July 10, 1934. L. SUTHERLIN 1,966,226

GETTER IN VACUUM TUBES

Filed Oct. 8, 1927

Fig. 1.

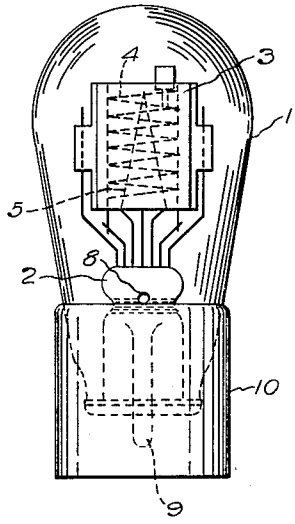


Fig. 2.

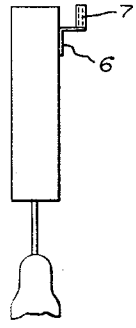


Fig. 3.

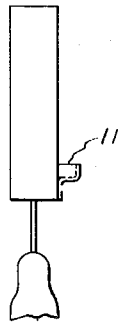
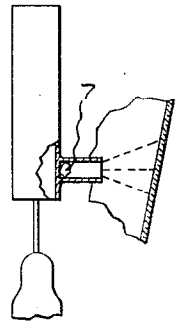


Fig. 4.



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Patented July 10, 1934 1,966,226

UNITED STATES PATENT OFFICE

1,966,226

GETTER IN VACUUM TUBES

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Application October 8, 1927, Serial No. 224,870

1 Claim. (Cl. 250—27.5)

My invention relates to methods of exhausting vacuum devices and particularly to methods of exhausting radio tubes.

One object of my invention is to provide a method of exhausting vacuum devices by the vaporization of a volatile material within the device and by predetermining the stage of the process of exhaust at which such vaporization shall occur.

Another object of my invention is to provide a method of mounting the vaporizable material used to improve the vacuum in a vacuum-tight enclosure so that the electrodes thereof may be heat treated without vaporizing the material and that the material may then be vaporized at any desired time during the process of exhaust.

A further object of my invention is to provide means whereby material vaporized within a vacuum tube may be caused to deposit on a predetermined portion of said tube.

Other objects of my invention will be apparent upon reading the following description, taken in connection with the drawing, wherein,

Figure 1 is a view, in elevation, of a radio tube embodying my invention and showing a face view of the anode thereof,

Fig. 2 is a similar view, in elevation of the anode, taken at right angles to that of Fig. 1, and

Fig. 3 is an elevational view of an anode showing a modification of my invention as applied to radio tubes.

Fig. 4 is a view, partially in elevation and partially in section, showing a further modification of my invention and including an anode and a portion of the wall of a tube.

It has become a standard practice of the art of exhausting radio tubes to weld on the anode a small quantity of a vaporizable material, such as metallic magnesium, and to heat the anode usually by high-frequency induction during the process of exhaust in order to free the anode of gases and to vaporize the magnesium. The magnesium is known in the art as a "getter," and the vaporization and the subsequent deposition of the vapor upon the walls of the tube have the property of removing residual gases which the exhaust pumps are unable to remove from the tube.

The practice of welding the magnesium directly to the anode fixes the temperature to which the anode may be heated at the time that the magnesium is vaporized. However, the steps of heating the anode to drive out occluded gases and to vaporize the magnesium should not be made dependent upon each other, since they are really independent processes, and it should be possible to practice the one to any degree or for any desired period without performing the other.

In accordance with my invention, therefore, I provide a mounting for the "getter" on the anode in which it is out of direct heat contact with the latter. This makes it possible to heat the anode to any desired degree and for any desired length of time without vaporizing the "getter", and, later on, when the proper time has arrived, to do so. I, therefore, make the two processes quite separate and distinct.

Referring to Fig. 1, a glass bulb 1 of the ordinary type known in the radio art is provided with a stem 2 upon which are mounted an anode 3, a control electrode 4 and a cathode filament 5. All the foregoing are well known in the art and require no detailed description. Upon the anode 3 is welded a small bracket 6 which supports, at its outer end, a suitable piece of magnesium 7, or any other "getter" well known in the art. By varying the length of the bracket 6, the distance separating the "getter" 7 from the anode 3 and, correspondingly, the rate at which heat will be transmited between the two may be fixed at any desired value.

A radio tube so constructed may be exhausted, by any of the well known vacuum pumps, through the orifice 8 and exhaust stem 9. During the progress of the standard method of exhaust, the anode is heated to approximately 900° C. by bringing it within the field of a coil carrying high-frequency currents. The coil induces currents in the body of the anode metal thus heating it to the desired temperature to cause it to vaporize. It may, however, be desirable that it shall first be heated to some lower temperature in order to drive out gases which may be occluded within the body of the "getter" itself.

The precise degree to which the "getter" is actually heated may be regulated through a considerable range by proper positioning of the high-frequency coil. When the coil is placed nearer to the side of the anode which is opposite to the bracket 6 the "getter" will be heated less than it will when the high-frequency coil is brought near to the "getter" itself. When the anode has been heated for a sufficient period to remove the occluded gases to the desired degree, the high-frequency coil may be brought as near as possible to the "getter" 7, and the temperature of the latter raised to the vaporizing point. The tube may then be sealed off from the pump and, after being provided with a base 10, may be put into use.

It may, however, be desirable to only partially

vaporize the "getter" 7 before sealing the tube off from the pump, in which case, the high-frequency coil may be brought near the "getter" 7 after the tube has been sealed off and more of the "getter" vaporized. It is frequently of advantage, when this is done, to supply the tube with current, and heat all the electrodes well above their normal operating temperatures for a short time before finally vaporizing the getter. Tubes treated in this way have given most excellent service and have been found to draw a grid current with less positive potential thereon than structurally similar tubes exhausted by processes of the prior art. Because of this fact, these tubes are more efficient detectors.

Instead of using a single high-frequency coil to heat both the anode and the "getter", a small separate coil may be provided for the latter operation.

An alternative method of practicing my invention makes use of an anode of the type shown in Fig. 3. Instead of mounting the "getter" on a bracket on the anode, a small piece of magnesium metal is introduced into the tube at the time it is made up and allowed to lie loosely against the glass. When the anode has been heated sufficiently to free it from gases, the tube may be tilted and shaken in such manner as to cause the little piece of magnesium to fall on the anode and it may then be vaporized by direct conduction of heat from the latter. In order to facilitate the practicing of this method, a small pocket, such as 11 in Fig. 3, may be provided in the anode. This will catch the piece of magnesium when the tube is shaken and hold it until it has been vaporized.

In the case of certain radio tubes, notably those which are to be operated with a considerable bias potential between the grid and cathode, difficulty has been encountered because of the fact that films of getter material deposit on the glass between in-leading wires and cause current leakage between electrodes. In many radio circuits, this produces undesirable effects. I have accordingly devised the arrangement shown in Fig. 4 to prevent such leakage.

The getter is positioned at the bottom of a small well formed by welding the end of a metal tube to the anode, or to such a bracket as 6 in Fig. 1. This tube may, for example, be ⅛ of an inch in inside diameter and ¼ of an inch long. Its axis is directed so that the vaporized getter which issues from it when the latter is heated will deposit on a relatively small area of the tube wall well removed from any electrodes or conductors thereto.

This arrangement has a further advantage in that getters, as ordinarily deposited, form a mirror surface over a large part of the walls of a tube and this prevents the heat from the electrodes from escaping from the tube in the form of radiation. In consequence of permitting such an escape tubes having the arrangement shown in Fig. 4 run at lower temperature than tubes of the prior art having the same dimensions and power input.

It will be understood that, while I have referred to magnesium metal as the "getter", other materials, such as calcium, for example, may be employed for this purpose. I, therefore, desire to cover broadly, in the claims any material the vaporization of which results in improving the vacuum of a tube in which it is enclosed.

It will thus be seen that I have provided methods by which it is possible to render the heating of the anode and the vaporization of the "getter" during the exhaust of a vacuum tube independent of one another.

While I have described the foregoing specific methods of practicing my invention, numerous other ways of employing the principles thereof will be evident to those skilled in the art. I desire, therefore, that the following claim be given the broadest interpretation consistent with the principles which I have set forth and with the limitations imposed by the prior art.

I claim as my invention:

In a vacuum-tight container, a getter holder, a getter in said holder, a conductive support for said getter holder, said getter holder having an orifice in one side large enough to avoid rupturing said getter holder in flashing said getter, said conductive support holding the orifice of said getter holder closely adjacent a wall of said container whereby the trajectory of said getter through said orifice intersects a relatively small area of said container wall.

LEE SUTHERLIN.