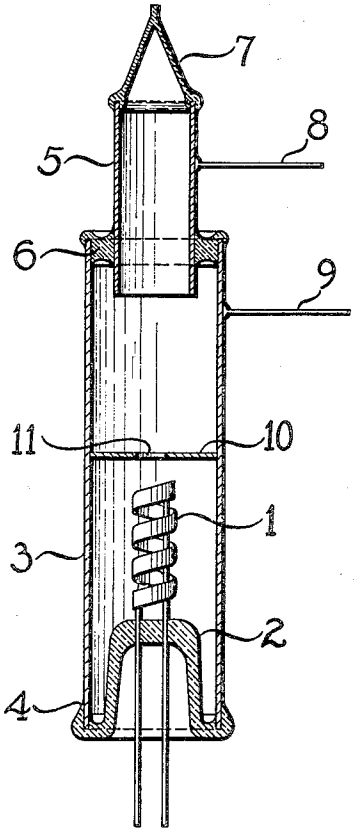
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ELECTRON TUBE

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ELECTRON TUBE

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This invention relates to improvements in electron discharge devices which are equipped with a grid for the control of the discharge current between the main electrodes and has for its object to provide a more efficient control of such a tube by means of the grid. The invention is particularly applicable to gaseous electron discharge tubes.

Another object is to provide an electron tube in which the outer envelope is largely composed of a metal.

Another object is to provide a tube having a grid which has a large and efficient radiating surface and which therefore operates at a relatively low temperature.

Another object is to provide a grid, the effectiveness of which is not impaired to the degree customary with other known forms by the deposition of emission increasing substance which is thrown off by the cathode.

Other objects and advantages will appear from the following specification and drawing, which latter illustrates one embodiment of my invention.

Referring to the drawing, an electron tube of the vapor or gaseous type which may contain for instance mercury vapor, has a filamentary cathode 1 which in the present instance is illustrated as a spiral conductor. The leading-in wires for the cathode 1 are embodied in a conventional seal 2 of glass or other refractory material. Surrounding the cathode and forming the major part of the outer enclosure of the evacuated space is a grid 3 in the form of a suitable metal cylinder. The grid is joined to the seal 2 at 4 in any approved manner. Mounted at the end of the grid opposite to that at which the cathode is mounted is a cylindrical metallic anode 5 which is joined to the grid by means of a seal 6. The cylindrical anode projects slightly beyond the seal 6 into the grid 3, and outward beyond seal 6 to form a part of the outer envelope of the evacuated space. A third seal 7 joined to the cylindrical anode 5 serves as a conduit for exhausting the vessel and is sealed off after such exhaustion. However, it is also possible to seal off the vessel by closing the end of the anode by welding or other suitable means. The anode and the grid are provided with suitable terminal wires 8 and 9 respectively. The grid is divided longitudinally into two compartments by means of a metallic partition 10 which completely divides it into two halves except for a relatively small opening 11 through which the discharge current between the cathode and anode may pass.

A tube constructed in this manner showed much superior control characteristics than the tubes without the partition known heretofore. In gaseous electron discharge tubes the grid generally is capable of exerting control over the starting of the discharge between the anode and cathode until the voltage between the main electrodes reaches a certain maximum value after which the grid loses its control function. The grid voltage which prevents discharge between anode and cathode usually increases with the voltage between the main electrodes, more or less linearly. It has been found that a tube provided with a partition but otherwise identical to another tube without the partition gave reliable control for voltages between the anode and cathode up to 600 volts whereas the tube without the partition could not be controlled by means of the grid for voltages above 300 volts.

While a complete theory of operation of the improved tube is not yet available it is believed that the improved results are due to the following facts: In the conventional tube without the partition, electron increasing material thrown off by the cathode is deposited on the grid and due to the heating of the grid it produces there secondary emission to the anode which secondary emission impairs the controlling effect of the grid. In the present instance the grid is very effectively cooled and this reduces to some extent the secondary emission but such secondary emission nevertheless takes place. The introduction of the partition makes it practically impossible for any emission increasing material thrown off by the cathode to be deposited on the surface of the grid in the upper compartment near the anode, while any electrons originating in the deposit on the surface of the grid in the lower compartment near the

cathods as secondary emission are effectively prevented from entering the upper chamber surrounding the anode by the comparatively small opening in the partition. Therefore a direct conduction due to secondary emission from the grid to the anode and the resulting impairment of the control function of the grid is obviated by the present construction.

The electrons which emanate from the cathode 1 in the lower compartment when the tube is non-conducting, have a relatively low speed and are prevented from becoming accelerated by the grid 3 which surrounds them almost completely. These electrons are therefore prevented from passing through the opening 11 to the anode 5 and to start ionization which would cause a passage of current through the tube. Furthermore, due to the small opening in the partition, the amount of active material thrown off by the cathode which can reach and deposit upon the anode is very small. This, together with the fact that one end of the anode projects beyond the compartment formed by the tubular grid and forms part of the tube envelope effectively cooling the whole anode, diminishes the tendency of the anode to act as a cathode during the negative half cycle when the tube is operating on alternating current, and thereby cause "arc-backs" or conduction in the reverse direction.

What I claim as new and desire to secure by Letters Patent is:

1. A gaseous electron discharge tube including a cathode, an anode and a control grid forming part of the envelope of said tube and being divided into two compartments connected by a relatively small aperture, said cathode and anode being arranged respectively in the two compartments.

2. A gaseous electron discharge tube including a cathode, an anode and a control grid forming part of the envelope of said tube and being divided into two compartments by a constriction having a relatively small aperture, said cathode and anode being mounted respectively in the two compartments.

3. A gaseous electron discharge tube including a cathode, an anode and a control grid comprising a cylinder and forming part of the envelope of said tube, said cylinder being divided into two compartments by a transverse constriction having a relatively small central aperture, said cathode and anode being mounted respectively in the two compartments.

4. A gaseous electron discharge tube including a cathode, an anode and a control grid comprising a cylinder and forming part of the envelope of said tube, said cylinder being divided into two compartments by a transverse constriction having a relatively small central aperture, said cathode and anode being mounted respectively in the two compartments along the central axis of said cylinder.

5. A gaseous electron discharge tube including a heated cathode, an anode and a control grid comprising a cylinder and forming part of the envelope of said tube, said cylinder being divided into two compartments by a transverse constriction having a relatively small central aperture, said cathode and anode being mounted respectively in the two compartments along the central axis of said cylinder.

6. A gaseous electron discharge tube including a control grid comprising a metal cylinder and forming part of the envelope of said tube, said cylinder being divided into two compartments by a conducting transverse constriction having a relatively small central aperture, a heated cathode mounted in one compartment, and a tubular anode mounted at and insulated from the outer end of the other compartment.

7. A gaseous electron discharge tube including a control grid comprising a metal cylinder and forming part of the enevlope of said tube, said cylinder being divided into two compartments by a conducting transverse constriction having a relatively small central aperture, a heated cathode mounted in one compartment and a tubular anode mounted at and insulated from the outer end of the other compartment, said tubular anode forming a conduit for evacuating the tube.

8. A gaseous electron discharge tube including a control grid comprising a metal cylinder and forming part of the envelope of said tube, said cylinder being divided into two compartments by a conducting transverse constriction having a relatively small central aperture, a heated cathode mounted in one compartment and a tubular anode mounted at and insulated from the outer end of the other compartment, one end of said tubular anode projecting outwardly beyond said compartment to form a part of the tube envelope.

In witness whereof, I have hereunto subscribed my name.

EUGENE A. GIARD.