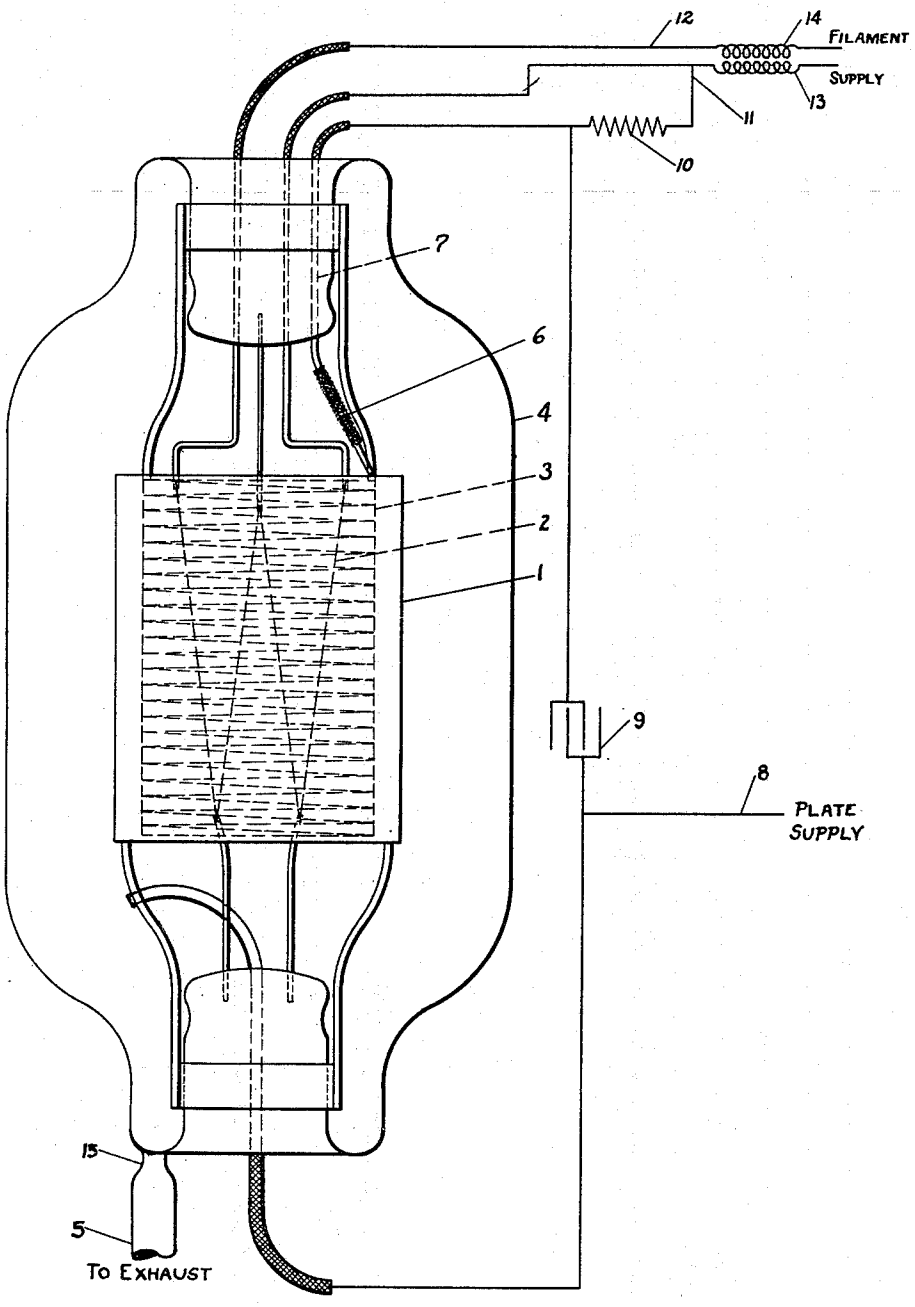
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METHOD OF CLEANING UP GASES

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METHOD OF CLEANING UP GASES

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This invention relates to electron discharge devices and more particularly relates to a means of effecting complete evacuation of said devices by the provision of a novel means of effecting the vaporization of a so-called getter material within said device at the conclusion of the usual mechanical exhaust process, for the purpose of removing the residual gases contained therein.

Heretofore in the art it has been customary to exhaust the electron discharge devices by mechanical means such as vacuum pumps and when the internal pressure of the device has been reduced to the minimum value permissible with such devices, a so-called "getter" material such as magnesium, calcium, misch metal, and other such highly reactive materials has been vaporized within the evacuated device to combine with and eliminate the remaining residual gases therein.

One of the most common means of vaporizing this getter material has been by mounting the getter on a metallic tab spaced from the electrodes in the neck of said device so that the same is substantially unheated by the assembly and metal degasification procedures, and thereafter heat the metal tab by means of induced electric currents to the temperature at which the said getter material is substantially vaporized. Such a method requires personal attention during the vaporizing operation, is difficult to control, and moreover requires a particular assembly of parts during mounting, whereby the getter mounted on the tab may be placed in such relation to the electrodes that subsequent operations employing heat will not substantially destroy the same, or substantially oxidize the metal tab upon which it is placed.

This process of gettering is not entirely efficient in that the metal tab upon which the getter material is mounted becomes oxidized or adsorbs sufficient gas due to its necessary location with respect to the sealing-in fires to substantially neutralize the contemplated gettering action on the residual gases in the envelope. This effect is particularly noticeable in electron discharge devices of the large power tube types, such as is known in the trade as UV—851 and others of similar construction. In addition thereto it is sometimes desirable to effect a secondary gettering action subsequent to the sealing off procedure in order to clean-up gases which are often liberated from the glass at the seal or by back diffusion from the pumps. It is usually impossible by the usual mounting means to effect a substantial secondary gettering action within devices of this character following the sealing off of the said device.

One of the objects of the present invention is to provide a novel means of effecting the vaporization of a getter material within the device wherein the said getter may be vaporized in any desired and required amount as needed, and to permit the retention of a sufficient remainder to be effective in a second gettering process if desirable.

Another object of this invention is to provide a means of effecting the vaporization of the getter material by non-inductive heating which means would be operable when the said tube is subsequently sealed off and removed from the source of high frequency currents employed in the inductive heating process.

Another object of this invention is to reduce the variable effects heretofore encountered in the electron discharge devices utilizing high plate potentials due to the deleterious effects of residual gases therein.

Other objects and advantages may be seen as the invention is more fully disclosed.

The basic principle involved in my invention is the utilization of the heating effect of ultra high frequency currents passing through a metal conductor, this heat being transferred by radiation or conduction to the getter positioned in close relation to the heated conductor. The source of the high frequency current passing through the conductor is from an external oscillation circuit connected with the plate and filament leads of the device. By proper regulation of the input energy of the tube the high frequency current produced by the external oscillation means may be controlled within narrow limits and the getter may be heated to any desired temperature and for any desired interval of time as desired.

In order to more fully comprehend the na-

ture of my invention, reference is to be made to the accompanying drawing wherein is shown a diagrammatic view of a regulation type of a three electrode electron discharge device incorporating the inventive feature.

The three electrodes, plate 1, filament 2, and grid 3 or control electrode are enclosed in the glass envelope 4 which is mounted on the exhaust system at point 5. The "getter" material 6 which is to be utilized in effecting substantial clean-up of residual gases within the evacuated device is mounted in a suitable manner in close relation to grid lead 7 in the manner indicated.

At the conclusion of the mechanical exhaust procedure and prior to sealing off the device at point 5 the following electrical connections are made.

The plate voltage supply lead 8 is connected to a condenser 9 of .002 M. F. D. capacity to the grid lead 7 and from there through a resistance 10 to one of the filament leads 11 and 12, which leads have radio frequency chokes 13 and 14 placed in series in the filament circuit.

As a specific embodiment of this invention the process will be described as utilized in effecting the gettering of an electron discharge device of the type known to the trade as the UV—851, however, the basic principle involved may be applied equally as well to tubes of other types with certain modifications in equipment to provide the oscillation current necessary to produce the desired heating effect in the grid lead of the device.

During the assembly of the device the desired getter material is placed in desired close relation to the grid lead of the device denoted in the drawing as numeral 7 which may most conveniently be done by winding a wire or ribbon of the getter material about the grid lead in close spiral formation. Thereafter the device is assembled and attached to the exhaust system in the usual manner as indicated at 5. The internal pressure of the device is thereafter reduced to the minimum figure permissible by the exhaust means which with the apparatus available approximates .01 micron. After the metal parts therein have been suitably heated and electronically bombarded to remove occluded and adsorbed gases therein, the glass envelop highly heated and the pressure within the device reduced to the above mentioned lowest permissible figure, the residual gases are then removed by flashing the getter in the following manner.

A suitable potential in volts is applied to the plate 1 of the device and the filament 2 thereof is suitably heated to the required operating temperature depending upon the nature of the electron-emitting cathode employed. Thereafter the grid lead is connected to the condenser 9 to the plate supply lead and to the resistance 10 to the filament supply. In this particular instance condenser 9 is of .002 M. F. D. capacity and resistance 10 is of 10,000 ohms. This sets up oscillatory currents which increase with increase in the plate potential applied. By varying the plate potential therefore at the plate supply source, the energy input to the grid lead may be increased or decreased. The heating effect produced by such an oscillatory current depends upon the resistance of the grid lead within the tube. The internal grid lead is usually made of stranded copper wire comprised of 22 strands of .010" wire. The plate voltage applied may be increased until the high frequency current passing through the grid lead heats the internal portion to bright redness which is more than sufficient to heat up the magnesium, magnesium-alkali earth metal alloy, misch metal or other getter material employed, to the vaporization point.

Through the utilization of a proper pressure ionization gauge the gettering action of such heating process may be followed and at the proper internal pressure the device may be sealed off.

Thereafter it is often noted that gases liberated from the glass at the seal 15 or which may be accumulated in the device from back diffusion, accumulate to such an extent as to substantially destroy the desired operating vacuum of the device.

By my process I am enabled to substantially effect a secondary clean-up action by again heating up the getter material in an identical manner as heretofore described whereby additional getter material may be vaporized and the operating efficiency of the device again restored. Subsequently during the operation of the device, sufficient gas may be developed therein by electronic dissociation of intermetallic compounds under the influence of electronic bombardment to substantially destroy the operating efficiency thereof. In that event I am enabled to utilize this means of effecting a third clean-up action therein.

While I have specifically described the invention as relates to the utilization thereof in the manufacture of a specific type of an electron discharge device, it is obvious to one skilled in the art that many variations and departures from the specific steps therein and in the specific process may be made without departing essentially from the nature of my invention.

What is claimed is:

1. The method of treating an electron discharge device including a grid lead and a vaporizable getter material attached thereto, comprising exhausting the device, passing an ultra high frequency current through the grid lead to heat the same during the exhaust operation, sealing off the device, and thereafter again passing an ultra high frequency

current through the grid lead to heat the same and flash the getter material.

2. The method of treating an electron discharge device including a grid lead and vaporizable getter material attached thereto, comprising exhausting the device, passing an ultra high frequency current through the grid lead to heat the same and flash a portion of the getter material during the exhaust operation, sealing off the device and thereafter again passing an ultra high frequency current through the grid lead to heat the same and flash the getter material.

In testimony whereof, I have hereunto subscribed my name this 26th day of July 1928.

HAROLD EDWARD CLARRY.