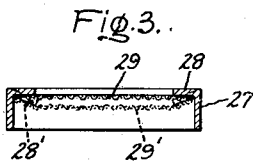
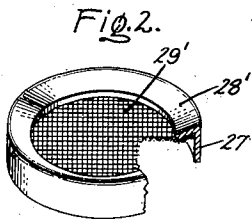
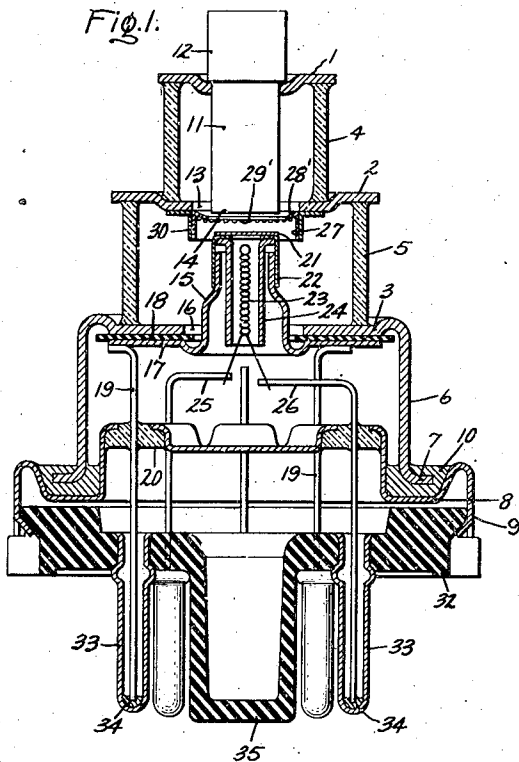


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CONTROL GRID FOR ELECTRIC DISCHARGE
DEVICES AND METHOD OF MAKING SAME
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CONTROL GRID FOR ELECTRIC DISCHARGE
DEVICES AND METHOD OF MAKING SAME

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7 Claims. (Cl. 250—27.5)

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The present invention relates to electric discharge devices and more particularly to an improved taut grid construction and a method of making the same.

In electric discharge devices such as those described and claimed in the copending Beggs application Serial No. 436,633, filed March 28, 1942, now Patent 2,416,565, dated February 25, 1947, and assigned to the assignee of the present invention, it has been found that a considerable variation in electrical properties of the devices is caused by relative movement of the electrodes and by the deposition on the envelope of material vaporized from the cathode during the manufacture and operation of the device. In accordance with an important feature of the present invention, I provide an improved grid or control electrode structure and a mounting therefor which at the same time shields the insulating portion of the envelope from material vaporized from the cathode.

It is an object of the present invention to provide a new and improved electric discharge device.

It is another object of the present invention to provide a new and improved grid structure.

It is a further object of my invention to provide an improved method of making taut grid structures.

It is still another object of the present invention to provide a new and improved control electrode and mounting therefor for an electric discharge device which insures uniform operating constants for devices of the same construction.

In the illustrated embodiment of the invention, an electric discharge device of the type described and claimed in the above-identified Beggs application is provided in which the high frequency terminals are in the form of metallic disks which are spaced by insulating cylinders sealed to the various disks. The control electrode is in the form of a plurality of fine wires or mesh supported from a metal cylinder which is, in turn, supported from the grid terminal or disk by a mounting cylinder. The mounting cylinder or the grid cylinder, or both, extend from the grid disk toward the upper surface of the cathode to prevent material vaporized from the cathode from depositing on the insulating cylinder separating the grid and cathode terminals. The feature of providing a vaporization shield of the above type is described and claimed in the copending Liimatainen application Serial No. 589,487 filed concurrently herewith, now Patent 2,411,046, dated November 12, 1946, and assigned to the assignee

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of this application. The mesh of the grid is bonded to the lower side of an inwardly extending flange on the grid cylinder, and this flange is then folded downwardly to stretch the grid, with the result that the grid-cathode and grid-anode spacings are more easily maintained within desired limits.

For a better understanding of the present invention, reference may be had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims. In the drawing, Fig. 1 is an elevational view, in section, of an electric discharge device embodying the present invention; Fig. 2 is a perspective view, partially broken away, of a portion of the grid structure employed in the embodiment of the invention shown in Fig. 1, and Fig. 3 is a sectional view showing a grid structure embodying my invention in an intermediate and final stages of manufacture.

Referring now to the drawing, the invention is illustrated as embodied in an electric discharge device in which the high frequency terminals are provided by a plurality of disks 1, 2 and 3 of progressively increasing diameter. Disks 1 and 2 are spaced by a cylinder of insulating material 4, preferably of glass, which is sealed at its opposite ends to disks 1 and 2. Similarly, disks 2 and 3 are separated by a larger cylinder of glass 5 which is sealed to the disks 2 and 3. The disk 3 forms a part of a cylindrical structure including a skirt 6 which terminates in an outwardly extending flange 7. The flange is adapted to be received in a trough-like portion 8 of a header or closure member 9. The header 9 is secured to the skirt 6 by a body of fusible material 10, such as solder, which is melted and allowed to cool with the elements in assembled position after exhaust of the device has been completed.

The anode of the device is provided by a cylindrical member 11, preferably formed of good conducting material such as copper, having an enlarged portion 12 extending above the disk 1. The portion of the anode lying within the envelope extends axially of the envelope and through an opening 13 formed in the grid disk 2 and terminates in a planar surface 14. The cathode of the device may be of any suitable construction and to advantage may be of the type described and claimed in the copending Beggs application Serial No. 453,158, filed August 1, 1942, now Patent 2,416,566, dated February 25, 1947, and assigned to the assignee of the present invention. As described more fully in this Beggs application, the cathode structure includes a generally cylindrical support

15 extending upwardly through an opening 16 in the cathode disk 3 and having an integral flange portion 17 extending in opposed relation to the lower face of the disk 3 and separated therefrom by an insulating disk 18 of suitable material such as mica. The cathode supporting structure is maintained in assembled relation against the mica disk by relatively rigid supporting conductors 19 which bear against the lower face of the flange 17 and each of which is sealed through an opening in the header 9 by a body of glass 20. As will be readily understood, this construction insulates the cathode support from the disk 3, as far as direct current potentials are concerned, but forms an effective direct connection to disk 3 for high frequency currents. The electron emitting surface of the cathode comprises a disk 21 which is coated with a suitable emission enhancing material such as an alkaline earth oxide. The disk 21 is mounted on the support 15 by a cylindrical member 22 formed of thin metal foil which provides for a good electrical connection with the active cathode surface and the support 15 while minimizing the transfer of heat between these elements. A suitable heater element 23 extending concentrically with the cathode support 15 is surrounded by a tubular shield member 24 to minimize the direct radiation of heat from the heater element to the cathode support. The member terminates in a flange to provide a good heat transfer connection with the active portion 21 of the cathode. Suitable lead-in conductors 25 and 26 are sealed through the header 9 in the same manner as the conductors 19 to provide a means for supplying current to the heater element 23.

In accordance with an important aspect of the present invention, the control member includes a grid cylinder 27 having an inwardly directed flange 28 at its upper end. The grid wires or grid mesh 29 are welded or otherwise bonded to the lower face of the flange 28 and this flange is subsequently depressed, or folded downwardly, to the position shown at 28' in Fig. 3 of the drawing to stretch the grid wires. As illustrated, the marginal portion or flange 28 in its final position is inclined with respect to the plane of the grid wires. It will be apparent that this deformation of the marginal portion increases the transverse dimensions of the aperture, particularly at the lower edge thereof in the region where the grid wires are engaged by the lower edge of the flange. A grid constructed in this manner maintains its shape under manufacturing and operating conditions, rendering it possible to produce devices having uniform electrical characteristics. The grid cylinder 27 is received in and supported from a mounting cylinder member 30 which extends downwardly from the lower face of the grid disk 2. With this construction the grid may be positioned in the grid mounting cylinder 30 and adjusted until the desired spacing is attained, after which the cylinder 27 is welded to the cylinder 30. Either the cylinder 27 or the cylinder 30, or both, are made of sufficient length to extend to the level of the active cathode surface or a little below as shown in Fig. 1, in order to prevent material vaporized from the cathode from depositing on the wall of the insulating cylinder 5. It has been found that such a construction renders the discharge device much more uniform in operating characteristics by eliminating variations in interelectrode capacity due to the conductive coating which is otherwise present in varying degrees on the insulating surface 5. Certain features of the grid mounting described above

are common to the copending Beggs application Serial No. 548,859, filed August 10, 1944, now U. S. Patent No. 2,402,119, granted June 18, 1946, and assigned to the assignee of the present application. The subject matter of the Beggs application is prior art with respect to my invention.

In the embodiment of the invention illustrated the device is completed by an insulating adapter or base member 32, secured to the header 9 and including a plurality of terminal prongs 33 which receive the various conductors extending from the header 9. These conductors are preferably soldered to the inside of the terminal prongs as indicated at 34. The base member 32 is provided with a central positioning extension 35.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and it is, therefore, the aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of this invention.

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

1. A grid structure including a cylindrical metal support having an apertured end wall, a plurality of grid wires lying in a plane and extending across the aperture and bonded to the inner surface of said end wall, said end wall being inclined inwardly with respect to said plane, said grid wires being maintained in a stretched condition by said inclined end wall.

2. A grid structure including a metal support having an aperture therein, a plurality of grid wires extending across the aperture and lying in a plane and bonded to one surface of said support, said support having the marginal region surrounding said aperture being inclined toward said one side, said wire mesh being maintained in a stretched condition by said inclined marginal region.

3. A grid structure including a cylindrical metal support having an apertured end wall, a plurality of wires extending across the aperture and lying in a plane and bonded to the inner surface of said end wall, said end wall being inclined toward said plane, said grid wires being maintained in a stretched condition by said inclined end wall.

4. An electric discharge device comprising a plurality of electrodes including an anode, a cathode and a control member, a disk-like member providing an externally accessible connection for each of said electrodes, a plurality of cylindrical members of insulating material sealed between said disk-like members to space said connections, the disk-like member for said grid including a cylindrical support concentric with one of said members of insulating material and extending toward said cathode, a grid structure including a cylindrical supporting portion received in and secured to said support, the lowermost portion of said support and grid structure extending below the upper surface of the cathode to prevent material vaporized from said cathode from depositing on said one member.

5. A high frequency electric discharge device having a plurality of planar electrodes including an anode, a cathode and a control member, a disk-like member providing an externally accessible connection for each of said electrodes, a plurality of cylindrical members of insulating material sealed between said disk-like members to space said connections, a cylindrical support depending from one of said members in concentric

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relation with respect to one of said insulators, a grid structure including a cylindrical supporting portion received in and secured to said support, the lower end of said support and grid structure extending toward the surface of said cathode to prevent material vaporized from said cathode from depositing on said one insulator and thereby prevent changes in the interelectrode capacity of said device which would otherwise result from material deposited on said one insulator.

6. The method of manufacturing a taut grid for an electric discharge device including a plurality of grid wires and a metal support having a planar portion provided with an aperture which comprises the steps of bonding the grid wires to one side of said support at the marginal region defining said aperture and bending said marginal portion of said support out of its original plane to increase the dimensions of the aperture and thereby stretch said grid wires.

7. The method of manufacturing a taut grid for an electric discharge device including a plurality of grid wires and a metal support having a planar portion provided with an aperture which comprises the steps of bonding the grid wires

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to one side of said support at the marginal region around said aperture and bending said marginal portion of said support out of its original plane in the direction of the side to which the wires are bonded to increase the dimensions of the aperture and thereby stretch said grid wires.

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