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GETTERS FOR ELECTRON TUBES

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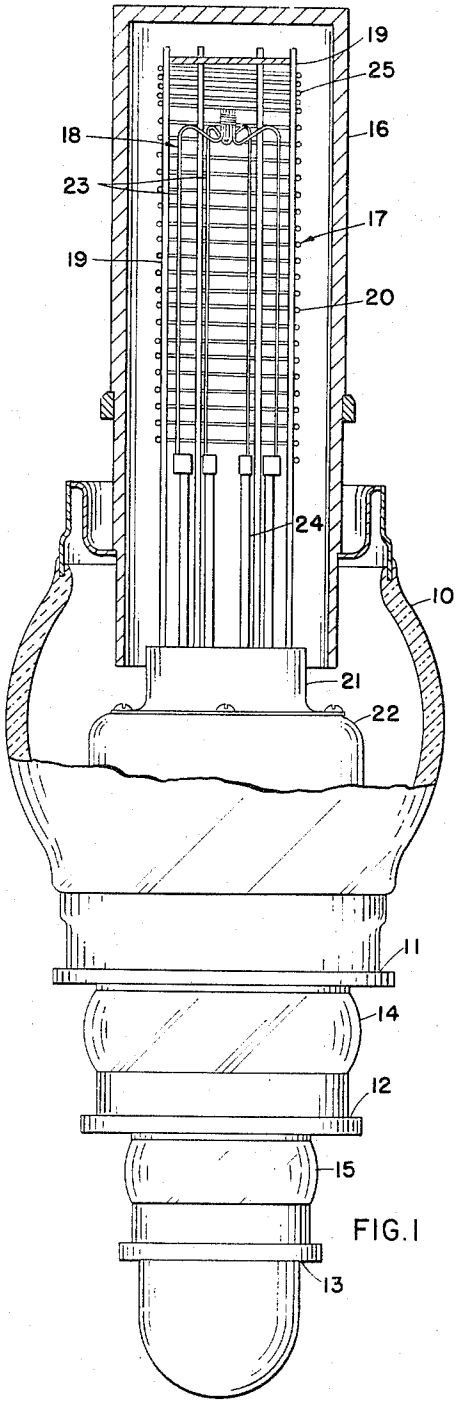


FIG. 1

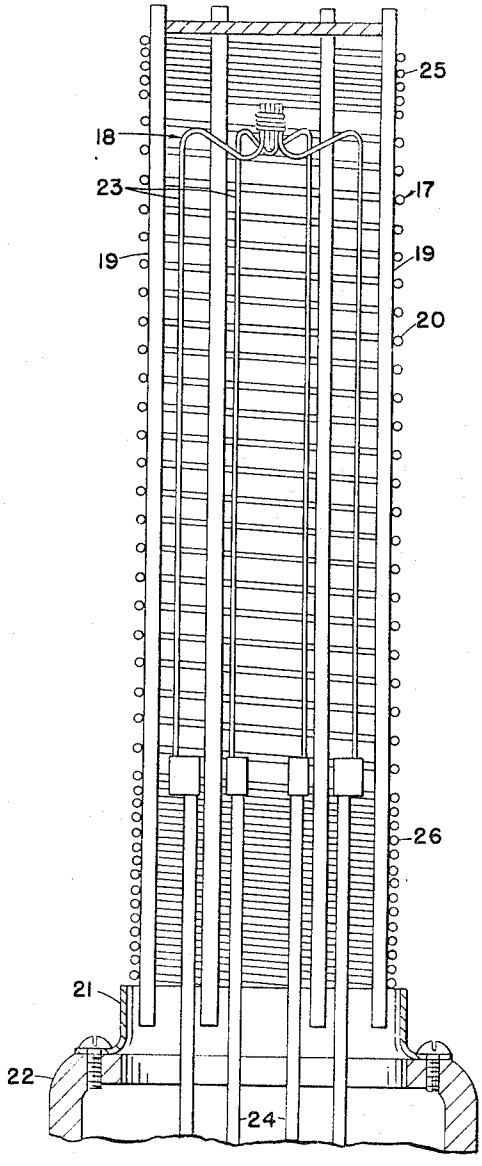


FIG. 2

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GETTERS FOR ELECTRON TUBES

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This invention relates to improvements in gettering means for electron tubes and has particular reference to the embodiment of a gas-absorbing material, such as zirconium or titanium, in electron tubes having cagelike grid structures. Still more specifically this invention is concerned with the provision of a getter in the form of a series of windings of zirconium wire placed upon at least one end of the grid stays of such a grid structure.

Sprayed zirconium coatings, for gettering in electron tubes having thoriated tungsten filaments, have been commonly used in the electron tube industry, although some manufacturers preferred to use small sheets or wires of zirconium located on supports in the center of the filament structure. Sprayed coatings are unsatisfactory, however, because of the extreme difficulty in obtaining perfect adhesion of zirconium powder upon a support. This results in loose particles within the tube, which particles are conducive to flash arcing during operation of the tube. The alternate method of placing strips or wires of zirconium within the filament structure has generally proved to be expensive because of the need for providing additional supporting means for the strips. With the latter type of getter, it is also sometimes difficult to locate the getter in a position where it will operate at proper temperatures for maximum gas-absorbing efficiency.

I have found that windings of zirconium getter wire can be applied upon either the fixed or the unsupported ends of the grid stays, without interfering with the grid wires, and barely outside of the grid-filament interelectrode space. The getter wire is thereby located in a relatively high temperature area of the tube when placed on the unsupported end of the grid stays, and in a slightly cooler area when placed on the fixed ends thereof. Such a getter can, by control of the overall length of the winding, be located in a large enough area so that various portions of the getter will be disposed within a range of different temperatures, thereby increasing the efficiency of the getter.

Accordingly, it is a primary object of this invention to provide improved gettering means for use in electron tubes having cagelike grid structures.

Another object is to provide a getter which has the ability to maintain a low gas pressure within an electron tube to prevent filament poisoning, in other words loss of emission, when the tube is highly loaded during the processing cycle, and to continuously operate in a like manner during subsequent operation of the tube.

Another object is to provide gettering means of the above character which permits tubes to be run at higher values of power, thereby permitting higher tube ratings with no decrease in tube life.

A further object is to provide a getter device which economically overcomes the aforementioned deficiencies of prior art gettering devices.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is an elevational view, partly in axial section, of an electron tube embodying the invention; and

Fig. 2 is an enlarged axial sectional view of the grid and filament electrodes of the tube shown in Fig. 1 showing a modification of the getter means.

The use of getter materials such as zirconium, titanium, barium and others, in power tubes is decidedly advantageous, particularly in tubes having easily poisoned thoriated tungsten filaments. Such getter materials readily absorb gases that tend to poison the filament during the processing and subsequent operation of the tube.

Gettering is particularly desirable in air-cooled tubes because in such tubes the power loading is limited by the maximum temperature at which the tubes can be safely run. To explain this, it is known that increases in anode temperature cause liberation of filament-poisoning gases from the tube elements. Therefore, a getter which will absorb such gases is highly desirable. The use of a getter in accordance with this invention thus permits higher values of loading to be applied to a tube than is possible with prior art structures, with no decrease in tube life.

In the present invention zirconium, for example, in wire, ribbon, or other relatively narrow strip form is used to overcome the disadvantages inherent in sprayed powder materials. Referring to the drawing, an electron tube of one type with which the getter of the invention may be used comprises an envelope formed with a central dielectric bulb portion **10** having extending from its lower end a plurality of metal terminals **11**, **12** and **13** which are insulated from one another by insulating members **14** and **15** in a conventional manner.

From the other end of the bulb **10** extends a hollow cylindrical anode **16** within which is located a cagelike grid structure **17** encircling a filamentary cathode. The grid structure **17** comprises a group of longitudinally extending support posts **19** arranged in a circle and having a grid wire **20** spirally wound thereover. The grid structure is supported by a flanged ring **21** which is bolted or otherwise rigidly secured to an annular support **22** which is in turn mounted upon grid terminal **11** which provides means for supplying electrical potential to the grid in the usual manner.

The cathode **18** comprises a group of filament wires **23** which extend longitudinally of and within the grid structure for the purpose of emitting electrons which are driven through the grid wires to the anode **16**. The filament wires **23** are supported by rodlike members **24** which in turn are electrically connected, by means not shown, to terminals **12** and **13** whereby proper cathode potential may be applied to heat the filament so that electrons will be driven therefrom.

In one embodiment of the invention, the grid wire **20** is wound upon the support posts **19** only in the areas opposite the cathode **18**, thus leaving the ends of the support posts **19** uncovered. Usually the grid wire is wound to nearly the ends of the posts. I have found it unnecessary to extend the grid winding onto the portions of the posts which are not opposite the cathode, and have instead wound upon the unsupported ends of the posts a separate strip **25** of zirconium, or other selected getter material, which is preferably in wire or narrow ribbon form.

Upon the opposite ends of the posts **19** I have wound a second strip **26** of the getter material, which strip may extend for any predetermined distance along the posts between grid wire **20** and ring **21**.

Although I prefer that the getter strips be in wire or narrow ribbonlike form, a sleeve of the getter material may be provided if desired.

The getter strips **25** and **26** are welded or mechanically fastened to the posts **19**, thus providing an economical getter structure, and one which is, due to the length of

the strips, located so that portions thereof are in areas of different temperature values. It is known that the gettering ability of zirconium, for example, has optimum values of temperatures for various gases. To getter oxygen or nitrogen most efficiently the zirconium strips should be heated to a temperature of upwards from about 800° C., and for hydrogen at a temperature below about 300° C. Therefore, due to the lengths of the getter strips **25** and **26** and their respective locations in different temperature zones, each strip will individually function efficiently to getter various gases.

It is not intended that the zirconium strips should become a part of the grid proper because zirconium does not possess sufficient mechanical strength to maintain its initial position at normal grid-operating temperatures and, therefore, is unsatisfactory as a grid material per se.

A getter constructed and arranged as described herein has another advantage in that as a tube is more heavily loaded electrically, the zirconium will rise in temperature due to the increased grid loading, and will immediately tend to absorb any gas that may evolve from the grid due to the increased temperature caused by the increased load.

Although getters are not normally used in power tubes having pure tungsten filaments, the simplicity and efficiency of this invention makes it possible to advantageously use getters in such tubes, particularly zirconium. In these tubes flash arcing has been a serious problem and is due in part to excessive gas pressures which, although for the most part are not high enough to cause loss of emission, are sometimes high enough to cause flash arcing. Furthermore, the secondary emission characteristics of the grid may be affected by gas forming various compounds or even by gas sputtering new surfaces on the grid, depending of course on the type of gas involved. The presently described getter keeps the gas pressure lower than is necessary for stable filament emission and thus prevents contamination of the surfaces and results in more stable characteristics with respect to secondary emission from the grid.

From the foregoing it will be apparent that improved getter means for electron tubes has been provided in accordance with the objects of this invention. It is to be understood, however, that those skilled in the art may make certain modifications in the means shown and described without departing from the spirit of the invention as expressed in the appended claims.

I claim:

1. In an electron tube embodying an envelope having a hollow anode connected thereto, a cagelike grid structure within the anode and comprising a group of spaced grid-carrying posts supported at one end within the envelope and having their other ends extending freely in substantially parallel relation into the anode, a cathode within the grid structure, and getter means comprising getter material encircling and mounted on the grid-carrying posts at one end thereof.

2. A device substantially as set forth in claim 1 wherein the getter means is comprised of getter material encircling and mounted on only the free unsupported ends of the grid-carrying posts.

3. A device substantially as set forth in claim 1 wherein the getter means is comprised of getter material encircling and mounted on only the supported ends of the grid-carrying posts.

4. An electron discharge device comprising an envelope having a hollow anode at one end thereof, a filament of known length extending into the anode substantially axially thereof and having one end supported within the envelope, a grid structure comprising a group of posts located substantially parallel with and between the filament and anode, the posts being supported at one end within the envelope at points remote from the filament and extending at their free ends substantially beyond the filament, a grid wire wound upon the posts and restricted substantially to the areas thereof which overlie the filament, and getter means comprising strips of getter material located upon the posts in areas thereof which extend beyond the filament.

5. A device substantially as set forth in claim 4 wherein the getter strips are mounted upon the free unsupported ends of the posts.

6. A device substantially as set forth in claim 4 wherein the getter strips are mounted upon the supported ends of the posts.

7. A device substantially as set forth in claim 4 wherein the getter means is zirconium.

8. A device substantially as set forth in claim 4 wherein the strips of getter material are in direct heat conductive relation to the grid posts.

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