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INSULATING MEANS FOR METALLIC SPACERS IN ELECTRON DISCHARGE DEVICES

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Fig. 1.

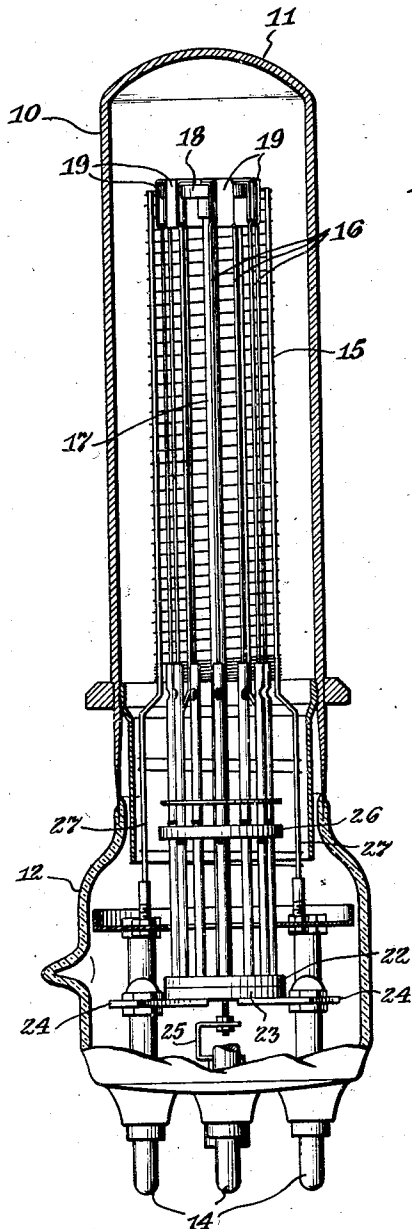


Fig. 2.

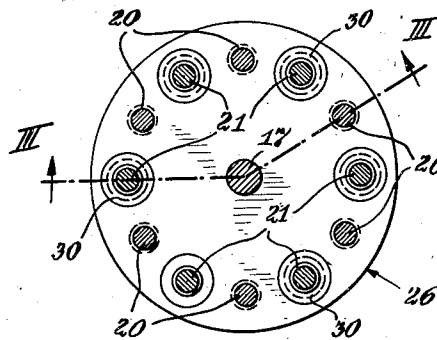


Fig. 3.

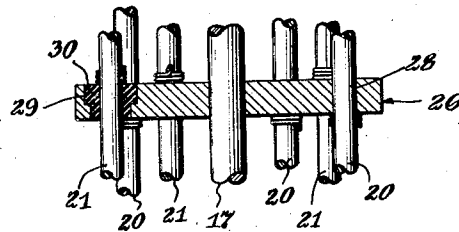
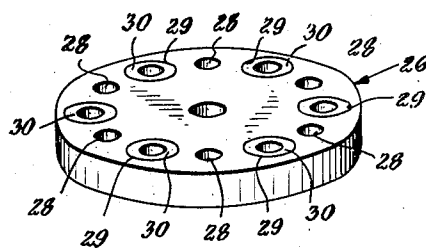


Fig. 4.



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INSULATING MEANS FOR METALLIC
SPACERS IN ELECTRON DISCHARGE
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4 Claims. (Cl. 250—27.5)

1

One construction of high power vacuum tube, having the usual triode elements of cathode, anode and grid, has included lava or other insulators for spacing the several legs or strands of the filamentary cathode. It is one of the requirements of a high power tube of this type that the spacing of the grid from the cathode is relatively small so that the tube may have the desired electrical characteristics. In consequence of the construction, spacing and use, there is a very intense and concentrated high voltage high frequency field between the filament and grid. Inasmuch as the forces producing gas effects in a tube are roughly proportional to the power involved and gassing is instigated more readily in an electrostatic R. F. field, the power tubes under consideration have shown tendency to evolve gas from the insulating spacers. The gassing effect is cumulative and although the first gassing may be small and apparently unimportant, the small amount evolved makes the tube even more susceptible to the effects of the electro-static field with the result that the tube becomes more gassy and the conductive path between filament and grid becomes more pronounced. The arc striking across the electrodes along the conductive path has been so severe that the insulators have frequently punctured and fused. As a result of these circumstances, the power and life of the tubes have been limited.

In its most general aspect, the present invention seeks to overcome the difficulties and deficiencies of the prior art.

The invention aims to suppress the effects of the high voltage high frequency field on the insulator for the filament support wires.

In conjunction with suppression of the effects of the field, the invention has as an object to maintain the symmetrical grouping of the several legs of the filament and the close spacing of the grid and filament heretofore practiced.

Still further objects of the invention will appear to those skilled in the art as the description progresses, both by direct reference thereto and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is an elevational section of an electron discharge device embodying the present invention;

Figure 2 is a plan of the spacer member with the filament wires and supporting rod in cross-section;

2

Figure 3 is a sectional view on line III—III of Fig. 2; and

Figure 4 is a perspective view of the spacer member.

In the specific embodiment of the invention illustrated in said drawing, the general organization of the electron discharge device provides a vacuum tight container formed by an outer metal tube 10 which acts as the anode and which is closed at the upper end by a metal piece 11 integral with the tube. The lower end of the tube is closed by means of a glass bowl or base 12 which is sealed to it in suitable manner as by a feather-edge joint. From the bottom of the bowl, at the exterior thereof, project the usual prongs 14 for making connection with the internal electrodes.

Coaxially within the anode is a grid 15, and inside the grid is a cathode 16 formed as a plurality of hair-pin sections each with parallel wires or legs and all said legs symmetrically disposed in cylindrical arrangement in relatively close proximity to the grid. On the axis of the coaxial electrodes is a metallic post 17 which constitutes a center support for the upper end of the cathode, and for that purpose has a quartz or other insulating cap 18 at its upper end from which all of the filament legs are hung at their ends, as by hangers 19 carried by said cap. The filament sections each have one leg secured at its lower end to a post 20 and the other end secured to a similar post 21, the several posts extending downwardly into the bowl 12. All posts 20 constituting one set are secured in a transverse metallic plate 22 forming a common electrical connection thereto and the other posts 21 constituting the other set pass with clearance through plate 22 and through a ceramic plate 23 therebelow and secured in brackets 24 which support the ceramic and metal plate thereabove. These brackets are carried by inwardly projecting parts of a plurality of the aforementioned prongs and thereby having electrical connection to the exterior. Said metallic plate has connection 25 to another one of said prongs. Of course one set of posts will be at a considerably higher potential than the other set for obtaining current flow in the several filament sections.

Intermediate the ends of the several posts 20 and 21 and also on the central post 17, is a spacer 26. The grid supporting wires 27 pass to the bowl at the outside of the spacer out of contact therefrom, but because of limited space, necessarily near to the same and likewise near to the filament posts. There is a high electrical gradient

3

or R. F. electrostatic field between the posts of one set and the grid. It is the presence of the spacer in this electrostatic field and proximity of the grid-supporting wires to the spacer and to the set of posts having this high gradient to the grid which has afforded a shorting path for the R. F. current from grid assembly to the cathode assembly. Heretofore this spacer has been a lava or other ceramic disc.

According to the present invention, said spacer 26 is comprised as a metal disc, preferably steel, having holes therethrough at even intervals circumferentially for the filament posts. Alternate ones 28 of said holes are of appropriate diameter to have fitting engagement with the filament posts. The intervening holes 29 are larger than the filament posts and preferably of greater diameter next the top surface than next the bottom surface of the spacer. In the specific showing, this difference in diameter is exemplified as a stepped formation of hole. Within each of these larger holes 29 is a correspondingly shaped bushing 30 of insulating material, said bushing being prevented from dropping by virtue of the smaller diameter of the bottoms of the holes in which situated. The bushings are of ceramic or other insulating material and thus insulate one leg-supporting post for each filament section from the spacer. The several filament sections are or may be therefore in electrical parallel.

The spacer construction accordingly provides a disc of metal within which the insulating bushings are embedded so that metal entirely surrounds the bushings peripherally and takes them out of the R. F. electrostatic field which is ineffective within the metal. This construction accordingly entirely eliminates the cause of puncturing or heating of the ceramic, so the ceramic or lava bushings are fully effective as insulators.

I claim:

1. A spacer for filament posts comprising a metallic disc having holes therethrough in evenly spaced circular sequence with alternate ones of said holes having larger diameters than said posts, and bushings fitting said larger holes and engaging around said posts centering the posts in the holes and insulating the posts from the disc.

2. A spacer for filament posts comprising a metallic disc having holes therethrough in circular sequence and some of said holes being larger than the said posts, said larger holes each having greater diameter next the top of the disc than at the bottom thereof, and insulating bushings having one end larger than the other and similarly shaped to the shape of the said holes and situated therein with the large ends of the bushings in the large ends of the holes and the

4

small ends of the bushings in the small ends of the holes and around the said posts, said insulating bushings being substantially flush at their ends with the outer surfaces of said spacer next said holes.

3. A spacer for filament posts comprising a metallic disc having holes therethrough in circular sequence and some of said holes being larger than the said posts, said larger holes each having stepped formation with the upper part of the hole having greater diameter than the lower part of the hole, and an insulating bushing in each stepped hole, said bushing being in part in each part of said hole and having a shape corresponding to said stepped hole and fitting the same and around the said post, said insulating bushings being substantially flush at their ends with the outer surfaces of said spacer next said holes.

4. An electron discharge device having a multiple wire cathode and a grid, means for spacing the wires of the cathode, said cathode having posts on the wires comprising the same and with said posts extending through said spacing means, insulating means between some of said posts and said spacing means, said grid having parts thereof passing in proximity to said spacing means, said spacing means providing metal girdling said insulating means throughout the axial length of said insulating means and between the same and said grid parts to prevent an R. F. field from passing through said spacing means to said insulating means and posts, said spacing means and insulating means both being shouldered within the axial length of interengagement thereof thereby preventing displacement in one direction, and means on the post preventing displacement in an opposite direction and retaining said shoulders substantially in engagement.

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