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SUPPORT FOR ELECTRODES

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Fig. 1.

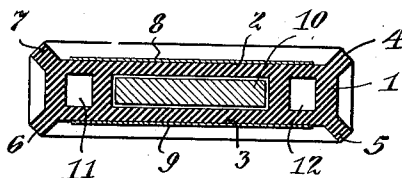


Fig. 2.

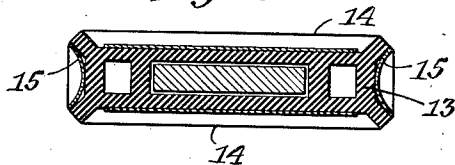


Fig. 3.



Fig. 4.

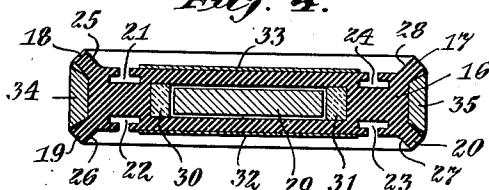
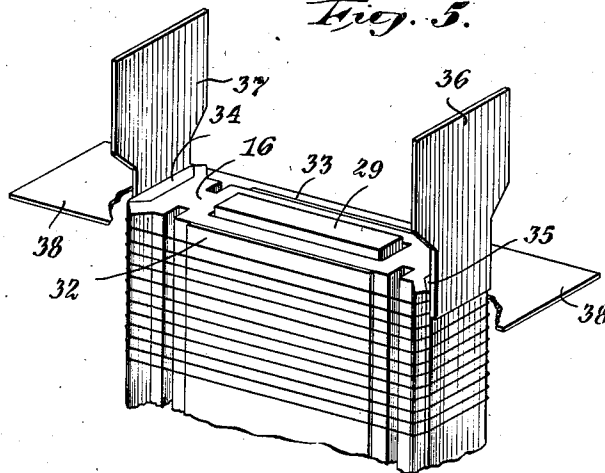


Fig. 5.



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SUPPORT FOR ELECTRODES

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13 Claims. (Cl. 250—27.5)

The invention relates to discharge tubes and especially to the support for the electrodes of such discharge tubes.

An object of the invention is to maintain a fixed distance between the electrode elements, especially of the cathode and control electrodes.

Another object of the invention is to provide a support for electrodes which will not substantially change in size and form under the influence of high temperature.

Other objects and advantages of the invention will be apparent from the following description and drawing, in which:

Fig. 1 is a cross-section through a preferred support for the cathode and control electrodes.

Figs. 2 and 4 are cross-sections of two modifications of the invention as disclosed in Fig. 1.

Fig. 3 is a perspective view of an element of Fig. 2.

Fig. 5 is a perspective view of the modification in Fig. 4 with additional elements.

Certain types of discharge tubes such as high vacuum amplifier tubes require extremely small distances between individual electrodes, especially the distance between the cathode and the control grid. The practical maintaining of such small distances to a constant value is extremely difficult in tubes of the prior art because such electrodes consist of two separate elements which are fixed in their position relative to one another only at their ends. With such constructions, it is often impossible to maintain the desired narrow tolerances or such narrow tolerances are only accomplished at the cost of a great deal of time and trouble.

The invention provides a construction for the electrodes and electrode support in electric discharge tubes whereby the small electrode distances are accurately maintained and the manufacturing and assembly of the electrode arrangement is accomplished in a more certain manner.

In particular, a common support of insulating material is used for the two or more several electrodes which require small distances between them. This common support of insulating material guarantees the accurate maintaining of the electrode distances at least over the effective length of the electrodes and practically over their entire length. This common insulating support is preferably of ceramic material which not only has high heat resistance but also will maintain practically its same size and form under the influence of the high temperature constantly present in the tube during operation.

In Fig. 1, the support 1 is of ceramic material

and acts as a common support for both the cathode and the grid. This common support in the preferred embodiment illustrated, has preferably two parallel extending surfaces 2 and 3 having the cathode 8 and 9 thereon. This cathode preferably comprises a base metal coating sintered onto the ceramic material as a metal coating. Such a coating may be of platinum, nickel, copper, silver, or other suitable materials. The emitting material is placed on top of the metal coating and may comprise the familiar electron emitting barium, strontium and calcium oxide. The ceramic material has preferably prolongations 4, 5, 6, and 7 at the corners lateral to the cathode surface. These projections 4, 5, 6, and 7 are preferably provided with grooves in which the grid wires are placed. If the grid wires are wound sufficiently tight, an absolutely sure and fixed distance between the cathode and grid is assured. A suitable heating element 10 is preferably centrally arranged within the ceramic support. This heating element may, of course, comprise the usual heating coil. The heat which is produced in the heating element should be conducted mainly to the emitting surfaces 8 and 9 of the cathode. The portion of the ceramic support adjacent the projections for the grid wires has means therein which make difficult the conduction of heat through the ceramic body from the heating element to the projections. The means, illustrated in Fig. 1 by which the heat conduction to the projections is reduced, are the hollow spaces or cavities 11 and 12.

If several grids are required and accurate spacing is desired, the projections of the ceramic support may have slots of different depths therein. One wire may be wound in slots of one depth and another in slots of another depth. For grid wires, molybdenum, iron, nickel alloys, and the like, may be used. It is desirable, of course, that the wires have an equal expansion to that of the ceramic material.

In order to maintain tight the grid wires 14, there is disclosed a laterally inserted flexible plate 15 in cross-section in Fig. 2 and in perspective in Fig. 3.

There are, of course, various modifications that may be made in the embodiment disclosed in Figs. 1 and 2. In Figs. 4 and 5, the projections of the ceramic body 16 are so formed that the grid wires lie on the narrow surfaces 17, 18, 19, and 20, and these surfaces are separated from the main body by deep slots 21, 22, 23, and 24. These slots have a further advantage in the fact that the vaporized emission material that might be given off

in activation or subsequent operation can hardly reach inside these slots and so there is no danger of forming a conductive layer between the cathode and grid to provide a leak or short circuit between the electrodes. The surfaces 25, 26, 27, and 28 between the electrodes may be covered if desired with substances such as graphite which do not form conducting chemical compounds with the emissive material vaporized on them from the electrode. Inserts 30 and 31 of poorly heat conducting material may be inserted between the heating element 29 and the portion of the insulating body extending towards the grid supporting projections 17, 18, 19, and 20. By one or more, or all of these means, the heat produced by the heating element is conducted, for the most part, to the cathode coatings 32 and 33, and the time for heating the cathode to sufficient electron emitting temperature is shorter than it otherwise would be.

If it should be desired to cool the grid more effectively, cross bands 34 and 35 of metal such as copper can be inserted on the ends and cooling vanes 36 and 37 extend therefrom as illustrated in Fig. 5. A mica disc 38, as illustrated also in Fig. 5, serves to support the electrode arrangement.

The anode preferably consists of a separately supported element surrounding the cathode and grid or grids, but it is apparent the control grid may be wound on deep slots on the projections and the anode supported on the outer ends of these projections.

In fact, various modifications may be made in the preferred embodiment illustrated, and accordingly, only such limitations are intended upon the following claims as is necessitated by the spirit and scope of the following claims.

I claim:

1. An electrode structure for discharge tubes comprising an insulator having a flat area, a coating of electron emitting material on said flat area, unitary projections on said insulator and grid wires wound on said projections.
2. An electrode structure for discharge tubes comprising an insulator having a flat area, a coating of electron emitting material on said flat area, unitary projections on said insulator and grid wires wound on said projections, and heating means for said electron emitting material enclosed by said insulator.
3. An electrode structure for discharge tubes comprising an insulator having a flat area, a coating of electron emitting material on said flat area, unitary projections on said insulator and a plurality of grid wires wound in slots of different depth on said projections.
4. An electrode structure for discharge tubes comprising an insulator substantially in the form of a polyhedron, a grid wound on said polyhe-

dron, a depressed surface on said polyhedron and a coating of electron emitting material on said depressed surface.

5. An electrode structure for discharge tubes comprising an insulator having a substantially flat area, electron emitting material on said flat area, integral insulator projections on at least two sides of said flat area and grid wires wound on said projections.

6. An electrode structure for discharge tubes comprising an insulator having a substantially flat area, electron emitting material on said flat area, integral insulator projections on at least two sides of said flat area and grid wires wound on said projections, and a slot between said projections and the electron emitting material on said flat area.

7. An electrode structure for discharge tubes comprising an insulator having a substantially flat area, electron emitting material on said flat area, integral projections on at least two sides of said flat area, grid wires wound on said projections, and a thin wall extending from the portion of the insulator supporting said flat area to the portion of the insulator supporting said projections.

8. An electrode structure for discharge tubes comprising an insulator having a substantially flat area, electron emitting material on said flat area, integral projections on at least two sides of said flat area, grid wires wound on said projections, and means keeping said grid wires tight.

9. An electrode structure for discharge tubes comprising a ceramic insulator, grid wires wound on said ceramic insulator, a surface on said ceramic insulator, spaced from said grid wires and a layer of electron emitting material on said surface.

10. An electrode structure for discharge tubes comprising a ceramic insulator, grid wires wound on said ceramic insulator, a surface on said insulator spaced from said grid wires, a metal coating bonded to said surface and an electron emitting coating on said metal coating.

11. An electrode support of ceramic material having a flat surface and projections lateral at an obtuse angle to said surface and having grooves in said projections.

12. An electrode support of ceramic material having a flat surface and projections lateral of said surface and having grooves therein and a slot between said flat surface and said projections.

13. An electrode structure comprising an insulator member having two parallel surfaces, electron emitting material on said surfaces, projections lateral of said surfaces and a grid on said projections for each surface and spaced the same distance therefrom.

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