC DISCHARGE DEVICE STRUCTURE

Filed Sept. 15, 1955



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2,837,682

ELECTRIC DISCHARGE DEVICE STRUCTURE

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4 Claims. (Cl. 313—260)

My invention relates to electric discharge devices and pertains more particularly to a new and improved electric discharge device structure for supporting elements therein.

Many electric discharge devices, such as those of the receiving tube types, comprise evacuated or gas-filled envelopes containing mount structures or electrode support assemblies comprising a plurality of cooperating electrode elements and one or more spaced insulative members or supports between which the electrode elements are secured and supported in insulated spaced relation by having end portions thereof inserted in suitable apertures in the supports.

Generally, it is desirable that the end portions of the electrode elements fit tightly in the apertures in the supports in order to minimize tube noise and microphonics under tube operating conditions. In order to accomplish this, it has heretofore been a practice to form the apertures the same size as or slightly smaller than the cross-sectional areas of the elements fitted therein and thus obtain something of a press fit. It has been found, however, that when the insulative members or supports are formed of mica or similar laminated material the practice of forming the apertures smaller than the elements often results in crushing or flaking of the edge portions of the support defining the apertures during insertion of the elements or subsequently as a result of vibration or thermal expansion and contraction of the electrode elements. The broken or flaked edges, in addition to introducing undesirable loose particles in the tubes, cause loose fits and consequential tube noise and microphonics.

To offset the conditions resulting from loose fits it has been proposed to form the apertures with a blunt instrument and thereby provide burred or delaminated edge portions which will yield to the electrode elements when inserted in the apertures and which will fit snugly about the elements to provide a tight fit.

However, when the apertures are formed by a blunt instrument the edge portions of many of the individual laminae constituting the material of the support are wholly or partially fractured during the forming operation. These portions tend to flake off during insertion of the electrode elements or subsequently during tube operation and thereby subtract from the tightness of the fit and introduce loose particles into the tube structure.

Additionally, even laminae which are not fractured or weakened substantially during the forming operation have a tendency to fracture or flake off upon insertion of the tube elements or as a result of subsequent vibration and thermal expansion movements of the elements.

Still further, the burred or delaminated edge portions of apertures formed by blunt punching are not rendered uniformly yieldable and do not define uniform, accurate apertures, with the result that uniform tight fits in different tubes, and indeed, in different elements in the same tube are generally not insured.

Accordingly, a primary object of my invention is to

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provide a new and improved electric discharge device structure including means for minimizing tube noise and microphonics in operation.

Another object of my invention is to provide new and improved electrode support means adapted for substantially uniformly reducing tube noise and microphonics in different tube structures.

Another object of my invention is to provide a new and improved electrode element support structure including means for insuring a tight fit of elements therein.

Another object of my invention is to provide, in an electric discharge device, an electrode support structure adapted for retaining the electrode elements therein without subjecting the device to the presence of undesirable loose particles.

Another object of my invention is to provide a new and improved means for securing elements in a laminated support therefor.

Another object of my invention is to provide a support member adapted for receiving an element to be supported and formed to include a plurality of discrete substantially elongated delaminated portions adapted for engaging the element thereby to effect a tight fit of the element in the support member.

Another object of my invention is to provide a simple, inexpensively produced laminated electrode element support which is adapted for facilitating assembly of tube mount structures.

Further objects and advantages will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention, I provide an electric discharge device structure including a support member formed of a single sheet of laminated material such as mica. The structure is apertured for receiving an element to be supported thereby. The aperture is shaped to define a plurality of discrete substantially elongated portions, the inner ends of which are free, define an area less than the cross-sectional area of the element to be supported, and are adapted for engaging the element in the aperture. The elongated portions are delaminated to separate the individual laminae thereof. Thus, when the element is inserted in the aperture the individual laminae readily yield and engage the element in a resilient flexed manner. In securing the element in the support member and after having formed the aperture in the described manner I delaminate the elongated portions of the support by backing up the support adjacent these portions and applying a force to the edges thereof toward the side from which the support is backed up.

For a better understanding of my invention reference may be had to the accompanying drawing in which:

Fig. 1 is an enlarged fragmentary perspective view illustrating a preferred embodiment of my invention;

Fig. 2 is an enlarged fragmentary perspective view of a portion of the support member including an aperture formed in accordance with one aspect of my invention;

Fig. 3 is an enlarged fragmentary sectional view taken along the line 3—3 in Fig. 1;

Fig. 4 is an enlarged exploded fragmentary perspective view of equipment adapted for forming the support apertures in accordance with my invention;

Fig. 5 is an enlarged fragmentary sectional view illustrating the equipment of Fig. 4 in one operational position; and

Fig. 6 is an enlarged fragmentary sectional view of the punching equipment in another operational position thereof.

Referring to Fig. 1 there is shown an electric discharge

device or electronic tube of the receiving tube type generally designated 1. From the outset, it is to be understood that my invention is not limited in application to the particular form of tube construction illustrated but is equally applicable to the many different and well-known types of devices wherein laminated members are employed for supporting elements and tight fits of the elements in the supports are desired.

The device 1 includes an envelope 2 containing a mount structure generally designated 3. The mount structure 3 comprises a pair of spaced insulative supports or support members 4, only one of which is shown. The supports 4 as seen in Figs. 2 and 3, are formed of single sheets of laminated insulative material such as mica. The supports 4 are adapted for supporting a plurality of cooperating electrode elements in insulated spaced relation by having end portions of the elements extending through apertures in the members 4. By way of example, the electrode elements may comprise a cathode 5, a grid 6 comprising a spirally wound wire on a spaced pair of support rods 7 and an anode or plate 8, including integrally formed or suitably attached end portions 9.

In order to simplify description of my invention, I shall hereinafter limit such description to the means and method I have provided for securing one of the grid support rods 7 in the upper one of the laminated insulative supports 4. However, it will be clear from Fig. 1 and the following description that all of the other electrode elements illustrated are adapted for being securely fitted in one or both of the support members 4 in a manner identical to that which will be described. Additionally, it will be seen that when one or more of the electrode elements is fitted in the support members in accordance with my invention a low noise and low microphonics electric discharge device will result.

As seen in Figs. 2 and 3, the portion of the laminated support member 4 adapted for receiving the end of the grid support rod 7 is formed to include an aperture 10 of a particular configuration. The aperture 10 comprises a circular central portion and a plurality of criss-crossing or radially extending slot-like portions 11. Described in another manner, the member 4 includes a circular central aperture 10 and is slotted radially from the edge of the aperture 10 as at 11. Regardless of the terms of description, it will be seen that the aperture in the member 4 is shaped to define a plurality of discrete or separate free-end portions or tabs 12 which are substantially elongated and extend centrally. Additionally, the central portion of the aperture 10 or the area defined by the innermost edges of the tabs 12 is smaller than the cross-sectional area of the rod 7 so that when the rod 7 is inserted in the aperture the tabs will flex and thereafter engage the rod resiliently for holding it tightly in the support member 4.

Now, it is well-recognized in the art that mica and similar laminated materials customarily used for constructing the members 4 are generally brittle and inclined to fracture or flake upon application of a bending moment to edge portions thereof, which is what occurs when the rod to be supported is inserted in the smaller aperture in the support member. In order to minimize this tendency toward fracture and flaking and to insure flexing of the tabs 12 and a substantially tight circumferentially uniform fit of the rod 7 in the support member 4, I have, as mentioned above, formed the tabs 12 so as to be substantially elongated. Additionally, I have delaminated or separated the individual laminae constituting the tab portions 12. Thus, the individual laminae, because of their relative thinness and substantial free length, are adapted for bending or flexing without fracturing upon insertion of the rod 7 in the aperture. Additionally, the flexed laminae resiliently engage the rod and thus secure the rod snugly or tightly in the support member. None or a minimum of laminae-fracture is encountered and thus, the gripping effect of the tabs 12 is substantially

uniform about the circumference of the rod which enhances the tightness of the fit. Still further, the flexibility of the individual laminae enables them to maintain a tight fit regardless of movements of the elements in the support member, as might be caused by vibration or thermal expansion and contraction. That is, inasmuch as the laminae are already bent after the rod 7 is inserted therein, any movement of the rod 7 will merely cause the laminae to bend farther rather than crush at the edges. In Fig. 3 the tab proportions and, specifically, the lengths of the individual laminae constituting the tabs, are greatly exaggerated for purposes of illustration. Actually, the individual laminae of each tab are of the same length. The same is true of the laminae constituting the tabs illustrated in Fig. 5 which pertains to the punching step to be described in detail hereinafter.

It will be seen that while I have limited my description to the support of the grid rod 7 in the member 4 and show the central portion of the aperture 12 as substantially circular for receiving a member of circular cross-section, my invention is adapted for supporting elements other than grid rods and of cross-sectional configurations other than circular. For example, if the members to be supported are rectangular or elliptical in cross section, the central portion of the aperture in the mica may be suitably similarly shaped to accommodate reception of such a member to be supported.

In order to delaminate or separate the individual laminae of the tabs 12 for the purpose described above, I have provided a punching means and method illustrated in Figs. 4-6. As seen therein, I have provided female and male punch members 15 and 16, respectively, shaped for forming the aperture illustrated in Fig. 2.

The cutting edges of the members 15 and 16 are relatively sharp and adapted for making a clean cut of the aperture 10. Additionally, the cooperating vertical surfaces of the members 15 and 16 are straight sided such that after the aperture is cut the edges of the tab portions 12 formed thereby substantially engage or bear against the vertical surfaces of the cutting or punching member 16. Thus, when the member 16 is withdrawn from the member 15 after having punched an aperture 10 the withdrawing action causes the tab 12 to be delaminated, or in other words the laminae constituting the tabs are separated in the manner illustrated in Fig. 5.

To facilitate this delamination of the tabs 12, I have provided a back-up member 17 adapted for cooperating with the punch members 15 and 16. The back-up member 17 is formed with a substantially straight-sided aperture 18 shaped for receiving and permitting the operating movement of the male punch member 16 therein when the member 17 is disposed atop the female punch member 15 with a laminated support member 4 positioned therebetween for punching in the manner illustrated in Fig. 6. Additionally, the aperture 18 is formed to include four arcuate surfaces 19 the edges of which are adapted for backing up the support member 4 along the arcuate dot and dash lines designated 20 in Fig. 2. Thus, the support member 4 is held in place as the male member 16 descends in the manner shown in Fig. 6 for punching the aperture 10. Additionally, and as seen in Fig. 5 the back-up member 17 holds the support member 4 against the member 15 while the male punch member 16 is withdrawn therefrom. Additionally, the referred-to arcuate surfaces 19 disposed along the dot and dash lines 20 of Fig. 2 back up the support member 4 adjacent the tabs 12 to facilitate delamination of the tabs 20 without effecting the undesired delamination of any portion of the remainder of the support member 4.

It will be seen that while I have shown a member 17 with a particularly shaped aperture 18 for backing up a member 4 to effect delamination of the tabs 12, if for any reason it should be desired that the tabs 12 be shaped differently from that shown in Fig. 2, the member 17 could be formed accordingly and for facilitating the de-

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lamination of the tab portions by backing up the support member 4 suitably adjacent the tabs.

Thus, it will be seen that I have provided a new and improved electric discharge device structure adapted for reduced tube noise and microphonics and that my invention involves a new and improved support arrangement.

While I have shown and described specific embodiments of my invention I do not desire my invention to be limited to the particular form shown and described and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. An electric discharge device comprising, an envelope, a plurality of cooperating electrode elements and at least one apertured member having portions of said elements fitted therein and supporting said elements in said envelope, said member being formed of a single sheet of laminated insulative material and including a plurality of discrete delaminated centrally extending elongated portions being flexed and resiliently engaging said portions of said elements for providing a tight fit of said elements in said member.

2. The combination of a support member formed of a single sheet of laminated material, said member including an aperture formed to define a plurality of elongated centrally extending portions, said portions being delaminated, and an element inserted in said aperture, said

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element being greater in dimension than the dimension between the ends of said portions whereby the laminae constituting said portions are flexed and resiliently engage and retain said element tightly supported in said member.

3. A support member comprising, a sheet of laminated material apertured for receiving an element to be supported thereby, said member including a plurality of discrete substantially elongated portions adapted for engaging said element, and said portions being delaminated.

4. The combination of a support member and an element supported thereby comprising, a single sheet of mica, said member including an aperture adapted for receiving said element, said aperture being smaller in dimension than said element, said sheet being slotted radially from said aperture thereby to provide a plurality of centrally extending portions, said portions being delaminated to insure flexing thereof and contact of substantially all of the laminae comprising said portions with said element upon insertion of said element in said aperture thereby to avoid breakage of said material and provide a tight fit of said element in said member.

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