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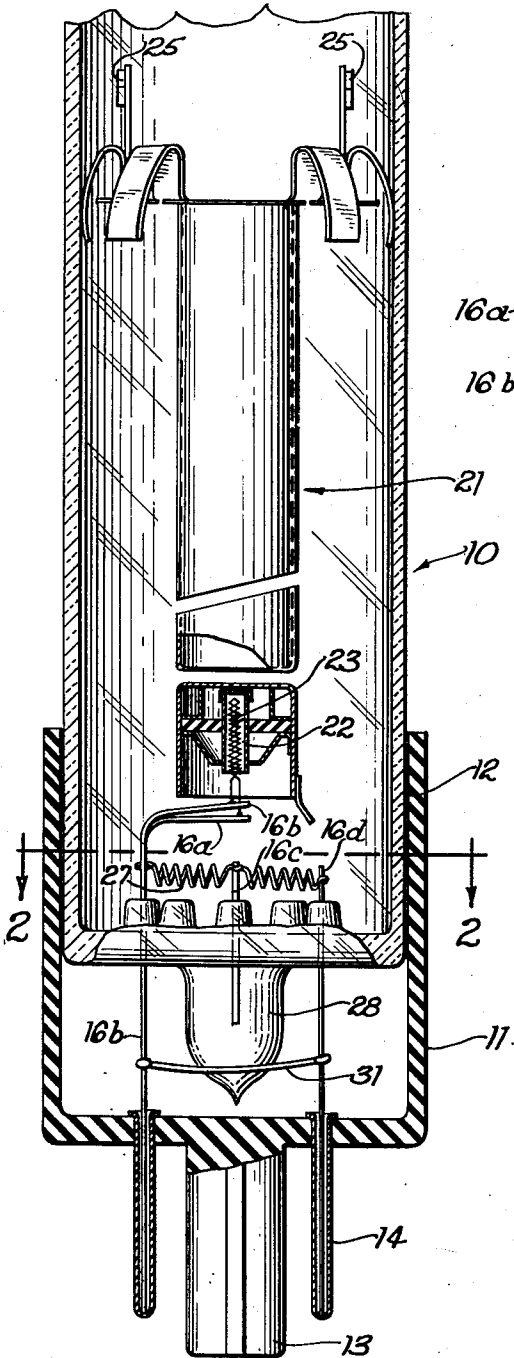
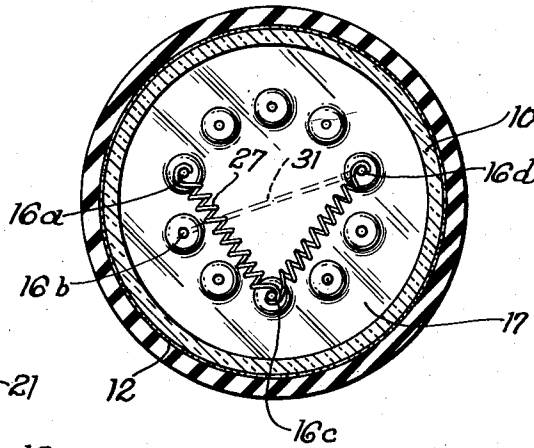
2,668,253

GETTER FOR ELECTRON DISCHARGE DEVICES

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Fig. 1

Fig. 2



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GETTER FOR ELECTRON DISCHARGE DEVICES

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4 Claims. (Cl. 313—174)

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This invention relates to electron discharge tubes, and more specifically to a getter therefor which is arranged not only for performing its function during the manufacture of the tube but for continuing that function during the life thereof.

I am aware that in United States Letters Patent No. 2,469,626, granted to John R. Beers on May 10, 1949, there is disclosed a getter having an object somewhat similar to that of the instant invention. However the arrangement therein disclosed has been found inadequate as a continuous getter due to exhaustion of its gas-absorptive character during the manufacture of the tube. It is believed that this occurs upon activation of the electron emitter or cathode, which, in general, comprises a mixture of barium and strontium carbonates. When activating the emitter under increased voltage, as is customary, the carbonates are broken down into oxides with carbon dioxide as a product of the reaction. Inasmuch as a zirconium getter will exercise a strong affinity for carbon dioxide, such action results in the formation of zirconium oxide and zirconium carbide with consequent devitalization of the getter which, if it is to function as a continuous getter, must retain substantially its pure metallic state. Consequently, when this prior construction and arrangement is resorted to, one of the principal advantages gained by the employment of zirconium as a getter is sacrificed.

For absorbing residual gases generally several types of getter material are available, e. g. barium or magnesium. However none of these is effective for hydrocarbon vapors, e. g. those which may remain in the tube envelope as a result of oil in the vacuum pump, such as an oil diffusion pump. In this regard zirconium has been found effective, but is preferably to be maintained as a continuously functioning getter if hydrocarbon vapors occluded in the tube elements are to be satisfactorily eliminated following their release during operation of the tube.

In the following description and in the claims the invention will be contemplated as including a so-called "zirconium" or Z-type getter as contrasted with the so-called "Batalum" or B-type. Those of the first-mentioned type are discussed in "Scientific Foundations of Vacuum Technique," by Saul Dushman, and published in 1949 by John Wiley and Sons, at pages 670 et seq., while those of the latter type are treated at pages 666 to 668. In the art "Batalum" getters are sometimes colloquially referred to as "one-shot" getters which, once heated to the necessary ef-

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fective temperature, are exhausted, as contrasted with the Z-type which may continue effectively as a getter while operating at the predetermined temperature.

Accordingly a principal object of my invention is the provision of a Z-type getter capable of functioning during the manufacture of the tube and continuously thereafter.

Another object is the provision of a getter as aforesaid so connected electrically as to permit activation of the zirconium during manufacture and easily adaptable for continuous performance.

A further object resides in the location of the getter to obviate adulteration thereof during activation of the emitter whether this be in the form of a directly heated filament or an indirectly heated cathode.

Additional objects are the provision of a Z-type getter in spiral or other suitable form, and the method of preparing the same.

Further objects will appear as the description proceeds.

Turning to the drawing which shows a preferred manner of carrying the invention into practice:

Fig. 1 is a combined axial cross-sectional and side-elevational view of the neck and base portion of a cathode ray tube embodying the invention; and

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1.

The glass neck 10 of the tube has the usual Bakelite base 11 cemented thereto as at 12. The socket pilot 13 and terminal prongs 14 are also conventional, certain of the several pressed lead-in wires or supports 16a, 16b, etc., being soldered to the prongs 14, while other are not connected electrically thereto. The neck 10 terminates in the customary press 17. An electron gun 21 of any desired type is carried by the leads and supports 16a, 16b, etc. as is understood, the cathode being indicated at 22 and its heater at 23. The electrical connections to the heater are made to leads 16a and 16b. The usual stainless-steel clad getters of the B-type are shown at 25, and may or may not be employed in addition to the getter of the invention to function in their well-known manner.

It will be comprehended that barium and other commonly used substances have proved to be excellent getters for nearly all gases except the vapors of hydrocarbon compounds, for example, organic or carbonaceous materials, and in particular oil vapor from oil diffusion pumps. The presence of vapor of this character can easily be

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detected as a bluish visible glow under high voltage ionization.

My improved continuous getter comprises a coil 27 preferably of zirconium wire or ribbon, or a support of other composition capable of being wound into a small diameter coil and having zirconium or other metal incorporated therein or thereon. I prefer to employ wire of approximately 0.005" diameter wound into close but not touching coils of about 0.030" outside diameter, although it is possible to arrange the getter in other configurations. One end of the coil is connected to heater terminal 16a, crossed over to an idle support 16c, and thence connected to an unused terminal lead 16d, care of course being taken to clear properly active leads of other electrodes. Such connections may be made by any reliable means.

It is particularly to be noted that my getter is supported at a position somewhat remote from the cathode 22 and heater 23, otherwise the zirconium or other metal is likely to undergo change into zirconium oxide and zirconium carbide as a result of activating the cathode, and as referred to hereinbefore. By spacing the cathode and my getter as far apart as the arrangement of the parts will allow, the danger of degradation of the getter is substantially minimized if not entirely eliminated. While, by way of example, my getter is shown as below the gun and is perhaps most easily supported and connected at that point, it is within contemplation to locate the getter at other non-interfering positions in the tube envelope.

The press 17 including the tubulation 28 may now be assembled with the tube body, the fusion of the press to the neck effected, and exhaustion of the tube commenced. It will be understood that numeral 28, while indicating a vestigial tubulation, is intended also to denote the original, extended tubulation through which the tube is evacuated and thereafter sealed off. During evacuation the cathode is "broken down" in the usual manner. Subsequently and while evacuation continues, voltage is applied to leads 16a and 16d until the getter reaches a cherry red color, whereby any gases occluded in the getter are driven off and exhausted and the getter enabled to perform its function. The tube is then sealed off. Before basing the tube a shorting jumper wire 31 is secured between the leads 16b and 16d which connection shunts the getter across the heater. Accordingly, during the life of the tube, the getter is in operation concurrently with the heater.

In connection with the immediately foregoing it will be appreciated that the parallel connection of getter and heater will increase the current consumption of the tube. For example, a standard cathode ray tube as used for television draws 600 ma. when operated at 6.3 v. on the heater, and assuming a drain of 250 ma. for the getter the tube is rendered off-standard. One solution is to modify the heater to a point where the total drain of heater and cathode does not exceed 600 ma. Alternatively the heater and getter may be connected in series, and the applied voltage increased. Such expedient would consist in merely eliminating the jumper 31 and arranging the socket to provide 6.3 v. to the heater and the necessary voltage to the getter, the common connection being at lead 16a.

It will have become apparent that the invention getter is not limited in its application to devices having an indirectly heated cathode, but is

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equally applicable to those in which the cathode is directly heated, and where herein I use the term "filament" the same is intended to refer not only to the filament in the case of a directly heated cathode, but to the heater in the case of an indirectly heated cathode.

While the getter of the invention has been found particularly efficacious in clearing up hydrocarbon vapors it has been found equal to the conventional stainless-steel clad barium getter in absorbing other gases. Moreover it is not a necessary limitation of my getter that the same be connected permanently in circuit, since the same may be flashed in the same way as other forms of getters during the manufacture of the tube and thereafter left in the tube unconnected electrically.

One of the outstanding advantages of the invention getter resides in its efficient action upon by-products of the Aquadag (a graphite and binder composition) customarily used for providing the inner coating of a cathode-ray tube. Under heat, such as occurs during operation of the tube, this binder is broken down and the resulting so-called "gunk" or carbonaceous matter, unless eliminated, will cause brown stains on the screen and a deposit on the cathode, this latter action sometimes being termed "cathode poisoning." The cathode as thus deleteriously affected is then rendered partially or entirely malfunctioning. By the use of my getter such harmful by-product of the binder is effectively absorbed.

While the invention getter desirably comprises zirconium, other metals may be found suitable, e. g. titanium and vanadium. Inasmuch as zirconium is a very ductile metal, a coil thereof would tend to sag in operation. However tungsten and other metals capable of long life at relatively high temperature possess ductility together with the required rigidity. I prefer therefore to constitute my getter as follows: A coil of tungsten of the required dimensions is first formed, mounted in an evacuable chamber and arranged for the application of electrical potential thereto. A predetermined quantity of zirconium tetraiodide crystals is introduced to the chamber, the chamber is evacuated, and the chamber heated to approximately 465° C. to vaporize the crystals to release free iodine and to deposit the vaporized zirconium metal on the tungsten support, this latter having meanwhile been heated by passage of current therethrough to approximately 1250° C. Thus there is provided a helically coiled support capable of being heated when connected in the tube and having the getter material thereon. The foregoing method of fabricating the getter has been found equally applicable to titanium and vanadium, the tetraiodide and iodide thereof respectively being utilized.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A thermionic tube having a containing envelope, a filament having two leads, a Z-type getter supported within said envelope, said getter having two connecting leads, one said lead being permanently connected by means of a jumper

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wire within said envelope to one lead of said heater, the other lead of said getter being permanently connected by means of a shorting jumper wire exterior to said envelope to the other lead of said filament after the envelope has been sealed off in order that said getter, which was not heated at any time during the manufacturing or processing of the tube, is automatically placed in service when said tube is placed in used.

2. A thermionic tube having a containing envelope, a filament having two leads, a Z-type getter supported within said envelope, said getter having two connecting leads, one said lead being permanently connected by means of a jumper wire exteriorly of said envelope to one lead of said heater, the other lead of said getter being permanently connected by means of a shorting jumper wire exterior to said envelope to the other lead of said filament after the envelope has been sealed off in order that said getter, which was not heated at any time during the manufacturing or processing of the tube, is automatically placed in service when said tube is placed in use.

3. A thermionic tube having a containing envelope, a filament having two leads, a plurality of terminals for said tube and a shell-like base for said terminals, said base defining a space with the tube envelope, a Z-type getter supported within said envelope, said getter having two connecting leads, one said lead being permanently connected by means of a jumper wire within said envelope to one lead of said heater, the other lead of said getter being permanently connected by means of a shorting jumper wire exterior to said envelope and within said base to the other lead of said filament after the envelope has been sealed off in order that said getter, which was

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not heated at any time during the manufacturing or processing of the tube, is automatically placed in service when said tube is placed in use.

4. A thermionic tube having a containing envelope, a filament having two leads, a plurality of terminals for said tube and a shell-like base for said terminals, said base defining a space with the tube envelope, a Z-type getter supported within said envelope, said getter having two connecting leads, one said lead being permanently connected by means of a jumper wire exteriorly of said envelope to one lead of said heater, the other lead of said getter being permanently connected by means of a shorting jumper wire exterior to said envelope and within said base to the other lead of said filament after the envelope has been sealed off in order that said getter, which was not heated at any time during the manufacturing or processing of the tube, is automatically placed in service when said tube is placed in use.

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