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COLD-CATHODE GAS-FILLED DIODE

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FIG. 1

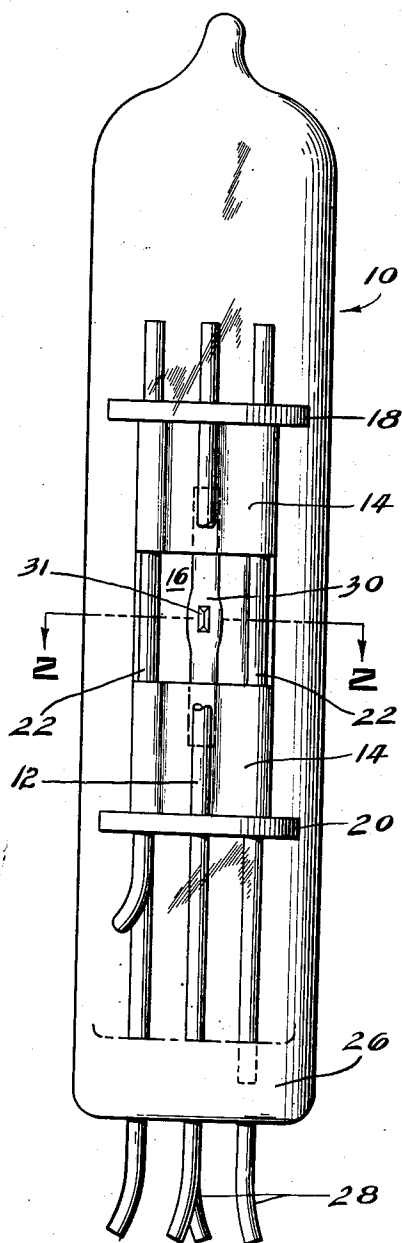
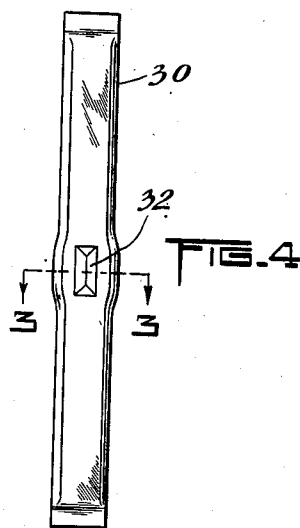
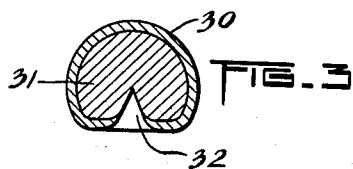
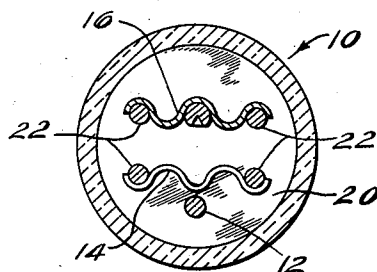


FIG. 2



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COLD-CATHODE GAS-FILLED DIODE

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5 Claims. (Cl. 313-181)

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The present invention relates to gas filled discharge tubes, and more particularly to gas discharge devices having a cold cathode.

An object of the present invention is the provision of a cold cathode gas filled discharge tube having substantially no variation in firing characteristics between successive tests.

Another object of the present invention is the provision of a gas discharge tube having a high degree of stability.

A further object of the present invention is the provision of a cold cathode gas filled discharge tube having as low as possible a leakage conductance between cathode and anode.

Still another object of the present invention is the provision of a gas discharge tube utilizing a combined getter and activator structure.

Still a further object of the present invention is the reduction of leakage between electrodes in a gas discharge tube.

The foregoing objects, and others which may appear from the following detailed description, are attained by providing, within a gas filled envelope; a rod-like cathode, and a plate-like anode; the cathode being coated with an active material. The anode has an aperture therein, and on the opposite side of the anode from the cathode is provided a metallic capsule filled with barium, or a barium compound. When the capsule is heated, the getter material vaporizes out of a wedge shaped hole in the capsule through the aperture in the anode. Part of the evaporated barium is deposited on the cathode. The remainder of the getter material which misses the cathode rod is deposited on the interior wall of the glass bulb, where it serves somewhat as a conventional tube getter. Since the leakage conductance between the cathode and the anode in the tube must be as low as possible, the window arrangement of the anode prevents the barium from depositing on the supporting micas for the tube elements. While I have particularly mentioned the use of barium as a combined cathode activator and getter, other alkaline earths and their compounds may be used.

The present invention will more clearly understood by reference to the following detailed description, which is accompanied by a drawing, in which

Fig. 1 illustrates in an enlarged elevational view an embodiment of the present invention, while

Fig. 2 is a sectional view taken along line 2-2 of Fig. 1,

Fig. 3 is a section across the getter element

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alone shown in a further enlarged view, while Fig. 4 is an elevational view of the getter structure alone.

The tube shown in Fig. 1 includes a sealed envelope 10, preferably of vitreous material, filled with an ionizable gas at a reduced pressure. Various gases may be used, argon and/or neon being typical examples. The mount structure within the envelope includes a cathode 12, an apertured sheet metal anode 14, and a getter capsule supporting plate structure 16. These elements are maintained in their proper relative position with respect to one another by mica spacers 18 and 20. For reasons which will be explained below, it is preferable to place the anode or a portion of the anode closer to the cathode than to the getter supporting plate. In the illustrated embodiment of the invention, the anode 14 is longitudinally corrugated and disposed with the corrugations parallel to the cathode so as to bring the convex surface of one of the corrugations close to the cathode. In the particular embodiment shown in Figs. 1 and 2, the anode 14 and the getter supporting plate 16 are welded, or otherwise secured, to support rods 22, which pass through the mica spacers 18 and 20. Certain of the support rods 22 and the cathode rod 12 have conductive extensions through the header 26 at the base of the tube to form lead in wires 28. The getter support plate 16 carries a getter capsule in the form of a hollow iron sleeve 30, filled with getter material 31. A wedge shaped hole 32 is provided on the side of the sleeve 30 facing the cathode 12 through the hole in anode 14. After the tube is assembled, the getter supporting plate 16 may be heated by induction heating. This vaporizes the getter material and causes it to be projected through the wedge shaped hole 32 and through the hole in anode 14 toward cathode 12. A large part of the vaporized barium or other getter material strikes the cathode 12 to form an active surface on the cathode. It has been found that vaporized metal cathode surfaces so deposited are less subject to changes in their characteristics than is the case where metal compounds are sprayed on the cathode before assembly. Due to the rod-like formation of cathode 12, it remains cool while the tube is passed through the induction heating field. The getter material will therefore be deposited on the cathode rod. Some of the getter material misses the cathode rod 12, and is sprayed on the interior of glass envelope 10, where it serves in the same way as the conventional tube getter.

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The area on the cathode rod and on the envelope which is reached by the spray is sharply defined because of the small aperture 32 in the getter capsule being spaced a comparatively great distance from the larger aperture 16 in anode 14 while at the same time the aperture is relatively closer to the cathode rod and to the wall of the envelope behind the cathode rod. Diffusion of the getter around the edge of the anode aperture is minimized and, as a result, the edges of the sprayed area are sharply defined.

In heretofore known practice, active materials have been placed in an auxiliary glass bulb attached to the tube envelope, and vaporized into the tube; thus covering the interior of the envelope and all the elements. Thereafter, by heating the bulb and all of the elements except the cathode, the actuating material was caused to be redeposited on the cathode only. It will be seen that the present invention simplifies the construction of the tube by eliminating several of the steps of the prior art practice.

It will be noted that in furtherance of the reduction of the leakage between the cathode and the anode as much as possible, the apertured anode 14 acts as a spray shield, the central portion allowing the getter material to deposit on the cathode, but the upper and lower solid portions serving to shield both mica elements 18 and 20 in the space between the anode 14 and the cathode 12. Thus, the insulating characteristics of the mica are retained. It has been found that gas discharge tubes so constructed are extremely stable in their characteristics.

While I have particularly shown and described an embodiment of the present invention, it is to be particularly understood that this invention is not limited thereto, but that variations within the scope of the invention may be made.

What I claim is:

1. A gas discharge tube having, within a hermetically sealed casing, a number of electrodes including a narrow, elongated cathode, a flat anode having a central aperture therein, and a getter capsule supported at the side of said anode remote from said cathode, said capsule having an aperture therein aligned with the aperture in said anode, said capsule being spaced from said anode a distance so related to the size of said central aperture that material vaporized from said capsule is sprayed only on the portion of said cathode intermediate its ends, and on the interior of said casing in the region immediately adjacent said cathode, said electrodes being maintained in position within said casing by insulating spacers attached to their ends, the end portions of said anode being disposed as a shield between said capsule aperture and those portions of said spacers between the cathode and the anode.

2. An electron discharge device including, within a hermetically sealed casing, a narrow, elongated cathode, a sheet metal anode, and a getter capsule supporting plate, said cathode, anode, and plate being spaced apart and arranged one after the other along a line transverse to the axis of said casing, said anode having a portion extending closely adjacent said cathode and embodying a central aperture in said portion, the space between said cathode and said anode por-

tion being considerably less than the space between said anode portion and said plate, and a getter capsule mounted on said plate, said getter capsule having an aperture in alignment with said central aperture in said anode, this arrangement of said getter capsule aperture and said central anode aperture being effective to conceal the ends of said cathode from said getter capsule aperture, and to restrict the spray reaching said cathode to the intermediate portion of said cathode.

3. A discharge tube having a number of electrodes including an elongated cathode, an anode having an aperture in a portion thereof disposed close to but spaced from said cathode, and a getter capsule supported at the opposite side of said anode from said cathode and spaced a considerably greater distance from said anode than the cathode is spaced therefrom, said capsule having an aperture substantially smaller than said anode aperture, said capsule aperture being aligned with the aperture in said anode, means for heating said capsule whereby material within said capsule is sprayed only on the portion of said cathode intermediate its ends.

4. An electron discharge device including, within a hermetically sealed casing, a narrow elongated cathode, and a pair of substantially flat parallel plates at one side of said cathode, the one of said plates having a portion disposed adjacent said cathode having an aperture therein and being adapted to serve as an anode, said anode portion being spaced from said cathode a considerably lesser distance than that between said anode portion and the other of said parallel plates, a getter capsule mounted on the other one of said plates, said capsule having an aperture therein in alignment with said aperture in said anode, a pair of insulating spacers supporting the ends of said cathode and said plates and maintaining said spaced relationship, the aperture in said anode being substantially larger than that in said getter capsule, whereby the surfaces of said insulating spacers between said anode and said cathode are protected from getter spray and the portion of said cathode exposed to said spray is definitely delineated.

5. A gas discharge tube having, within a hermetically sealed casing, a number of electrodes including an elongated cathode, an anode having an aperture therein, and a getter capsule supported at the side of said anode remote from said cathode, means for heating said capsule by induction, said capsule having an aperture therein aligned with the aperture in said anode, the spacing of the aperture in said anode from said cathode being a small fraction of the spacing between said getter capsule and said cathode to that material vaporized from said capsule is sprayed on the portion of said cathode only intermediate its ends and on the interior of said casing in the region immediately adjacent said cathode.

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