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E. A. LEDERER

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GETTER FOR ELECTRON DISCHARGE DEVICE

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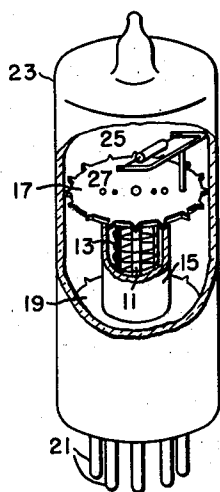


Fig. 1.



Fig. 2.

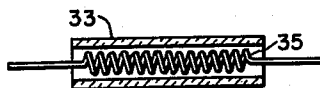


Fig. 3.

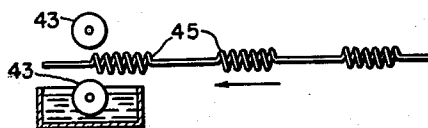


Fig. 5.

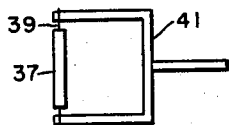


Fig. 4.

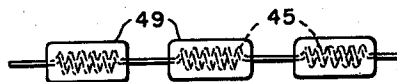


Fig. 6.

WITNESSES

Wm. B. Sellers.
H O Blair

INVENTOR

Ernest A. Lederer

BY

F. E. Browder
ATTORNEY

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GETTER FOR ELECTRON DISCHARGE DEVICE

Ernest A. Lederer, Essex Fells, N.J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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12 Claims. (Cl. 316—25)

This invention relates to electron discharge devices and more particularly to the use in such devices of chemically active gas clean-up materials known as getters.

A getter is a material used to reduce the pressure of the residual gases in an evacuated electron discharge device either during or after the mechanical exhaust process. A getter should be inert under ordinary conditions but should be of such a character that it can be made highly active by some process such as evaporation or a chemical change brought about by heating. The getter is usually volatilized inside the electron discharge device and removes the residual gas by either chemical or physical action or both.

It is known that loose particles, such as may originate from a getter device may cause noise in radio receiver tubes, screen blemishes in cathode ray tubes, pickup tubes and image intensifiers, and may cause other defects in these and other types of electron discharge devices.

In general, according to my invention, I propose that suitable porous, inert and refractory bodies, which have been impregnated with an appropriate material such as barium azide (BaN_3) be used as getter devices.

Therefore, it is an object of this invention to provide an improved getter device for electron discharge devices.

It is a further object of this invention to provide an improved getter device for electron discharge devices which minimizes the number of loose particles in an electron discharge device.

These and other objects of the invention will be apparent from the following description, taken in accordance with the accompanying drawing which forms a part of this application, and in which:

Figure 1 is a perspective view of an electron discharge device embodying my invention, the glass envelope and the anode being broken away to show the interior structure of the device;

Fig. 2 is a perspective view of one embodiment of a getter device constructed according to my invention;

Fig. 3 is a view, partly in section, of another embodiment of the getter device constructed according to my invention;

Fig. 4 is a top view of a getter device and getter support member similar to that shown in Fig. 1;

Fig. 5 is a schematic drawing of a method for constructing getter devices according to my invention; and

Fig. 6 is a view of getter devices constructed by the method shown in Fig. 5.

In Fig. 1, there is shown an electron discharge device embodying my invention including a cathode electrode 11 surrounded by a grid electrode 13 which, in turn, is surrounded by an anode electrode 15. A glass envelope 23 encloses the electrode structure. Mica spacers 17 and 19 and lead-in wires 21 are also shown. The getter device 25 is supported by the getter support member 27 which is attached to the mica spacer 17. If desired, to minimize spurious electrical charges, the getter support member 27 may be electrically connected to the cathode and therefore to the ground.

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In Fig. 2, there is shown a getter device constructed according to my invention, including a wire heater member 29 upon which a ceramic body or getter carrier member 31 has been placed. The ceramic getter carrier member 31 should be constructed of a material which is inert with respect to the getter material used. In one embodiment of my invention, the material should be inert with respect to barium azide and metallic barium. Suitable ceramic materials are aluminum oxide, magnesium oxide, beryllium oxide, thorium oxide and zirconium oxide. Suitable materials from which the wire heater members may be made include nichrome, tungsten, molybdenum and similar refractory metals or alloys.

In Fig. 3, there is shown a getter device constructed according to another embodiment of my invention in which a wire heater member 35 is enclosed by a ceramic tube member 33. The wire heater member 35 may be any of the known types of heaters, such as coil, straight or folded heaters.

In Fig. 4, there is shown a top view of a getter device similar to that shown in Fig. 1, in which a wire heater member 39 has been enclosed in a ceramic getter carrier member 37 and is supported by a getter support member 41. The getter support member 41 may be constructed of iron wire and the getter device may be heated by induction heating. If desired, the getter device may be connected across lead-in wires and heated by the current from the lead-in wires.

In Fig. 5, there is shown a schematic drawing of a method for constructing a getter device according to my invention, in which wire heater members 45 are drag coated with a suitable ceramic material such as aluminum oxide by pulling them through rollers 43. The coated heater members 45 are then fired in accordance with well-known ceramic practice and may be overcoated with additional ceramic material forming a structure such as that shown in Fig. 6, including the wire heater members 45 and the ceramic coating 49. The coated heater wires are then immersed in a saturated solution of barium azide in water and after a suitable soaking period, the getter device is dried at room temperature. If an accelerated drying process is desired, the temperature should not exceed 150°C . After drying, the ceramic material is still porous but barium azide has been distributed throughout the ceramic getter carrier member. The getter device is mounted in an electron discharge device which is then evacuated. If the getter device is heated for a short time to a temperature of approximately 400°C , the barium azide will be decomposed into its constituents, barium and nitrogen, and the nitrogen gas formed may be removed by vacuum pumping. At the temperature of approximately 400°C , the vapor pressure of the free barium metal is so low that substantially no evaporation takes place. Upon raising the temperature of the getter to approximately $700^\circ\text{--}800^\circ\text{C}$, barium metal will evaporate therefrom. It may be desirable for a part of the barium metal to remain within the ceramic getter carrier member especially if it is impractical to evaporate all the barium because of lack of space for deposition of the metal. Because of the porosity of the ceramic getter carrier member, the barium metal distributed therein provides a very large surface to the residual gas and thus aids in its removal.

Instead of using an inert, porous and refractory body as the getter carrier member, it may be advantageous in certain cases to substitute a porous metal for the ceramic material. This porous metal should be inert with respect to barium metal, i.e., no alloying should take place. The porous metal getter carrier member should also be refractory and it should be easily prepared in a porous or spongy form. Suitable materials include zir-

conium, titanium, hafnium, thorium, tantalum, and columbium. These metals are particularly desirable because they exhibit gas clean-up properties themselves and will, therefore, augment the getter action of the barium metal. Tungsten, molybdenum, cobalt, iron, and nickel may also be used. Another suitable material is the eutectic alloy of aluminum and cerium which also has gas cleanup properties. If metal is used as the getter carrier member, the heater wires must be insulated.

Utilizing the described technique combined with good ceramic or powder metallurgical practice, getter devices may be prepared which do not explode, burn out or emit small particles. Because of its surface tension, molten barium metal will adhere tenaciously to the porous body so that it is extremely unlikely that solid barium particles would fall off the carrier. While barium azide may give off free barium metal particles when heated too rapidly, the disclosed technique which embodies close mechanical and thermal contact between an inert and an active material will preclude hot spots and local exothermic reactions.

If desired, the getter device may be flashed in specified directions by using suitable shields and support constructions. Also, in electron discharge devices where a getter deposit on the envelope is detrimental, the getter device may be heated only for such periods and such temperatures that it is made highly absorptive.

Another advantage of a getter device such as that disclosed in my invention is that it is easily adaptable to special requirements such as the requirement of low current but a relatively high flashing voltage. For example, if high-frequency induction heating is used, such as with the device shown in Fig. 4, the resistance of the getter heater should be low. For heating with current supplied through lead-in wires, it may be advantageous to use a long, fine heater wire of high specific resistance made in a coil.

While the present invention has been shown in a few forms only, it will be obvious to those skilled in the art that it is not so limited but is susceptible of various changes and modifications without departing from the spirit and scope thereof.

For example, the present invention is not limited to the use of barium azide as a source of active material, as active barium may be obtained in various ways as is known in the art. Of course, other active materials than barium may be used, such as other alkaline earth metals.

Also, if desired, the source of active material may be separated from the porous body which is utilized because of its large surface.

I claim as my invention:

1. A gas cleanup device comprising a porous refractory body, said body being impregnated with a material which liberates a chemically active substance upon heating said body being inert with respect to said chemically active substance.

2. A source of barium comprising a porous refractory body, said body being impregnated with a barium containing material which liberates barium upon heating said body being inert with respect to barium.

3. A getter device for an electron discharge device comprising a porous refractory body, said body being impregnated with barium azide, said body being inert with respect to barium.

4. A getter device for an electron discharge device comprising a porous refractory ceramic body, said body being impregnated with a salt of hydrazoic acid and a metal selected from the group consisting of the alkali metals and the alkaline earth metals said body being inert with respect to said metal.

5. A getter device for an electron discharge device comprising a porous refractory body of ceramic composition, said ceramic composition being selected from the group consisting of oxides of aluminum, magnesium,

beryllium, thorium and zirconium, said body being impregnated with barium azide.

6. A getter device for an electron discharge device comprising a porous body of refractory metal, said body being impregnated with a material which liberates a chemically active substance upon heating said body being inert with respect to said chemically active substance.

7. A getter device for an electron discharge device comprising a porous body of refractory material, said refractory material being selected from the group consisting of zirconium, titanium, hafnium, thorium, tantalum, columbium, tungsten, molybdenum, cobalt, iron, nickel and the eutectic alloy of aluminum and cerium, said body being impregnated with barium azide.

8. A method of introducing active metal into an electron discharge device, said method including the steps of impregnating a porous refractory body which is inert with respect to said active metal with a material which liberates said active metal upon heating, and heating said impregnated porous refractory body to liberate said active metal.

9. A method of introducing an active metal into an electron discharge device having an envelope, said method including the steps of impregnating a porous refractory body which is inert with respect to said active metal with a material which liberates said active material upon heating, mounting said impregnated porous refractory body within said envelope of said electron discharge device, heating said body to decompose said material and liberate said active metal and evaporating at least part of said metal from said body.

10. A method of introducing barium into an electron discharge device having an envelope, said method including the steps of impregnating with barium azide a porous refractory body of ceramic composition, selected from the group consisting of oxides of aluminum, magnesium, beryllium, thorium and zirconium, mounting said impregnated body within said envelope of said electron discharge device, heating said body to a temperature of approximately 400° C. to decompose the barium azide into barium and nitrogen, removing the nitrogen from said envelope and heating said body to a temperature of approximately 700°-800° C. to evaporate at least part of the barium from said body.

11. A method of introducing barium into an electron discharge device having an envelope, said method including the steps of impregnating with barium azide a porous body of refractory metal selected from the group consisting of zirconium, titanium, hafnium, thorium, tantalum, columbium, tungsten, molybdenum, cobalt, iron, nickel, and the eutectic alloy of aluminum and cerium, mounting said impregnated body within said envelope of said electron discharge device, heating said body to a temperature of approximately 400° C. to decompose the barium azide into barium and nitrogen, removing the nitrogen from said envelope and heating said body to a temperature of approximately 700°-800° C. to evaporate at least part of the barium from said body.

12. A source of an alkaline earth metal comprising a porous refractory body, said body being impregnated with a material containing an alkaline earth metal, said body being inert with respect to said alkaline earth metal, said material liberating said alkaline earth metal upon heating.

References Cited in the file of this patent UNITED STATES PATENTS

1,605,087	Weller	Nov. 2, 1926
1,952,717	Lederer	Mar. 27, 1934
1,965,588	Foulke	July 10, 1934
1,967,575	Hunter	July 24, 1934
2,173,259	Lederer	Sept. 19, 1939
2,208,692	Wamsley	July 23, 1940
2,362,468	Clark	Nov. 14, 1944
2,412,302	Spencer	Dec. 10, 1946
2,421,984	Bobrow	June 10, 1947

Notice of Adverse Decision in Interference

In Interference No. 90,977 involving Patent No. 2,899,257, E. A. Lederer, Getter for electron discharge device, final judgment adverse to the patentee was rendered Aug. 23, 1962, as to claims 2, 8, 9 and 12.

[Official Gazette December 4, 1962.]

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