March 15, 1949. N. B. KRIM 2,464,241

SPACER FOR ELECTRON DISCHARGE TUBES

Filed May 10, 1945

Fig. 1.

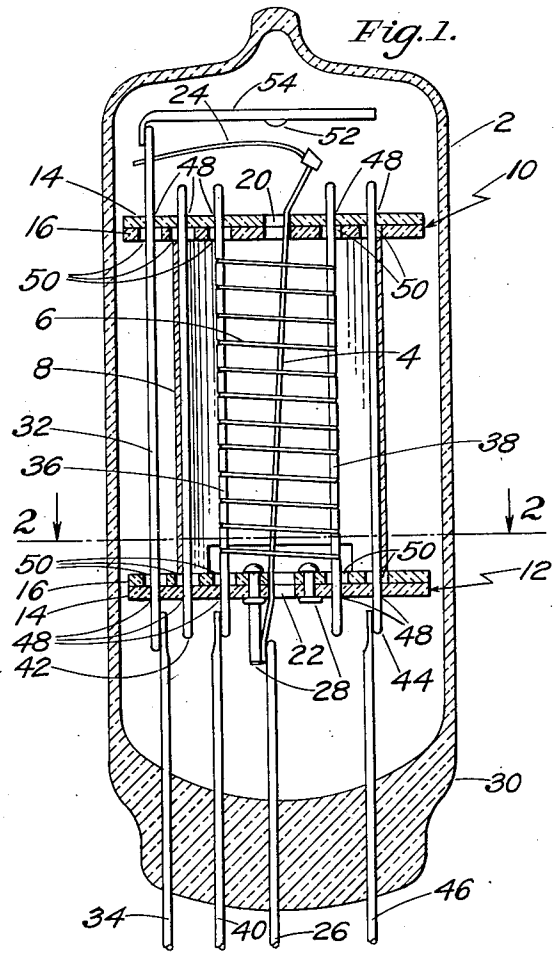
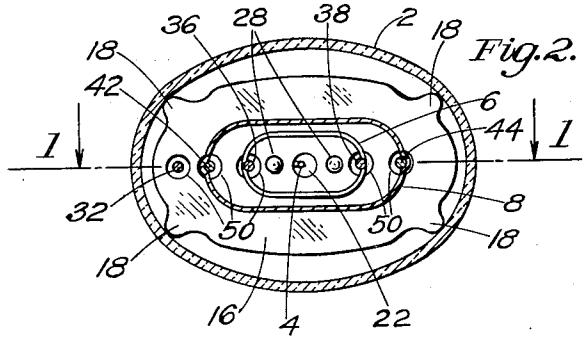


Fig. 2.



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SPACER FOR ELECTRON-DISCHARGE TUBES

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This invention relates to electron-discharge tubes, and more particularly to the means by which the elements of the electrode assembly are maintained in proper position within the tube.

Such means for maintaining the electrodes of the electrode assembly in proper position usually comprises one or more spacing members of insulating material, preferably of mica, provided with perforations through which said elements extend. As herein used, the term—"elements"—is to be understood as including not only electrodes, but also any posts, rods, or the like supporting said electrodes.

It is necessary that said elements have a tight fit in the perforations through which they extend in order to preclude, as much as possible, any displacement or vibration of said elements in said perforations, as any such displacement or vibrations when the tube is in use will have a disturbing influence that might seriously detract from the satisfactory performance of the tube.

In certain tubes, particularly in those of smaller size, such as those used in pocket radios, hearing aid devices and the like, said elements are so small in transverse diameter, and therefore call for such small perforations in said spacing members, that the insertion of said elements in said perforations not infrequently requires the use of a magnifying glass by the operator. The operation really requires an expert operator, and even then the operation is slow and laborious.

It is one of the objects of the present invention to provide means whereby the insertion of said elements in the perforations provided therefor in said spacing members is greatly expedited and facilitated and can be satisfactorily performed by any operator of ordinary ability.

This and such other aims and objects of the present invention as may hereinafter appear will be best understood from the following description read in connection with the accompanying drawing of a tube incorporating one illustrative embodiment of said invention.

In the drawing:

Fig. 1 is a longitudinal section on line 1—1 of Fig. 2, on a materially enlarged scale, of a tube incorporating one illustrative embodiment of the present invention; and

Fig. 2 is a horizontal cross-section on line 2—2 of Fig. 1 showing a top plan view of the lower spacing member and related parts.

In order to simplify the drawing, the tube selected to illustrate the present invention consists of a triode, comprising an hermetically sealed envelope 2 of glass or other suitable material, containing a filament cathode 4, a grid 6 surrounding said filament, and an anode or plate 8 of generally ellipsoidal shape in cross-section surrounding said grid. Insulating spacing members 10 and 12 for the elements of the electrode

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assembly are provided, said spacing members each comprising two or more superposed insulating plates, preferably of mica. The mica plates being quite thin, they not infrequently split along a line joining the perforations for the elements to be inserted therein. The use of two or more superposed plates strengthens said spacing members sufficiently to avoid such breakage. Increasing the thickness of said spacing members by using two or more superposed insulating plates also has the advantage of increasing the leakage paths.

For the sake of simplicity each spacing member in the illustrative embodiment of the invention shown comprises only two such insulating plates 14 and 16. These are preferably provided at their edges with a plurality of suitably spaced toothlike projections 18 (see Fig. 2) which engage the inner wall of said envelope 2 and brace said spacing members laterally.

The filament cathode 4 extends through coaxial apertures 20 and 22 provided centrally of said two spacing members 10 and 12, respectively. At one end said filament cathode 4 is welded to one end of a resilient electrically conductive member 24, and at its other end to a stiff lead-in conductor 26 and to one of several rivets 28 which serve to clamp together the two insulating plates 14 and 16 of the lower spacing member 12, viewing Fig. 1, only two of said rivets being shown, said lead-in conductor 26 being sealed through a press 30 formed at the base of said envelope 2. Similar rivets, not shown, may be provided for clamping together the plates 14 and 16 of the upper spacing member 10, viewing Fig. 1. At its other end said resilient member 24 is welded to one end of a conductor 32, extending through suitable perforations (hereinafter more fully described) in said spacing members 10 and 12. The other end of said conductor 32 is welded to a lead-in conductor 34, sealed through said press 30. Said resilient member 24 keeps the filament cathode under tension and in contact with the edge of the aperture 20 in the spacing member 10, the lower portion of said cathode being held in contact with the edge of the aperture 22 in the spacing member 12 owing to the fact that the rivet 28 to which it is welded is offset from said aperture 22. Objectionable vibration of said cathode filament is thus prevented.

The grid 6 is mounted upon electrically conductive posts 36 and 38 which extend through suitable perforations (hereinafter more fully described) in said spacing members 10 and 12, one of said posts, the post 36, for example, being welded to a lead-in conductor 40 sealed through said press 30 and supporting said grid. The anode or plate 8 is supported by two electrically conductive posts 42 and 44 extending longitudinally of said plate and welded to its inner surface

in longitudinal channels formed in the walls of said plate, one at each end of its major axis, said posts extending through suitable perforation (hereinafter more fully described) provided in said two spacing members 10 and 12, one of said posts, the post 44, for example, having its lower end welded to a lead-in conductor 46 sealed through said press 30 the upper spacing member 10 resting upon the upper edge of said plate 8.

In assembling the electrode assembly, the upper spacing member 10 is slipped down over the upper ends of the elements that are to be spaced thereby, the upper ends of said elements, in the present case, the grid supporting posts 36 and 38, the anode plate supporting posts 42 and 44, and the conductor 32, being threaded through the perforations provided in said spacing member 10 to receive them. In like manner the lower spacing member 12 is slipped up over the lower ends of said elements, the latter being similarly threaded through the perforations provided to receive them in said lower spacing member 12 in alignment with the corresponding perforations in said upper spacing member 10.

As stated in the beginning of this specification, one of the objects of the present invention is to provide means whereby the heretofore slow and laborious operation of threading said elements through the perforations provided for that purpose in said spacing members may be facilitated and expedited. In the present illustrative embodiment of the invention, this is accomplished by making the opening through which the element is inserted in the spacing member sufficiently large to enable the operator quickly and readily to locate the perforation with the end of said element and insert said element therein. Beyond said larger entrance opening to said perforation the latter is narrowed sufficiently to cause it closely to embrace the element threaded therethrough and cause it to fit tightly therein and thus firmly to hold it against displacement and vibration.

As shown in the drawing, this result is conveniently obtained by providing the plates 14 of the two spacing members with perforations 48 sufficiently restricted closely to fit the elements inserted therein and hold them securely against displacement and vibration, and making the perforations 50 in the plates 16 sufficiently large to enable them to be readily and quickly located by the operator with the point of the element to be inserted therein, whereupon it is only necessary to press the element into the opening when it will be guided automatically into and through the close fitting perforations 48 in the other plate 14.

If more than two superposed insulating plates are used to constitute a spacing member, the perforation in the third plate directly superposed upon the second one will exceed the size of the perforation in said second plate by a predetermined, suitable amount, and so on, the size of the perforation in each plate exceeding the size of the perforation in the plate upon which it is directly superposed by a predetermined suitable amount.

If desired the ends of the elements, such as the grid supporting posts 36 and 38, the plate supporting posts 42 and 44 and the conductor 32, may be rounded off by any convenient, conventional process. This not only facilitates the insertion of said elements through said perforations 48 and 50 but also removes the objectionable burr from the ends of said elements.

Owing to the fact that for the sake of clearness the tube is shown upon a greatly enlarged scale in the drawing, the angular contour of the inner surface of the perforation 50 in the plate 16 is greatly exaggerated. In actual practice the insulating plates 14 and 16 are extremely thin, they being no thicker than the transverse diameter of the tightly fitting perforations 48 of the plate 14, so that once inserted in the larger perforation of plate 16, the point of the element glides smoothly into the smaller perforation of plate 14.

A getter 52 of any suitable conventional construction is shown conveniently mounted upon a conductor 54 welded to the upper end of conductor 32.

I am aware that the present invention can be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present description to be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the aforesaid description to indicate the scope of the invention.

What is claimed is:

1. A spacing member for electrode elements of electron-discharge tubes, said spacing member comprising two superposed insulating plates each provided with suitably spaced perforations through which to insert electrode elements, corresponding perforations of the two plates being coaxially disposed when said two plates are superposed, the size of the perforations in one of said plates exceeding the size of the corresponding perforations in the other of said two plates.

2. A spacing member for electrode elements of electron-discharge tubes, said spacing member comprising a first insulating plate and an additional insulating plate superposed upon said first insulating plate, each of said plates being provided with suitably spaced perforations through which to insert electrode elements, the corresponding perforations of said plates being coaxially disposed when said plates are superposed, the perforations of said first insulating plate being of a transverse diameter firmly to clamp an electrode element inserted therein and prevent said element from vibrating, the transverse diameter of the perforations in the plate superposed upon said first plate exceeding by a predetermined amount the transverse diameter of the electrode element to be inserted therethrough and the transverse diameter of the corresponding perforation of the plate upon which it is directly superposed.

3. A spacing member for electrode elements of electron-discharge tubes comprising a pair of superposed, thin mica plates, said plates having coaxially disposed perforations of different sizes.

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