Sept. 16, 1969 J. R. BLATTER 3,467,879

PLANAR DISPENSER CATHODE ASSEMBLY WITH A CAP MEMBER TO WHICH AN ELECTRON-EMISSIVE, TUBULAR HEATER, AND ROD-SHAPED SUPPORT MEMBERS ARE CLAMPED

Filed Feb. 6, 1967 2 Sheets-Sheet 1

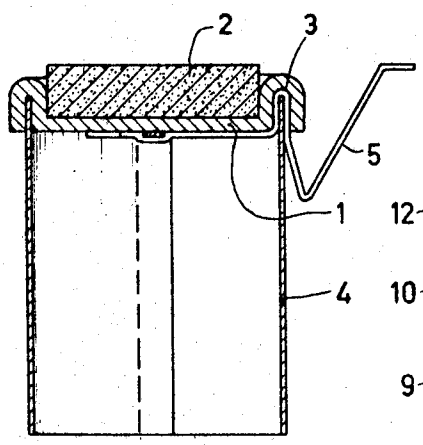

FIG. 1

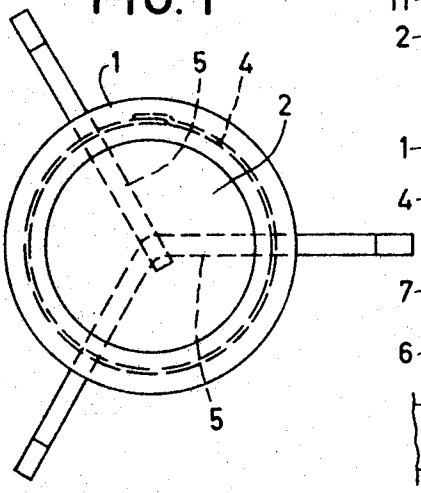

FIG. 2

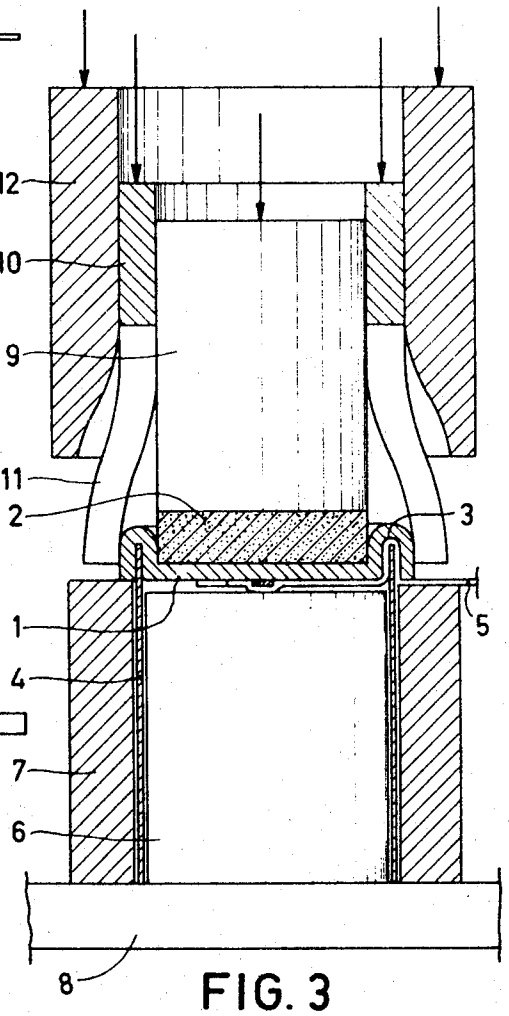

FIG. 3

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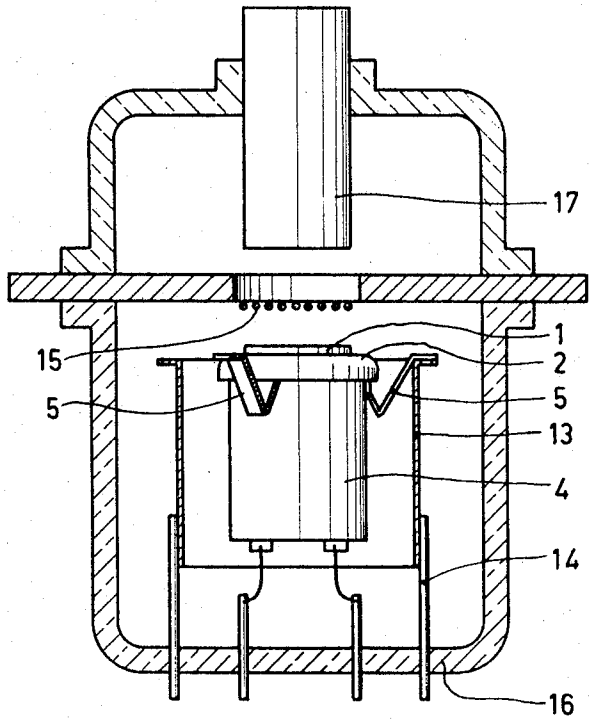

FIG. 4

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U.S. Cl. 313—346 5 Claims

ABSTRACT OF THE DISCLOSURE

A planar dispenser cathode assembly comprising a cap member having on one side means for receiving and clamping the electron-emissive member and on the opposite side an annular groove for receiving and clamping a tubular heater enclosure and rod-shaped support members.

The invention relates to an indirectly heated cathode consisting of a metal hood having an emissive end face, the hood being secured to a metal cylinder accommodating a heater body, which cathode is secured to a supporting member by means of a plurality of thin rod-shaped stay members. The invention more particularly relates to a planar dispenser cathode of small dimensions suitable to be incorporated into an electron gun. The invention further relates to a method of manufacturing such a cathode.

In general, cathodes having an emissive end face serve to produce a beam-shaped electron current.

In known cathodes, the thin stay rods are generally welded to the hood or to the cylinder accommodating the heater body. Welding such thin stay rods or strips involves a high percentage of rejects, however, and is expensive, since the rods must be held and welded separately, Especially in cathodes of small dimensions (diameter of the end face being 2 mms. or smaller), this is not simple. Moreover, the hood is also welded to the cylinder.

Since such cathodes having an emissive end face in general are comparatively heavily loaded due to the comparatively small dimensions of the emissive surface, it is advantageous to use a dispenser cathode, also because the surface of the emissive part is very smooth, which is favourable in the case of small electrode gaps. The known constructions of said cathodes are comparatively expensive, however, since the stock of emissive material is generally pressed or clamped in a cavity which is provided in a solid metal body by turning out.

It has been found that such cathodes consisting of a metal hood having an emissive end face, which hood is secured to a cylinder accommodating the heater body, while the cathode is secured to a supporting member by means of a plurality of rod-shaped stay members, can be manufactured in a very simple manner and at low costs if, according to the invention, the hood is provided on its side remote from the emissive end face with a circular groove in which both the end of the metal cylinder and the rod-shaped stay members are clamped.

In the case of a dispenser cathode, when clamping the cylinder and the stay rods in the circular groove, the emissive material can be clamped at the same time in a cavity of the emissive end face of the hood. If the emissive material has the form of a pre-manufactured pill, this pill can also be clamped in the cavity by deformation of the outer edge of the circular groove when the metal cylinder and the stay rods are clamped. Thus, no welding operation is necessary.

The invention will now be described more fully with reference to the drawing, in which:

FIG. 1 is a longitudinal sectional view of a given embodiment of a cathode in accordance with the invention.

FIG. 2 is a plan view of FIG. 1, and

FIG. 3 shows the device for manufacturing the cathode of FIG. 1.

FIG. 4 shows the attachment of a cathode of the invention in an electron discharge tube.

In the FIGURES, reference numeral **1** denotes a cathode hood or disc the end face of which is emissive due to the fact that an emissive pill or pellet **2** consisting, for example, of sintered porous tungsten impregnated with barium aluminate, is pressed in to a cavity of the hood **1**. See U.S. Patents 2,700,000; 2,769,708; 2,917,415; 2,929,-133 and 3,202,639. The hood **1** is provided on its side remote from the emissive end face with a continuous circular groove **3** in which a heater cylinder **4** and the stay rods **5** are clamped.

The stay rods **5** can be joined beforehand so as to form an assembly, as shown in FIG. 2.

The cathode can be manufactured in a very simple manner, as shown in FIG. 3. The cylinder **4** consisting of a molybdenum foil bent into the form of a cylinder and having a thickness of, for example, 25 to 50μ is placed between cylinders **6** and **7**, which cylinders bear on a base **8**. The assembly of the stay rods **5** is then placed in a recess of the upper face of the cylinders **6** and **7** on which the hood **1** is provided so that the upper end of the cylinder **4** is received by the circular groove **3**, the stay rods **5** likewise consisting of molybdenum being passed between the edge of the hood **1** and the edge of the cylinder **4**. The emissive pill **2** is then placed in the cavity of the hood **1** and pressed by a cylindrical die **9**. A hollow die cylinder **10** is slipped around this die **9**, which cylinder is provided with a plurality of saw cuts so that the parts **11** can yield slightly. This cylinder **10** is surrounded by a pressure cylinder **12** which moves the parts **11** downwards and axially inwards, as a result of which the edge of the groove **3** is deformed so that on the one hand the pill **2** is clamped in the cavity and on the other hand the cylinder **4** and the stay rods **5** are clamped in the circular groove **3**. Any welding operation is thus not required and the manufacture is very simple. The hood **1** is manufactured by deep-drawing from a molybdenum plate having a thickness of, for example, 100μ so that the expensive operation of hollowing the cavity for receiving the emissive pill **2** is dispensed with. The cavity need not be shaped very accurately, since due to the deformation of the edge of the hood **1** the pill **2** is clamped tight. This also applies to the groove **3**. Due to the fact that the hood **1** as well as the cylinder **4** and the stay rods **5** may consist of molybdenum, since they are not liable to become brittle by welding, difficulties due to differences in expansion coefficients are avoided. One of the features of the invention is that the emissive disc or pellet **2** remains clamped in its cavity, even though, as in the usual dispenser cathode, it is mainly of tungsten which possesses a different expansion coefficient than that of the molybdenum hood **1**, and the assembly is heated to an elevated temperature in the range of 850° C. to 1200° C. as is usual for such cathodes.

Alternatively, the stay rods **5** may be delivered in axial direction from supply reels, in which event they are not interconnected at the centre of the cathode. Furthermore, the emissive material may be shaped into the form of a pill using a composition of the type described in the aforementioned patents as a pressed type cathode when it is pressed into the cavity of the hood. Due to the fact that the stay rods **5** engage the hood **1**, the cylinder **4** is not

mechanically loaded so that its wall thickness may be very small.

FIG. 4 illustrates a typical manner of mounting the cathode of FIG. 1 in an electron tube. The cathode hood **1** is supported on a cylinder **13** by means of the stay rods **5**. The cylinder **13** is supported on a tube-bottom part **16** by lead-through pins **14**. A grid electrode **15** is disposed parallel to the upper surface of the emissive pellet **2**, between this pellet **2** and an anode **17**.

The cathode in accordance with the invention may have, for example, an outer diameter of approximately 2 mms. or smaller and is very suitable for use in electron guns for television picture tubes. However, the cathode may also have large dimensions and be used in tubes for very high frequencies such as travelling-wave tubes, reflex klystrons and the like.

What is claimed is:

1. An indirectly-heated planar cathode assembly for an electric discharge tube, comprising a metal end member having an electron emissive end face, a tubular member for accommodating a heater body, and at least one rod-shaped support member for mounting said cathode within the tube, said metal end member having on its side remote from the emissive end face an annular groove in which both the end of the tubular member and the rod-shaped support member are clamped.

2. An indirectly-heated planar dispenser cathode assembly for an electron tube, comprising a metal disc having an upturned edge defining on its top surface a central recess and on its bottom surface a circular groove, an electron emissive disc seated in the central recess and clamped therein by the upturned edge, a tubular member for accommodating a heater body, and a plurality of rod-shaped support members for mounting said cathode within the tube, the end of the tubular member and the rod-shaped support members extending into and being clamped within the groove on the bottom surface of the metal disc by wall portions thereof.

3. A cathode as set forth in claim **2** wherein the metal disc is formed from a sheet of molybdenum, the tubular member is formed from a sheet of molybdenum, and the electron emissive disc comprises tungsten.

4. A cathode as set forth in claim **3**, wherein the peripheral edge of the metal disc has a cross-section in the shape of an inverted U.

5. A cathode assembly as set forth in claim **1** wherein the tubular member comprises a thin-walled solid metal sheet, and the support member comprises a plurality of radially-extending rod-shaped metal members interconnected where they intersect at the center of the cathode, each of said rod-shaped members being clamped at portions spaced from their intersection within the annular groove.

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U.S. Cl. X.R.

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