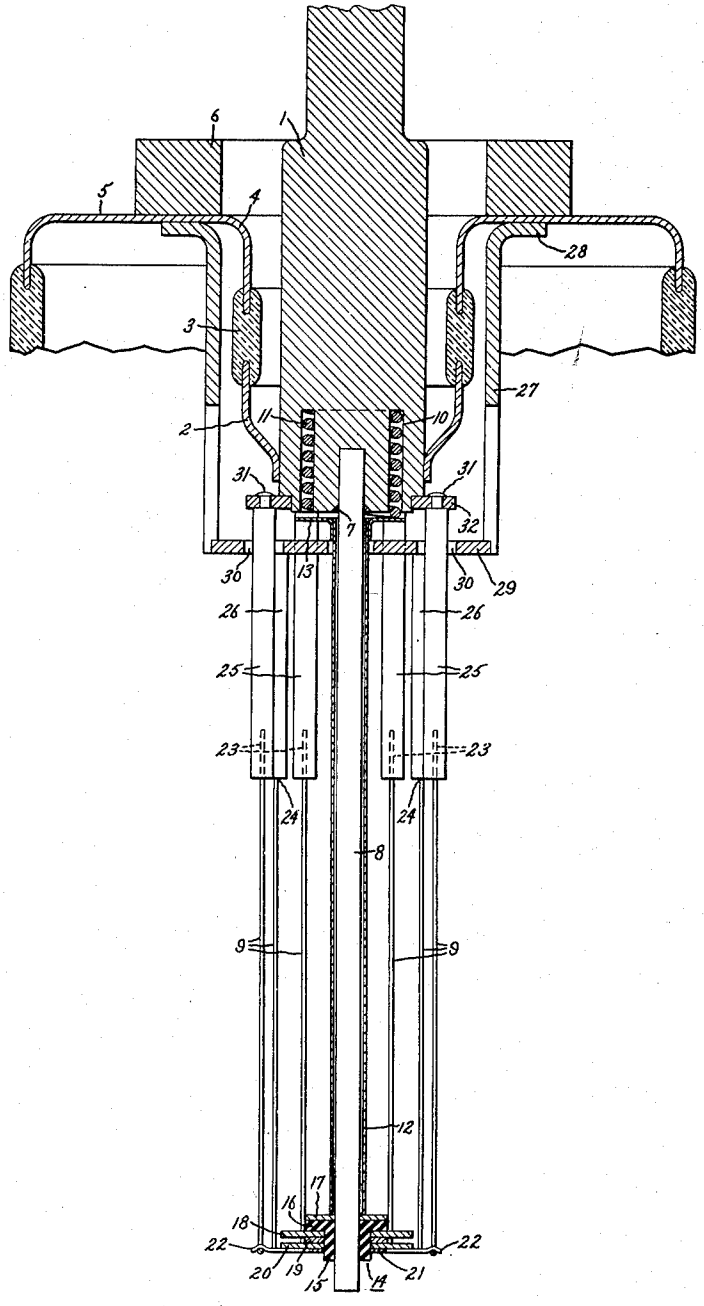
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SORPTION TYPE GETTER STRUCTURE

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SORPTION TYPE GETTER STRUCTURE

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My invention relates in general to evacuated electric discharge devices, and in particular to cathode and gettering structures for such discharge devices.

Evacuated electric discharge devices sometimes contain undesirable gases occluded within the envelope at the time that it is sealed. Further, the electrode structures may contain slight impurities capable of breaking down and forming gases under heat, or absorbed gases capable of being released under heat, so that gases may be formed within the envelope when the electrodes are raised to operating temperatures. The presence of certain of these gases is highly undesirable since they dilute the otherwise electrically-inert low pressure atmosphere and impair proper discharge device operation by affording the possibility of ionization or other undesirable effects. As a preventative measure to these effects by gases, it has become common practice to place within the evacuated envelope a material having the ability to take up and remove such gases by absorbing or forming compounds with the gases which are stable at the high operating temperatures. Such materials are now generally well known as "getter" materials, tantalum and zirconium, for example, serving successfully in this respect.

The successful gettering in an evacuated discharge device, however, requires that the getter material be placed in a position where it is generally centered within the evacuated volume in order that it readily comes in contact with any gases present, and that it be placed in a position to be considerably heated during the operation of the device, since the most successful combination with, or absorption of, gases takes place at a considerably elevated temperature.

My invention is particularly advantageous in the gettering of evacuated electric discharge devices having automatically-tensioned filamentary cathode arrangements such as that shown in U. S. Patent 2,489,872, issued November 29, 1949, to Thomas A. Elder et al., and assigned to the assignee of the present application. As such, my invention constitutes an improvement over the disclosure in the aforementioned patent, which patent may be considered as prior art. No inference should be made, nevertheless, that the present invention is limited to employment in electric discharge devices constructed otherwise wholly in accordance with the Elder et al. patent.

It is an object of my invention to provide a new and improved cathode and gettering structure for evacuated electric discharge devices.

It is a further object of my invention to provide an advantageous gettering structure for employment with cathode structures of the type having filamentary members maintained in place by spring tensioning.

It is a further object of my invention to provide such a gettering structure whereby the getter material is positioned centrally within the evacuated space of the discharge device envelope, and to receive heat during operation of the device from hot cathode elements.

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And it is a further object of my invention to provide such a gettering structure which is economical in cost and simple in assembly.

Briefly stated, my invention in the preferred embodiment thereof comprises an annular disk or washer of getter material, cooperating with a cathode structure including a support post mounted in, and extending axially from, a first terminal member. A helical spring is positioned with compression in an annular groove defined in the terminal member concentric with the support post, the spring bearing upon a collared sleeve slidably surrounding the support post, so as to tend to push the sleeve away from the first terminal member. Near the free end of the support post, the sleeve engages a washer which bears upon a collar of a cylindrical insulator slidably surrounding the post, the opposite surface of the collar in turn bearing upon the annular disk or washer of getter material, which extends considerably in a radial direction. A small spacing washer is sandwiched between the getter disk and a filament support plate having a plurality of radially-extending fingers, all of these elements being annular in configuration and surrounding the body of the cylindrical insulator. From the extremities of the filament support fingers, the closed ends of a plurality of looped filamentary members are supported, one free end of each filamentary loop member extending back to the first terminal member and the other free end extending back to a second terminal member in the vicinity of the first terminal member for securement and electrical connection thereto.

The action of the compressed spring, therefore, is such as to cause tension in all of the filamentary members by force transmitted through the aforementioned sleeve. The filamentary members are thereby kept accurately in position and prevented from sagging or deforming throughout the life of the device. By the placing of a getter disk or washer, which may, for example, be of tantalum or zirconium, between the end of the pushing sleeve and the fingered filament support plate, a very simplified getter fabrication is attained and its assembly into the cathode structure is very easily accomplished. Further, the getter disk is positioned coaxially within the array of filamentary members which are heated by current flowing therethrough during the operation of the device, so that the getter disk receives heat by radiation from the filaments and is elevated to a sufficiently high temperature to take up gases efficiently, at the same time being centrally located within the evacuated space to be encountered readily by any gases therein.

The features of my invention which I believe to be novel are pointed out with particularity in the appended claims. However, for a better understanding of the invention, together with further objects and advantages thereof, reference should be had to the following description, taken in conjunction with the accompanying drawing, in which the single figure is an elevational view, in section, of an evacuated electric discharge device cathode and gettering structure embodying my invention.

Referring now to the drawing, I have shown a cathode and gettering structure for an evacuated electric discharge device, a complete envelope, anode, and control electrode being omitted in the interest of simplicity. For an illustration of a suitable envelope, anode, and control electrode construction, reference may be had to the aforementioned patent of Elder et al. This cathode and gettering structure comprises a conductive first terminal member 1, insulatably sealed by means of a connecting member 2, bonded at one end thereof to member 1, and sealed at the other end thereof and to a cylindrical glass insulator 3. Insulator 3 receives in sealed relation also, as shown, a second terminal member including a re-entrant portion 4 of a cup-like member 5 which forms a part of an envelope and which carries an annular support 6. The second terminal member, including cup-like member 5 and support 6, is thus in concentrically-spaced and insulated relation to first terminal member 1. Secured to the inner end of member 1, as by welding at 7, and extending axially therefrom, there is provided a support post 8 which permits the tensioned support of a plurality of thermionically-emissive filamentary wires 9, preferably arranged in loop configuration as will be explained. An annular groove 10 is defined in the inner end of member 1, concentric with post 8, for receiving a helical spring 11, which is interposed between member 1 and an elongated sleeve 12 slidably surrounding post 8. Sleeve 12 is provided at one end with a collar 13 upon which spring 11, in compression, bears. Near the free end of post 8, a heat-resistant, preferably ceramic, insulating member or insulating bushing 14, having a cylindrical body portion 15 and a collar portion 16, is slidably positioned around post 8, the other end of spring-biased sleeve 12 bearing upon the collared end of insulating bushing 14, preferably through a stress-reducing washer 17. In accordance with my invention, a getter element, preferably an annular disk 18, of a material such as zirconium or tantalum, which readily takes up gases by absorption and chemical combination when elevated to a high temperature, is positioned around the body portion 15 of insulating bushing 14, bearing axially against collar portion 16 and extending considerably radially therefrom so as to have a relatively great surface exposed to the atmosphere within the discharge device, and to receive radiated heat, as will be presently shown. In a preferred form an annular spacing washer 19 of relatively small outer diameter, so as to leave most of the adjacent surface of disk 18 exposed and to preclude possible alloying of the getter material with adjacent metal parts, and an annular support stiffener 20, are also placed around body portion 15; disk 18, washer 19, and stiffener 20 being placed on body portion 15 axially in the order named from collar portion 16. To support and properly space the tensioned filamentary wires 9, a filament support plate 21, preferably annular as shown, is also placed in spaced relation with respect to disk 18 in a plane transverse to the axis of post 8, around body portion 16, bearing upon and being stiffened by stiffener 20. One end of each of wires 9 is secured to the periphery of plate 21, while the other ends of a first half of wires 9 are secured and connected to first terminal member 1 and the other ends of the remaining half of wires 9 are secured and connected to the second terminal member. The wires 9 may be grouped in pairs forming loop configurations, and support plate 21 may include a plurality of radially extending fingers 22 which engage the closed ends of the loops, i. e., the bights, formed by pairs of filamentary wires 9. The extremities of fingers 22 may have apertures therein through which one end of the filamentary wires 9 are threaded, or, in the preferred and simpler illustrated form, have channels in which the bights lie. The other ends 23 of a first half of filamentary wires 9 are each returned for securement and electrical connection to terminal member 1, while the other ends 24 of the remaining half of filamentary wires 9 are each secured and connected to the second terminal member. This is accomplished, for example, by arc welding the other ends 23 and 24 to the ends of elongated connectors 25 and 26 respectively. The second terminal member also includes a cylindrical reentrant portion 27 having a flared end 28 bonded thereat to the inner side of cup-like member 5, being concentric about member 1 and the re-entrant part of the envelope formed by portion 4, insulator 3, and connector 2, and being capped at the other end by an annular lid 29 having apertures 30 therein through which connectors 25 extend in spaced relation. Connectors 25 are thus bonded at 31 to first terminal member 1 through an extending washer 32 secured thereto, while connectors 26 are bonded to the second terminal member at lid 29.

It will be seen by this arrangement that the force exerted by the compression of spring 11 and transmitted through sleeve 12, insulating bushing 14 and filament support plate 21, serves to place tension on filamentary wires 9, thereby automatically keeping members 9 straight and accurately spaced during heated operation, which might otherwise cause them to sag or distort. In operation, a source of heating current is applied between first terminal member 1 and the second terminal member at support 6, causing current to flow through each of filamentary wires 9, which are thereby heated to temperatures necessary for proper emission of electrons. Terminal member 1 is preferably made of a good heat-conducting material, such as copper, to conduct heat away from spring 8 in order that spring 8 maintains its elastic properties, and that the seals at insulator 3 are not damaged by excessive heat. If it is desired, further means, such as fluid circulation means in or around member 1, may be provided to positively effect this cooling.

During the operation of the device, when filamentary wires 9 are heated, getter disk 18, which is located within the array of wires 9, receives radiated heat from the surrounding filamentary wires 9, getter element disk 18 thereby being elevated to a temperature at which the large exposed surfaces thereof located centrally within the evacuated envelope readily and efficiently take up any undesired gases which may be present. The gettering of the discharge device is successfully accomplished by a getter element,

such as disk 18, which is easily fabricated as by stamping from sheet stock, and which is conveniently assembled into the cathode structure at the time that insulating bushing 14, stiffener 20, and support plate 21 are placed on post 8.

While the present invention has been described with reference to a particular embodiment thereof, it will be understood that modifications may be made by those skilled in the art without departing from the invention. I, therefore, aim in the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

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

1. For use in an evacuated electric discharge device, a cathode and gettering structure comprising a first terminal member, a second terminal member insulated from said first terminal member, a support post mounted at one end thereof on said first terminal member and extending from said first terminal member, an insulating member mounted on the other end of said support post, an annular getter element of a material which readily takes up gases at elevated temperatures mounted transversely on said insulating member, a support plate mounted on said insulating member in spaced relation to said getter element and oriented in a plane transverse to the axis of said post, a plurality of emissive filamentary wires secured at one end of each to the periphery of said support plate, the other ends of a first half of said wires being secured and connected to said first terminal member and the other ends of the remaining half of said wires being secured and connected to said second terminal member, said getter element being located within the array of said filamentary wires.

2. For use in an evacuated electric discharge device, a cathode and gettering structure comprising a first terminal member, a second terminal member in concentrically spaced and insulated relation with said first terminal member, a support post mounted at one end thereof on said first member and extending therefrom, a sleeve member slidably mounted on said first support post, a spring interposed in compression between said first terminal member and one end of said sleeve member, an insulating member slidably mounted on the other end of said support post and engaged by the other end of said sleeve member, an annular getter element of a material which readily takes up gases when raised to an elevated temperature mounted transversely on said insulating member, a filament support plate mounted on said insulating member in spaced relation to said getter element and oriented in a plane transverse to the axis of said support post, a plurality of emissive filamentary wires secured at one end of each to the periphery of said support plate, the other ends of a first half of said wires being secured and connected to said first terminal member and the other ends of the remaining half of said wires being secured and connected to said second terminal member, said getter element being located within the array of said filamentary wires.

3. In an evacuated electric discharge device, the combination of a cathode having a support post, a collared insulating bushing around said post, a spring-biased sleeve slidably surrounding said post and bearing on said collared bushing, an annular filament support having a plurality of radially extending fingers positioned around said bushing, a plurality of thermionically emissive filamentary members in loop configuration, each supported at the bight thereof by one of said fingers and secured and electrically connected at the extremities thereof, and an annular disk of a material which readily takes up gases at elevated temperatures positioned around said bushing between the collar thereof and said filament support, said annular disk being heated by radiation from said filamentary members during operation of said cathode.

4. A cathode and gettering structure for evacuated electric discharge devices comprising a support post, an annular insulator having a cylindrical body portion and a collar portion slidably mounted on said support post at one end thereof, a spring-biased sleeve slidably surrounding said support post and bearing on the collar end of said insulator, an annular getter disk of zirconium, a spacing washer, and an annular filament support plate having a plurality of radially extending fingers, said disk and said washer and said support member being positioned coaxially on said body portion and spaced axially in the order named from said collar portion, and a plurality of emissive filamentary wires in loop configuration each supported at the bight thereof by one of said fingers and secured and electrically connected at the extremities thereof to be tensioned by said spring-biased sleeve.

5. In an evacuated electric discharge device, a cathode and gettering structure comprising a first terminal member, a support post secured to one end of and extending axially from said first terminal member, an annular groove concentric with said post being defined in said one end of said first terminal member, a helical spring positioned in said groove, a sleeve member slidably surrounding said post, a collar at one end of said sleeve member bearing against said spring, an annular insulator having a cylindrical body position and a collar portion at one end of said body portion, said insulator slidably positioned around said post with the other end of said sleeve bearing on said collar portion, an annular disk of a material which readily takes up gases when raised to an elevated temperature, a spacing washer, an annular filament support plate having a plurality of radially extending fingers, said disk and said washer and said support plate positioned around said body portion of said insulator and spaced axially from said collar portion in the order named, a plurality of filamentary wires in loop configuration each supported from the closed end thereof by one of said fingers, a second terminal member concentric with said first terminal member and insulated therefrom, the two extremities of each pair of said filamentary wires forming a loop being secured one each to said first and second terminal members respectively.

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