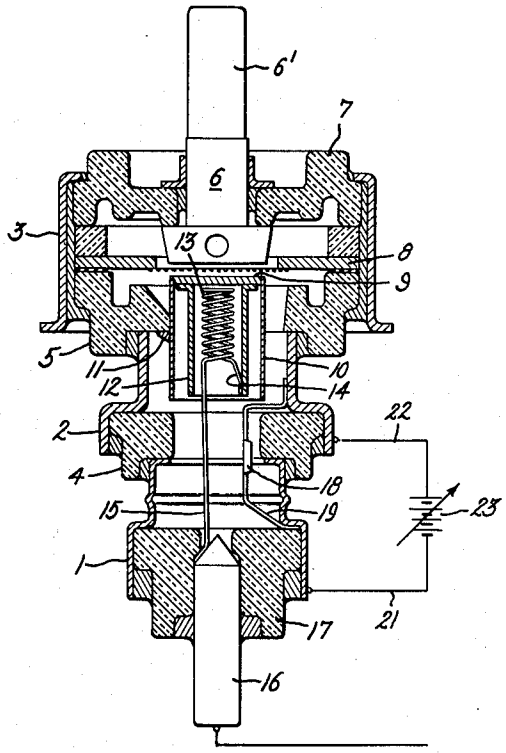
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ELECTRON DISCHARGE DEVICE AND METHOD OF GETTERING

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ELECTRON DISCHARGE DEVICE AND METHOD OF GETTERING

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My invention relates to discharge devices and more particularly to the art of gettering such devices.

In the fabrication of electron discharge devices it is common practice to introduce a getter of an active metal which when heated evaporates and deposits a metallic layer on the inner walls of the tube. This flash or explosion results in the liberation of the active metal and the depositing of a metallic layer on the inner walls of the device. While it has been found desirable to heat the getter compound by placing it on or in a filamentary metallic conductor and supplying current thereto, it has also been found that a current having too great a value fuses the filamentary conductor leaving the open ends loosely depending within the tube. In tubes employed in the ultra-high frequency range, such a condition raises the disturbance to an undesirable level such that the tube is rejected. In gettering tubes having transparent enclosures this problem is not acute since it is possible to observe the time at which the getter flashes. However, when tubes provided with ceramic and metallic enclosures, are gettered, the flash is not observable with the result that an excessive amount of current may be supplied thereto by the operator. It is also desirable to insure that the metal vaporized from the getter does not condense on the active electrode surfaces.

It is, therefore, a principal object of my invention to provide a new and improved method for flashing the getter in an electron discharge device.

Another object of my invention is to provide a new and improved electron discharge device and method whereby the getter may be flashed without fracturing the supporting filament.

Still another object of my invention is to provide a new and improved gettering process whereby only sufficient current is supplied to the getter to flash it.

In accordance with the teachings of my invention, a portion of the tube enclosure which comprises a translucent ceramic member is placed in direct alignment with the cathode heater. The getter is located in close proximity to this ceramic member and is flashed by supplying current thereto. While current is being supplied to the getter, the heater is also supplied with current such that when the tube is placed in a semi-darkened location a glow is visible through the ceramic. When the getter flashes and metal is deposited on the inner surface of the ceramic, the glow disappears and the current supply to the getter support is terminated.

For further objects and advantages and for a better understanding of my invention, attention is now directed to the following description and accompanying drawing, and those features which I desire to protect herein are pointed out with particularity in the appended claims. In the drawing, the single figure is a sectional view of an electron discharge device embodying the feature of my invention.

Referring to the drawing, an electron discharge device is there illustrated comprising three metallic members 1, 2, and 3, which may be of generally cylindrical

form, as shown, and of respective diameters such that the diameter of member 2 is greater than that of member 1 and the diameter of member 3 is greater than that of member 2. The members 1, 2 and 3 are arranged in coaxially aligned spaced relationship and separated from one another by insulating cylinders 4 and 5, cylinder 4 being arranged to join members 1 and 2 while cylinder 5 joins members 2 and 3. The members 1, 2 and 3 can be hermetically sealed to the cylinders 4 and 5 by any suitable sealing technique known to those skilled in this art. In those instances wherein it would be desirable to employ the gettering process of my invention, the insulating cylinders 4 and 5 are translucent such that the inner portions of the tube are not visible through the tube enclosure. An anode 6 provided with a cylindrical terminal 6' is positioned in spaced relationship with member 3 by an annular insulator 7. A grid assembly 8 is interposed between anode 6 and an active cathode surface 9. The active cathode surface is supported by a metal foil cylinder 10 which is fastened to a central aperture in cylinder 5. In the embodiment shown, brazing solder 11 provides the joint between cylinder 5 and cylinder 10. A metallic depending sleeve 12 is supported within cylinder 10 and houses a conventional filamentary heater 13 which suitably consists of a double helix of tungsten or any of the well-known metals or alloys suitable for use as heating filaments in electron discharge devices. One of the lower leads 14 of the heater 13 is connected to sleeve 12, and the other lower lead 15 is connected to a cylindrical cathode terminal 16. Terminal 16 is maintained in spaced relationship with and separated from circular metal member 1 by an insulating cylinder 17. Since this cylinder is an important part of a tube gettered in accordance with the teachings of my invention, it will be hereinafter more fully described.

A pellet 18 suitaly consists of an alloy of barium, aluminum or any other of the well-known compositions suitable for use as a getter in electron discharge devices and is supported within the tube by a filamentary metal member 19. This member has the extremities thereof connected to metallic members 1 and 2 while pellet 18 is mounted on or in the member 19 at the approximate center thereof. Electrical conductors 21 and 22, which are respectively connected to members 1 and 2, couple a variable voltage source 23 across members 1 and 2 and by means of the member 19, across pellet 18. Actually, the current is supplied to the filament 19 only, to raise the temperature. This, and not the current, heats up the getter (by heat conduction) to the flashing point. Heating current from source 23 is thus supplied to the getter assembly.

To flash the getter material 18 there is a minimum current which must be provided therein. However, because the flashing point depends upon a number of variables, such, for example, as the exact composition of the pellet and the composition and exact dimensions of the support structure, this minimum current value varies from pellet to pellet and consequently from tube to tube. It would seem possible to supply sufficient current to the pellet to flash those requiring the greatest amount of heat; this, however, necessitates the use of a current value which is great enough to frequently cause fusing of the support member 19. When this member is fractured, the ends thereof depend loosely within the tube and provide an undesirable source of disturbance which is of great importance when the tube is operated in the ultra-high frequency range. It is, therefore, desirable to supply enough current to flash the getter, but it is undesirable to supply any more than that. In tubes having glass or partial glass enclosures, this does not present a very great problem since an operator may observe the instant at

which the getter is flashed, but in tubes having all metal and ceramic enclosures, the flash is not observable.

In a tube constructed for gettering in accordance with my process, ceramic cylinder 17 is constructed of a translucent ceramic material. This cylinder is unobstructively aligned with the heater 13 such that when the heater is illuminated by providing a current therein, a glow is observable at the outer surface of cylinder 17. While observing this glow, the operator gradually increases the voltage output of source 23 until the current in filamentary member 19 is of a sufficiently high value to heat pellet 18 and produce the flash. Since this pellet is positioned in close proximity to the inner surface of cylinder 17, a metallic layer is deposited thereon. This metallic layer is sufficiently opaque to appreciably reduce if not altogether extinguish the glow visible through cylinder 17. Once the getter is flashed, which is signaled by the disappearance of the glow, the operator reduces the voltage from source 23 and disconnects the tube therefrom. When this process is employed, only those filamentary supports which have a fusing point less than or equal to the flashing point of the particular pellet will be fractured. This process has been proven to be well adapted to quantity production and appreciably reduces the number of tubes found to be defective as a result of improper gettering.

During the gettering operation it is important that the metallic vapor evaporated from the pellet does not condense on the active surfaces of the electrodes. In the manufacture of miniature tubes, such, for example, as the type herein described, this problem becomes important since because of the very small dimensions of the device itself, the getter must be located at a point close to the electrodes. In accordance with the teachings of my invention the cathode filament is heated during the period when the getter is flashed. Consequently, the cathode and the other electrodes in the immediate vicinity thereof are maintained at a high temperature such that the metallic vapor does not condense thereon but deposits a metallic layer on the cooler portions of the device. By immersing the entire discharge device in a fluid coolant, such, for example, as water, the parts of the device which form the envelope are maintained relatively cool and the metal vapor consequently condenses thereon.

Another advantage derived from immersing the discharge device in a liquid coolant during the gettering operation is that the ends of the getter support 19 are maintained relatively cool. Since pellet 18 is positioned at the center of support 19, it is located at the point on support 19 which is farthest distant from the coolant. Consequently, pellet 18 is located at the hottest point on the support member and a minimum value of current is required to flash it. It has been found that fewer support members are fractured during the gettering of the devices when the liquid coolant is so employed.

While this invention has been described by reference to a particular tube type, it will be understood that those skilled in the art may make many modifications of this device without departing from the true scope and the spirit of my invention. Therefore, by the appended claims I intend to cover all such changes and modifications as truly fall in my invention.

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

1. A method for flashing getter material in an electron discharge device having a partial translucent enclosure, comprising heating a cathode heater filament within said device to effect a glow observable through said translucent enclosure, and supplying energy to said getter material until said glow disappears.

2. A method for flashing getter material in a metal electron discharge device having a translucent ceramic body portion and a cathode heater therein, comprising supplying a voltage across said heater, supplying a voltage across said getter material, and removing said last named voltage when the glow of said ceramic is appreciably reduced.

3. A method for flashing getter material in an electron tube having a partial translucent ceramic body portion, a heater filament within said device and terminals electrically connected thereto extending without said device, comprising supplying a voltage across said terminals to heat said filament to effect a visible glow in said ceramic and increasing the amount of energy supplied to flash said getter material until said glow disappears.

4. An electron discharge device comprising an anode and a cathode, a filament located in close proximity to said cathode, a substantially opaque envelope containing said anode, cathode, and filament and having a relatively small translucent portion unobstructively positioned opposite said filament, and a getter provided within said discharge device intermediate said translucent portion of said envelope and said filament, whereby flashing of the getter deposits a layer of metal on said translucent portion to render same opaque.

5. An electric discharge device comprising an evacuated envelope enclosing a cathode and a heater therefor, a quantity of getter material, means supporting said getter material within said envelope, said getter material support means being subject to fusion upon the application thereto of heat in excess of a predetermined value, means coupling said heater to a current source to energize said heater, further means connected to said support means to energize said getter material, said getter-energizing means being adjustable, and means defining a line of sight operable on energization of said heater to transmit a glow from said heater exteriorly of said envelope whereby upon application of controllable current to said getter material vaporization products therefrom block said line of sight thus to enable control of the heat applied to said support means to avoid fusion thereof.

6. The device as defined in claim 5, wherein said envelope has an axis of symmetry, said getter material comprising a substantially straight body portion disposed parallel to said axis and in substantial alignment with a portion of said heater, and a translucent seal for said envolpe disposed in axial alignment with said getter and said heater.

7. A method for flashing getter material in an envelope having a translucent wall portion comprising the steps of providing a light source in said envelope to effect a glow observable through said translucent portion, and energizing said getter material until said glow is substantially reduced by deposition of getter material on said translucent wall portion.

8. A method for flashing getter material in an envelope containing electrode elements and having a translucent wall portion comprising the steps of providing a light source in said envelope to effect a glow observable through said translucent portion, disposing a quantity of getter material intermediate said light source and translucent portion, energizing said getter material until said glow is substantially reduced by deposition of getter material on said translucent wall portion, and cooling said translucent wall portion to facilitate deposition of said getter material thereon and to minimize deposition of said getter material on said electrode elements in said envelope.

References Cited in the file of this patent

UNITED STATES PATENTS

1,966,220	Rentschler et al.	July 10, 1934
2,130,190	Lederer	Sept. 13, 1938
2,275,864	Record	Mar. 10, 1942
2,354,946	Cohen	Aug. 1, 1944
2,445,993	Beggs	July 27, 1948