Sept. 15, 1936. H. DAENE 2,054,119

ELECTRON DISCHARGE DEVICE

Filed Aug. 18, 1934

Fig. 1

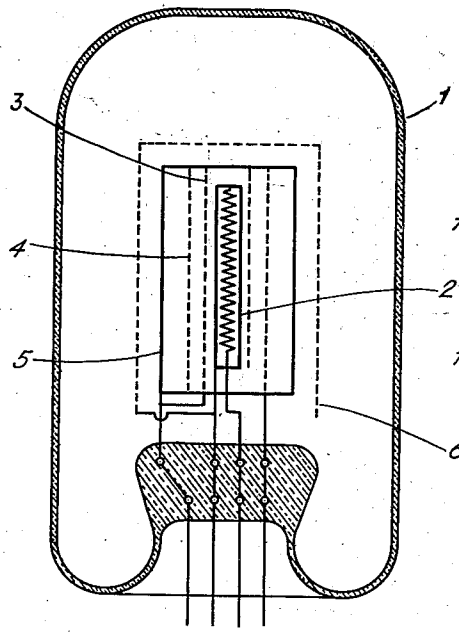


Fig. 2

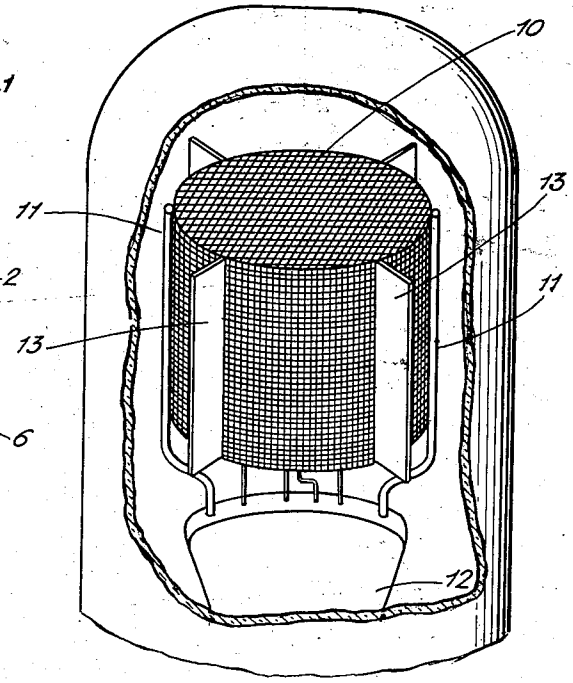
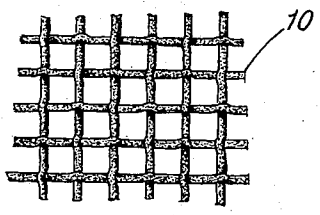


Fig. 3



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ELECTRON DISCHARGE DEVICE

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2 Claims. (Cl. 250—27.5)

My invention relates to electron discharge tubes provided with an outer screen shield which surrounds the other electrodes in the mount and carries no electrical load in normal operation of the tube.

To degas the electrodes of electron discharge vessels or tubes recourse is usually had to heating by high frequency currents. This method of heating employs a coil mounted outside the discharge vessel and energized by high-frequency currents which induce eddy-currents in the metal parts positioned within the vessel. As a result, these metallic parts are heated and thereby degassed. In the case of multi-electrode tubes of the usual form of construction having an outside anode, this heating affects substantially only the anode. It is unnecessary to adopt any particular means to heat the grid inasmuch as the mass of the grid is small so that the amount of gas which may be released during operation can be readily absorbed by getters. But the degassing of tubes becomes more difficult where a metallic shield or protective electrode surrounding the other electrodes is employed to afford protection from disturbing fields and to prevent impact of electrons upon the glass wall. If in the case of such tubes the high-frequency current method is used to degas the electrodes the shield or screen will become thoroughly degassed, whereas the electrodes within the shield will fail to attain the degassing temperature because only a part of the high frequency energy will be able to penetrate thru the protective screen electrode. Any attempt to improve the heating action by increasing the high frequency energy in the coil is limited by the melting temperature of the protective electrode. Under high frequency treatment the shield electrode becomes hot while the inner electrodes remain comparatively cool, hence the high-frequency heating method under these conditions is inadequate for degassing the electrodes of the tube.

It is therefore an object of my invention to provide an electron discharge tube having an outer screen electrode which will permit proper heating of the inner electrodes during the high frequency heat treatment to degas the electrodes in the tube.

In accordance with my invention, the usual simple and inexpensive high frequency heating method can be successfully applied to tubes having an outer screen electrode which in normal operation carries no electrical load and surrounds one or more inner electrodes which in normal operation carry an electrical load by making the heat losses of the outer unloaded electrode as large as possible. This may be accomplished by increasing the radiation and the conduction heat losses of the screen shield. The heat radiation of the outer electrode can be increased, for example, by roughening, painting or blackening, or by both roughening and blackening its surface. The radiating surface may also be increased by providing the protective electrode with fins, corrugations, or radiator ribs. Another way to increase radiation would be to make the protective electrode in the form of a wire network or screen which is blackened. The conduction heat losses may be increased by connecting the protective electrode in a thermally conductive manner with other parts of the discharge vessel, as for example, by securing the protective electrode with heavy or stout metal stays or supports in the press.

If a discharge vessel having a protective electrode of the kind here disclosed is heated by the action of eddy-currents, the protective electrode will give off so much heat that the high frequency energy may be considerably increased without the protective electrode being melted or vaporized. The high frequency energy which penetrates thru the protective electrode is correspondingly increased with the result that the plate or anode will be adequately heated. The heating of the plate will also be increased by the increased thermal radiation from the protective electrode.

While in the normal high frequency heat treatment of tubes with a protective electrode, which is not provided with means for increasing its thermal radiation, the inner electrodes are insufficiently heated, the use of a protective electrode made in accordance with my invention will permit the inner electrodes to be sufficiently heated so that the degassing is materially improved.

Ways and means for increasing the thermal losses of an electrode have previously been devised but this has heretofore been done solely for the purpose of cooling the electrodes which become heated during normal operation of the tube. In my invention on the other hand, I provide an outer protective electrode, normally cold in operation, with means for increasing its radiation in order that during manufacture the other electrodes may have the benefit of higher temperatures and greater heating.

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 refer-

ence to the following description taken in connection with the accompanying drawing in which Figure 1 is a schematic vertical cross section of a tube embodying my invention and Figure 2 is a perspective view of a modification of the outer screen electrode shown in Figure 1, and Figure 3 is a detail view of a portion of the outer screen electrode shown in Figure 2.

Referring to Figure 1, the electron discharge tube 1 has mounted therein a cathode 2, a space-charge grid 3, a control grid 4 and an anode or plate 5. In accordance with my invention, the protective electrode 6 surrounding the plate 5 is formed from a wire network or screen, which is blackened. This shielding or screening electrode 6, as a consequence, possesses greater radiation characteristics and permits a substantial increase in the high frequency energy without deleterious effects to the electrode during the degassing of the electrodes by high frequency heating. The protective electrode (or anode screening net or grid) is preferably connected to the cathode lead.

In the modification shown in Figure 2, this outer screen electrode 10 is supported by means of relatively heavy side rods 11 in the press 12 and is provided with the radially extending fins 13 secured at spaced points around its periphery. The screen 10 may be blackened or carbonized as indicated in Figure 3, to increase its heat radiating properties. Thus, by means of the blackened surface and the fins 13 the heat radiation from the electrode is greatly increased over the ordinary screen electrode and the heavy side rods 11 assist in conducting the heat away from the electrode to the press. This of course results in maintaining the protective electrode at a safe temperature during exhaust, although the high frequency heat treatment is increased in intensity to properly heat the electrodes within the outer protective electrode 10.

While I have indicated the preferred embodiment 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 a mount supported from a press and provided with a closed cylindrical screen electrode of wire network and a plurality of inner electrodes within said outer electrode and means on said outer electrode for increasing its heat radiation characteristic, and other means for increasing the heat conduction from the outer electrode to the press, comprising supporting side rods of relatively large cross sectional area embedded at their lower ends in said press and secured in intimate contact over an extended portion of their upper ends to the sides of said outer protective electrode.

2. An electron discharge device comprising, a mount supported from a press comprising a cathode, a concentrically positioned grid electrode, and an imperforate anode electrode, and a closed cylindrical screen electrode surrounding said anode electrode, and heat radiating means on said screen electrode to reduce the temperature difference between the screen electrode and the inner electrodes during high frequency heat treatment.

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