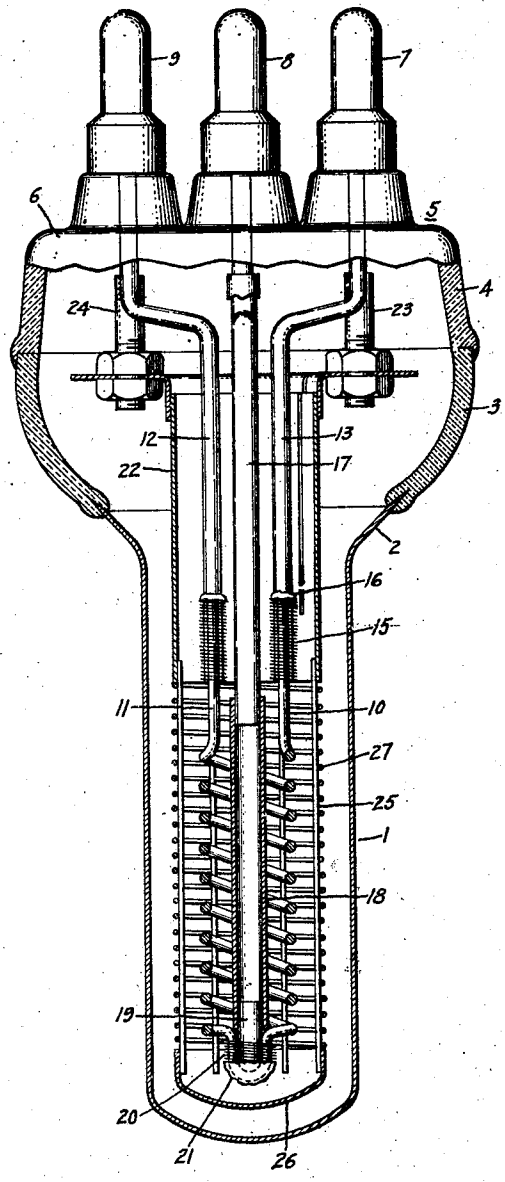
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ELECTRIC DISCHARGE DEVICE

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ELECTRIC DISCHARGE DEVICE

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My invention relates to electric discharge devices and more particularly to an improved construction providing improved gettering of the devices.

Certain materials, such as tantalum, have been employed as getters in electric discharge devices because of the ability of these materials to absorb gases during operation of the discharge devices and form compounds which are stable at temperatures within the range attained by the getter material under operating conditions. To be fully effective, however, the getter material in a new tube should be free of gas. To this end, it has heretofore been sought to "outgas" the getter during exhaustion of the tube, by heating the getter with high frequency to temperatures outside the range attained under operating conditions. A tantalum getter, for example, readily absorbs gases in an operating temperature range of some 800° C. to 1600° C., and the resulting compounds are readily broken down to liberate the gas in a high temperature range of some 1800° C. to 2000° C.

In some tubes, however, heating of the getter material by high frequency during the exhaustion is impracticable, so that it has heretofore been impossible to make the most effective use of the getter in such tubes. In accordance with an important aspect of my invention, I provide an improved structure, employing a getter material of this type, which facilitates subjecting the getter material to optimum temperatures for outgassing during the exhaust of the tube and provides for maintaining the getter at desired operating temperatures during normal operation of the tube.

It is an object of my invention to provide a new and improved electric discharge device.

It is another object of my invention to provide a new and improved gettering arrangement for electric discharge devices of the type in which the getter operates throughout the life of the tube to absorb gases from within the tube envelope.

In accordance with the illustrated embodiment of my invention, a getter in the form of a tube or sleeve of tantalum is connected in a circuit between a midtap to the filamentary cathode and the cathode terminal of the discharge device. With this arrangement, a large current may be passed through the getter during exhaust of the tube by connecting the end terminals of the filament together and to one terminal of the supply of heating voltage, with the other terminal connected to the midpoint of the cathode through the getter material. In this way the tantalum may be raised to the temperature range at which the compounds are readily broken down and driven off during the exhaust, thereby conditioning the getter for effective absorption of gases during operation of the tube. With the illustrated embodiment, the heater or cathode current does not flow through the getter during operation of the tube. The getter is heated by radiation and conduction from the cathode and by the flow of discharge current of the device through the tantalum sleeve.

For a better understanding of my invention, reference may be had to the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims. In the drawing, the single figure is an elevational view, partially in section, of an electric discharge device embodying my invention.

Referring now to the drawing, I have illustrated my invention as applied to a high power transmitting electric discharge device which includes an externally cooled anode 1 of tubular configuration which is closed at one end and which has a flare portion 2 at the other end which is sealed to a cylindrical glass member 3. Member 3 is in turn sealed to a vitreous part 4 of a stem construction designated generally by the numeral 5. The anode 1, the glass cylinder 3 and the vitreous part of the stem construction cooperate to provide a hermetically sealed envelope for the discharge device. The vitreous portion 4 of the stem construction terminates in a flat cap 6 to which are sealed a plurality of terminal prongs 7, 8 and 9. A cathode construction including a pair of helical cathode elements 10 and 11 is supported within the anode 1 and in concentric relation with respect thereto by relatively rigid lead-in conductors 12 and 13 which extend through the cap of the stem construction and are welded or otherwise secured to the terminal prongs 7 and 9, respectively. The cathode elements 10 and 11 may be secured to the lead-in conductors in any desired manner and, as illustrated, the overlapping end portions thereof are bound together by wire wrappings 15. After assembly, a permanent union between the elements 10 and 11 and lead-in conductors 13 and 14 may be effected by arc welding them together at the points designated by the numeral 16. An externally accessible connection with the center of the cathode is provided by the terminal prong 8 which is connected to a lead-in conductor 17. Conductor 17 is connected with the lower ends of the cathode elements 10 and 11 through a tantalum sleeve 18 and a short length of cylindrical conductor 19 to which the ends of

the cathode elements are secured. As illustrated in the drawing, the elements are bound to conductor 19 by a wire 20 and welded thereto, as illustrated by the numeral 21.

A control grid construction is interposed between the cathode elements 10 and 11 and the anode 1. As illustrated in the drawing, this grid construction includes a flanged cylindrical supporting member 22 carried by lead-in conductors 23 and 24. It will be understood that lead-in conductors 23 and 24 extend through the vitreous cap 6 and are secured to terminal prongs similar to prongs 7–9, inclusive. The prongs have been omitted from the drawing in the interest of simplification. The controlling portion of the grid structure includes a plurality of supporting wires 25 which extend parell to the axis of the cylindrical anode 1 which is secured at one end to the grid supporting cylinder 22 and at the other end to a metal cap 26 which supports the lower ends of the wires 25 in spaced relation about the cathode construction. The grid structure is completed by the grid wire 27 which is spirally wrapped around the supporting wires 25.

During the operation of an electric discharge device constructed in accordance with the illustrated embodiment of my invention the heating current for the cathode is supplied by a source of voltage connected with the terminal prongs 7 and 9. The external connection for the space current between the anode and cathode is provided by the terminal 8. The tantalum sleeve 18 conducts this space current during operation of the tube which contributes to the heating thereof. More important, however, is its location in proximity to the heating cathode so that it is maintained at a desired temperature by heat radiated and conducted to it from the cathode. As stated earlier in the specification, for a tantalum sleeve the temperature range for effective absorption of gas is from 800° C. to 1600° C. The present construction affords an easy way of raising the tantalum sleeve 18 to a high temperature during exhaust of the tube. For example, by connecting terminal prongs 7 and 9 together and to one terminal of a source of voltage and the other terminal of the source to terminal prong 8, it is possible to conduct twice the rated heater current through the tubular sleeve 18 with only rated current through each half of the cathode. In this way, it is possible to raise the tantalum sleeve to a high temperature, above 1600° C., and effectively break down the compounds formed when gas is absorbed by the tantalum. I have found that with proper conditioning of the tantalum in this way and with the construction of the illustrated embodiment of my invention that much more effective gettering action is realized during normal operation of the tube.

While I have shown a particular arrangement of my invention in which the getter forms a portion of the cathode lead and also a part of the supporting structure for the cathode, it will be understood that other arrangements may be employed in which the getter is connected between an electrode of the discharge device and an externally accessible contact or terminal. It will also be appreciated that my invention is not limited to the preferred material, tantalum, and that materials having similar properties, such as zirconium and molybdenum may be employed.

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

1. An electric discharge device comprising an evacuated envelope, a cathode supported within said envelope including a filamentary element wound to provide a hollow structure, a pair of externally accessible terminals, means connecting said terminals with the ends of said filamentary element to provide for the application of heating current to said cathode, a conductor sealed through said envelope, and a getter comprising a tantalum sleeve within said envelope interconnecting said conductor and a point on said cathode.

2. An electric discharge device comprising an evacuated envelope, a cathode supported within said envelope including a filament providing a hollow structure, a pair of externally accessible terminals, means connecting said terminals with said filament to provide for the application of heating current, a conductor sealed through said envelope, and a getter comprising a tantalum member within said envelope interconnecting said conductor and a point on said filament.

3. An electric discharge device comprising a directly heated cathode of the filamentary type wound to provide a substantially hollow cylindrical structure, means connected with the ends of said filament and sealed through said envelope to provide externally accessible connections for a source of heating current, a tantalum sleeve having one end connected to the midpoint of said filament, and a conductor sealed through said envelope and electrically joined with the other end of said sleeve.

4. An electric discharge device comprising a directly heated cathode of the filamentary type wound to provide a hollow structure, means connected to the ends of said filament and sealed through said envelope to provide externally accessible connections for a source of heating current, an element formed of material which readily absorbs gases when raised to an elevated temperature having one end connected to the midpoint of said filament, and a conductor sealed through said envelope and electrically joined with the other end of said element.

5. An electric discharge device comprising an evacuated envelope, a pair of externally accessible terminals, a cathode in the envelope comprising filament sections connected in series between said terminals and adapted to be heated to operating temperature by passage of current therethrough during operation of the device, a conductor sealed through the envelope wall and a tantalum getter member connected to conduct current between said conductor and the junction of said filament sections, said tantalum member being proportioned and arranged to be heated to gas-absorbing temperature when said filament sections are heated during operation of the device and during exhaustion of the device to be heated to a higher outgassing temperature by passage of current through said tantalum member in series with said filament sections in parallel.

JOHN W. FULTON.