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ELECTRODE STRUCTURE FOR ELECTRON

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FIG. 2

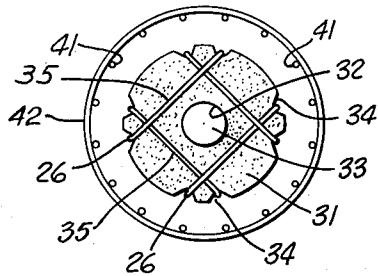


FIG. 3

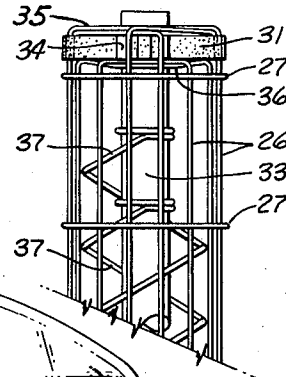
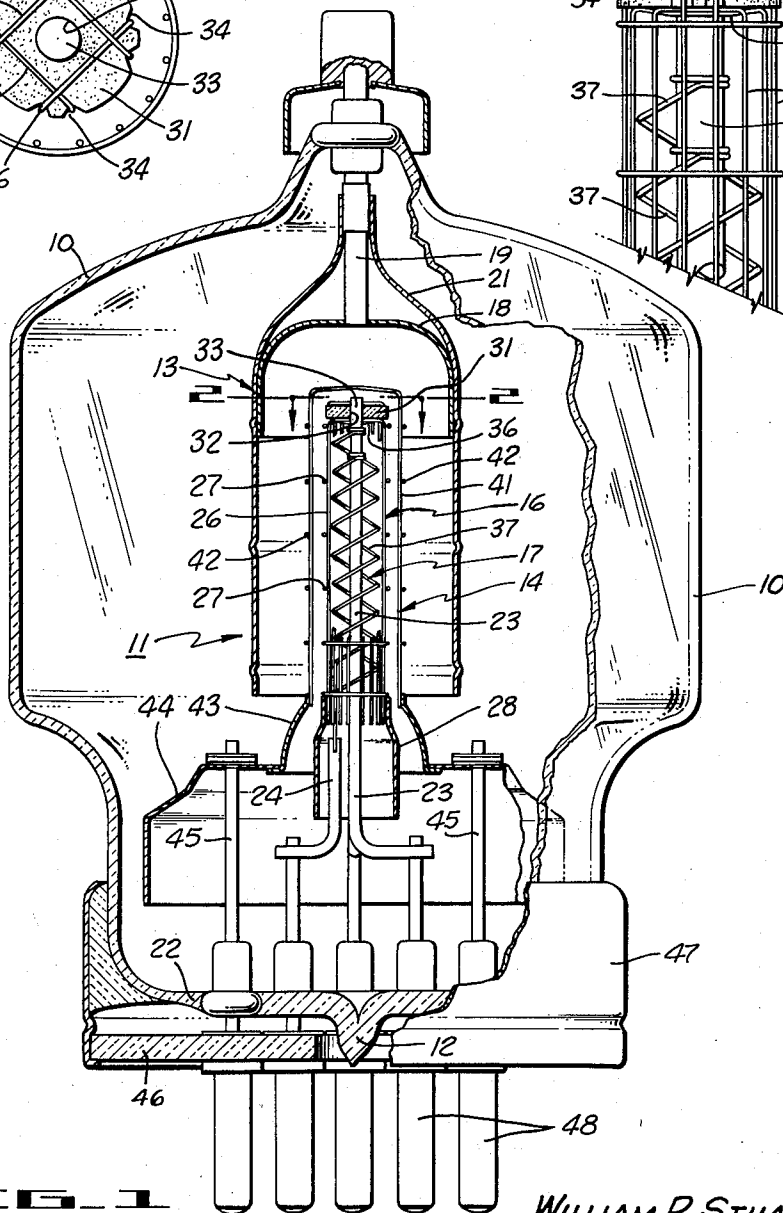


FIG. 1

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1

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ELECTRODE STRUCTURE FOR ELECTRON

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4 Claims. (Cl. 313-257)

This invention relates generally to electron tubes.

Prior art electron tubes have been subject to the disadvantages that shock and vibration causes movement of the grid elements and cathode. This often results in shorting between the control grid and the cathode and between grid elements. Undesired changes in tube characteristics also result.

It is a general object of the present invention to provide an improved electron tube structure.

It is another object of the present invention to provide means for preventing movement of elements of an electron tube.

It is another object of the present invention to provide means for preventing relative movement between the grid and cathode elements.

It is a further object of this invention to provide an improved electron tube in which the grid and filament are held coaxial by means of an insulating disk.

It is a further object of the present invention to provide an electron tube having a control grid which serves to support an insulating spacer which accommodates the cathode post to prevent relative movement between the cathode and grid.

It is another object of the invention to provide an improved electrode structure of the type formed from a plurality of wire bars wherein said wire bars serve to clamp into the electrode structure an insulating spacer member.

The invention possesses other objects and features of advantage, some of which with the foregoing will be set forth in the following description of the invention. It is to be understood that the invention is not to be limited to the particular disclosure of a species as other embodiments may be adopted within the spirit of the invention and the scope of the claims.

Referring to the drawings:

Figure 1 is an elevational view partly in section of an electron tube embodying my invention;

Figure 2 is an enlarged sectional view taken along the line 2-2 of Figure 1; and

Figure 3 is an enlarged elevational view showing the control grid structure and insulating disk.

Referring to the drawings, the tube comprises an envelope 10 of glass or other suitable material with exhaust tubulation 12 arranged at the center of the lower portion thereof.

The multi-grid tube illustrated is a tetrode having four electrodes indicated generally at 11, including an anode 13, screen grid 14, control grid 16 and cathode 17. The electrodes are concentric about the axis of the tube.

The anode 13 is tubular in form, preferably cylindrical. It is open at the bottom and preferably closed at the top by means of a cap 18 suitably attached thereto. The cap serves to protect the upper end of the envelope against bombardment and also functions as part of the mounting for the anode. The anode is mounted on a lead-in conductor 19 which is sealed to and supported

2

by the upper portion of the envelope. The conductor projects into the envelope along the axis of the electrode terminating on the cap 18. A bracket 21 is formed in the upper portion of the anode and converges onto the conductor 19.

The remaining electrodes are all supported by leads which project upwardly through the lower portion 22 of the envelope. The cathode 17 may be any suitable type of construction, but preferably comprises a helical filament of thoriated tungsten wire secured at the top to the cathode post 23 and at the bottom to the bracket 24. The bracket and post are attached to a pair of the leads which extend through the lower portion of the envelope.

The control grid 16 is preferably of cage-type construction comprising longitudinal or vertical wire bars 26 reinforced by horizontal wire rings 27. The longitudinal grid elements terminate in a cup-shaped base ring 28 to which they are attached as by spot welding. The grid projects into the anode along the cathode and is supported by the control grid leads which extend through the lower envelope portion 22.

Wound into the top of the longitudinal control grid wires 26 is an insulating spacer disk 31 having a hole 32 which accommodates with a close fit the upper portion 33 of the central cathode post 23. The preferred material for disk 31 is ceramic because of its mechanical strength and ability to withstand high temperature. As shown in Figures 2 and 3, eight of the longitudinal wires 26 are accommodated in notches 34 and form four transverse portions 35 which extend chordally across the top of the disk. The disk is held between these upper transverse portions 35 and the lower transverse portions 36. Thus, when the tube is subjected to vibration or shock, the cathode is held coaxial to the control grid, and filament wires 37 are maintained in their spaced position with respect to the grid structure 16.

A convenient method for forming the grid with the insulating spacer disk is to wind on a rod-like mandrel the first set of longitudinal bars 26; that is, the eight bars having the four transverse connecting portions 36. The disk 31 is then placed against the transverse portions 36 which it will be understood pass over one end of the mandrel. Finally the next eight grid bars are wound on the mandrel with their transverse portions 35 passing tightly over the disk 31, so that the disk is firmly clamped between the transverse portions of the two sets of grid bars. A sixteen bar grid has been disclosed as being desirable but a different number of bars can of course be used.

The screen grid 14 is also of cage-type construction comprising longitudinal bars 41 reinforced by transverse rings 42. The grid elements terminate in a cup-shaped base ring 43. The base ring 43 is mounted on a metallic shield 44 which is suitably secured to leads 45.

The shield 44 extends transversely of the electrodes and is substantially coextensively with the cross sectional area of the envelope. It is preferably cup-shaped and has its peripheral edges close to the inner surface of the envelope. This arrangement shields the conductors in the lower part of the tube from the anode.

The base of the tube preferably comprises a metallic ring 47 suitably secured to the envelope, as, for example, by cementing, and which carries an insulating disk 46 to which the prongs 48 are attached. These prongs are coaxially aligned with the leads extending into the envelope and are hollow to receive the lead extensions.

As described, the insulating disk is interwound in the top of the control grid and disposed to register with the upper portion of the cathode post. However, a disk of the character described may be interwound into any

3

one of the other elements and suitably engaged with the post or another element of the tube to prevent movement of the associated parts. Accordingly, one of the main features of the invention relates to the arrangement whereby an insulating spacer disk 31 is wound into a cage-type electrode. In this manner the insulator is firmly associated with the electrode so that when the insulator is placed in contact with another element of the tube, for example, the cathode rod in the embodiment disclosed in Figure 1, then the electrode is held rigidly spaced from such other tube element. A desirable feature of the disclosed method of supporting the insulating disk is that the electrode is wound directly around the disk, thus avoiding any extra procedure for attaching the disk to the electrode, such as by brazing.

An electron tube was constructed with an insulating disk which held the cathode and control grid elements coaxial. The tube was subjected to approximately 60 G's of acceleration and operated satisfactorily. Similar tubes, without spacing disks shorted out and became inoperative in the neighborhood of 27 G's of acceleration.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An electron tube grid comprising a plurality of U-shaped wire bars having the legs thereof extending longitudinally of the grid to define circumferentially spaced elements of a cylinder, a supporting base to which said wires are secured at one end of the cylinder, and at the other end of the cylinder an insulating member having opposite faces thereof extending transversely of the cylinder, the base of certain of said wire bars extending across and engaging one face of said member, and the base of others of said wire bars extending across and engaging the other face of said member, whereby said

4

member is gripped between said wire bars to form with the latter a rigid structure.

2. A grid as claimed in claim 1, in which said insulating member is peripherally grooved to receive certain of said wire bars to prevent circumferential displacement thereof.

3. An electron tube having a plurality of electrodes including a grid, said grid comprising a plurality of U-shaped wire bars having the legs thereof extending longitudinally of the grid to define circumferentially spaced elements of a cylinder, a supporting base to which said wires are secured at one end of the cylinder, and at the other end of the cylinder an insulating disk extending transversely of the cylinder, the bases of certain of said wire bars extending across and engaging one face of said disk, and the bases of others of said wire bars extending across and engaging the other face of said disk, whereby said disk is gripped between said wire bars to form with the latter a rigid structure, and a second electrode having a support engaging said disk to prevent relative lateral displacement thereof.

4. An electron tube as claimed in claim 3, in which said second electrode is a cathode, and said support is a rod extending longitudinally of said grid structure, said disk being apertured to receive said rod.

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