Aug. 1, 1939. G. M. ROSE, JR 2,167,852

ELECTRON DISCHARGE DEVICE

Filed Oct. 22, 1935

Fig. 1

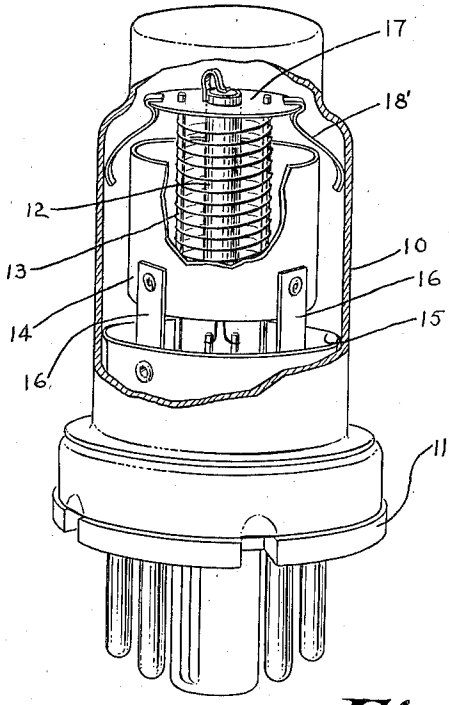


Fig. 2

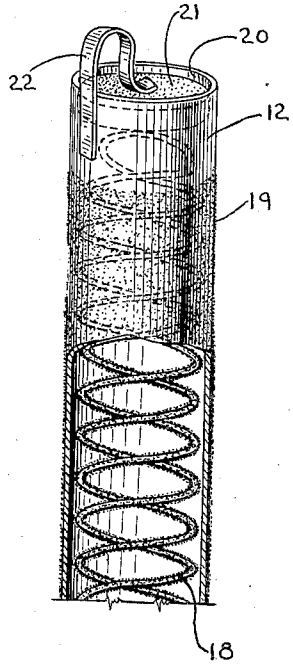
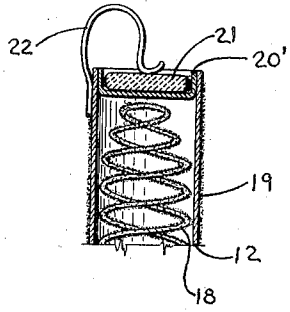


Fig. 3



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ELECTRON DISCHARGE DEVICE

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8 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, more particularly to improvements in the method and means for removing the residual gases in electron discharge tubes during their manufacture.

In the manufacture of electron discharge devices the envelope containing the electrodes is exhausted to provide a high vacuum within the envelope. The electrodes during this process are usually heated to a high temperature to drive out the gases in the electrodes. In order to render harmless whatever minute quantities of gas may remain after exhaust or be generated during later operation of the tube, a material placed within the envelope and termed a getter is heated so as to cause it to go off as vapor and combine with residual gases in the tube to form a solid deposit on the walls of the envelope. This process is known as "flashing", and, in the conventional arrangement for doing this, the getter material is supported on a small disc or plate of metal which is heated by means of a high frequency heating coil which is properly positioned with respect to the getter tab and supported outside of the tube envelope. This conventional method of "gettering" requires a separate support for the getter and an added step in the manufacture of the electron discharge device.

In connection with the development of metal envelope tubes one of the problems which has arisen is that of flashing the metallic clean-up agent or getter during the exhaust. The conventional method of placing the getter on a metal tab and inductively heating the metal to flash the getter is impractical in metal tubes because of the shielding action of the metal envelope. Attempts to fasten the getter tab to the grid, for example, and heating it by radiation have proved unsatisfactory since the tab affects the electrical characteristics of the tube and also the getter after being flashed condenses on the plate and other electrodes in the region struck by electrons. As a result secondary emission from these electrodes takes place. In addition the getter is free to condense on the insulators or insulating electrode spacers, thus increasing the leakage between the electrodes supported by the spacers.

An object of my invention is to provide an improved method of cleaning up the residual gases in electron discharge devices which is both simple and effective. Another object of my invention is to provide a support for a getter for carrying out the above method. A more specific object of my invention is to provide a simple and effective method of gettering which eliminates the necessity for using high frequency treatment to flash the getter and which is equally effective in both glass and metal envelopes.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will best be understood by reference to the following description taken in connection with the accompanying drawing in which Figure 1 is a view in perspective with parts broken away to show details of construction of an electron discharge device embodying my invention; Figure 2 is an enlarged view in perspective of the upper portion of the cathode shown in Figure 1 and embodying my invention; Figure 3 is an enlarged sectional view of the upper portion of a modification of the cathode shown in Figure 1 and embodying my invention.

The electron discharge device shown in Figure 1 has an evacuated metal envelope 10, which could however as far as my invention is concerned be glass, and a base 11. An electrode mount assembly is positioned within the envelope and comprises an indirectly heated cathode 12 preferably open ended and surrounded by grid 13 and anode 14, the anode being supported from the collar 15 by means of the insulating supporting members 16, three or more in number. The upper ends of the cathode and grid are positioned with respect to each other by means of an insulating disc 17, preferably of mica, to the edges of which are attached metallic spring spacing and supporting members 18' for positioning the grid and cathode centrally of the envelope 10. The upper end of the cathode preferably projects above the mica disc.

As best shown in Figure 2 the cathode 12 is provided with a heater 18 of the double helical coil type positioned within the cathode sleeve and insulated therefrom by an insulating coating on the heater coil. The cathode may have a coating 19 of the conventional electron emitting oxides.

In accordance with my invention the heater 18 is so positioned within the cathode sleeve 12 that a pocket or cup-shaped receptacle 20 is provided for receiving the getter in the form of a pellet 21 which fits into the cathode sleeve and rests on the upper end of the heater 18, and is preferably maintained in position by a resilient retaining member 22. As shown in the modification in Figure 3 a separate supporting cup 20' for the pellet may be used, and inserted in the end of the cathode 12, so that the getter is not in direct contact with the heater 18. A getter which

has given good results is the conventional barium-magnesium getter alloy.

After the mount has been assembled within the envelope 10, the tube is exhausted by pumps in the usual way while the envelope is heated to degas the envelope and the enclosed electrodes. Of course with a glass envelope the usual high frequency heat treatment of the electrodes would be given. During the exhaust the cathode heater 18 is raised to a sufficiently high temperature, usually somewhat above normal operating temperature, to heat the cathode and convert the coating of carbonates to the oxides so as to provide the electron emitting coating 19 on the cathode sleeve. I have found that under these conditions enough heat is transmitted to the getter to flash it at the proper stage of the exhaust and thereby produce a well exhausted tube.

While I do not wish to be limited to any particular theory, it seems probable that so long as there is gas or air in the tube the end of the cathode sleeve is considerably cooler than the rest of the cathode due to heat losses from the end of the cathode. As the gas pressure in the tube decreases the heat loss from the end of the cathode sleeve also decreases and the temperature of the end of the cathode rises. Both the gas pressure and the temperature are factors which control flashing of the getter. Toward the end of the exhaust the end of the cathode reaches a high temperature and the getter pellet of barium-magnesium alloy in the end of the cathode sleeve is flashed. The position of the getter with respect to the heater, as well as the kind of getter material, is so chosen that the maximum temperature reached by the getter at the end of the cathode during exhaust is above the flash point of the getter. By making the cathode sleeve longer and positioning the getter further away from the heater the length of time between bringing the heater up to temperature and the flashing of the getter can be increased, and thus the point in the exhaust at which the getter is flashed can be controlled as desired. It is obvious that the getter pellet could also be attached to the upper end of the cathode sleeve in the form of an enclosed pellet attached to the sleeve by a tab so that the heat transfer by conduction from the end of the cathode sleeve to the pellet can be controlled by the width of the tab and its length.

The cleaning-up of residual gases is much simplified and improved by my invention, and in addition to the simplicity of the method other advantages are that the getter is active as long as the tube is in operation, inasmuch as any getter material remaining after flashing distills off slowly at the cathode operating temperatures thus always insuring a tube free from gas. Due to the fact that the getter flash is directed away from the mount and its insulation, the deposit of getter on the mount or insulating spacers is minimized, thus reducing secondary emission and leakage. While described specifically in connection with metal envelope tubes, it is apparent that my invention is equally applicable to tubes having glass envelopes.

While I have indicated the preferred embodiments of my invention of which I am now aware and have also indicated only one specific application for which my invention may be employed, it will be apparent that my invention is by no means limited to the exact forms illustrated or the use indicated, but that many variations may be made in the particular structure used and the purpose for which it is employed without departing from the scope of my invention as set forth in the appended claims.

What I claim as new is—

1. An electron discharge device having an evacuated envelope and containing an indirectly heated cathode comprising a heater and a tubular sleeve surrounding said heater with one end extending beyond said heater for providing a pocket in one end of the tubular sleeve and means for holding getter material within said pocket near and close to said heater.

2. An indirectly heated cathode for an electron discharge device and comprising a heater, a tubular sleeve surrounding said heater with one end extending beyond the end of said heater for providing a pocket in the end of said cathode sleeve, and a getter pellet within said pocket.

3. An electron discharge device having an evacuated envelope, a tubular cathode mounted within said envelope and having a pocket in the end thereof for receiving getter material, a heater mounted within said cathode, and means on said cathode for retaining the getter material in the pocket of said cathode.

4. An indirectly heated cathode for an electron discharge device comprising a heater, a tubular sleeve surrounding said heater, a getter pellet inside said sleeve, and means for holding the getter pellet in heat conducting relationship with the walls of said sleeve.

5. An electron discharge device having an envelope, an indirectly heated cathode within said envelope, said cathode comprising a heater, a tubular sleeve surrounding said heater with one end extending beyond said heater for providing a pocket in the end of said heater and a cup-shaped getter support positioned within said pocket for receiving a getter pellet.

6. An electron discharge device having an envelope, an electrode mount assembly in said envelope including a tubular cathode, a heater in said cathode, and an insulating spacing member for spacing the cathode from the other electrodes in said mount assembly, the end of said cathode extending beyond said insulating spacer and having a pocket and getter material in said pocket.

7. An electron discharge device having an envelope, an electrode mount assembly in said envelope comprising a plurality of electrodes and including a tubular cathode, an insulated heater within said cathode, an insulating spacer for spacing the ends of the electrodes in said electrode assembly, the end of said tubular cathode extending beyond the insulating spacer and having a pocket for receiving a getter material and means for retaining the getter material in the pocket in said cathode.

8. A cathode assembly comprising a metallic cylinder having a coating of thermionic material on its outer surface, a cup shaped member closing one end of said cylinder, and alkaline earth metal in said cup shaped member.

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