

Sept. 15, 1942.

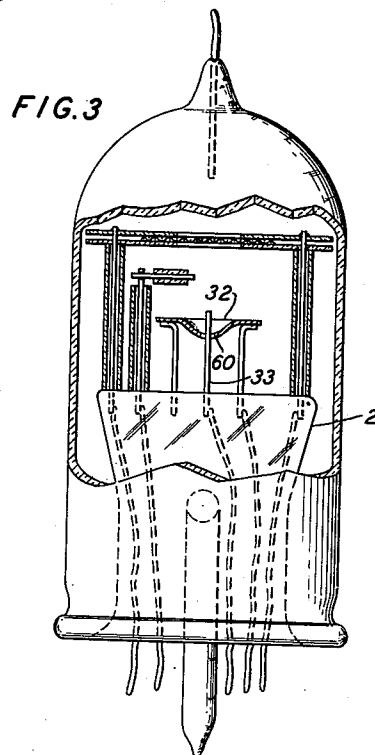
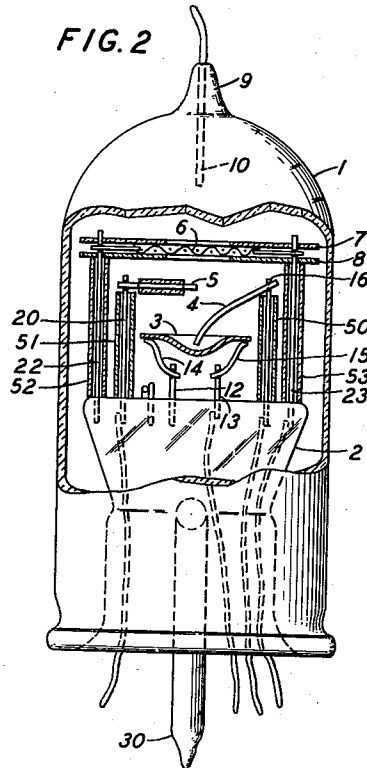
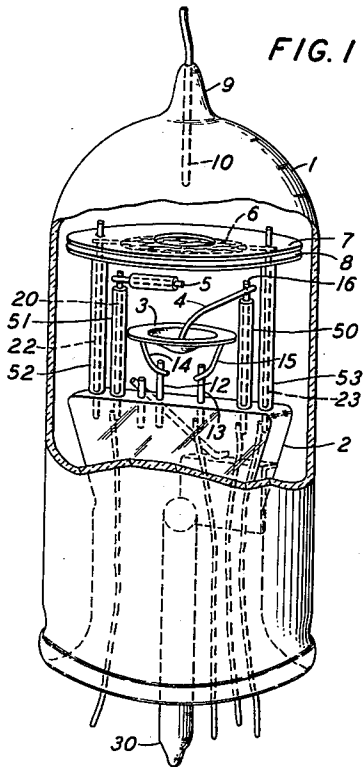
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2,295,569

GASEOUS ELECTRON DISCHARGE DEVICE

Filed Nov. 27, 1941

2 Sheets-Sheet 1



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FIG. 4

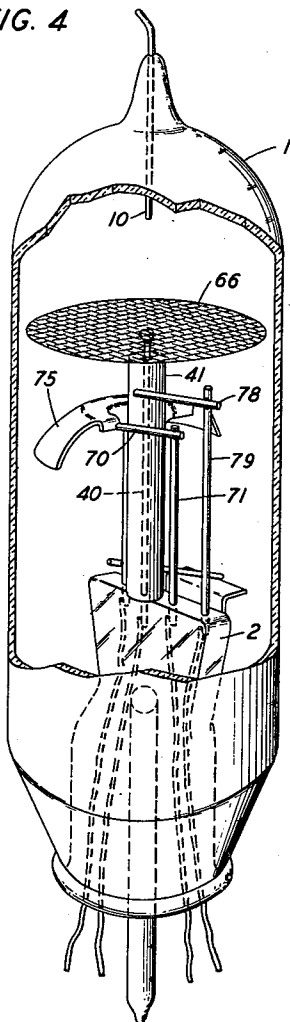
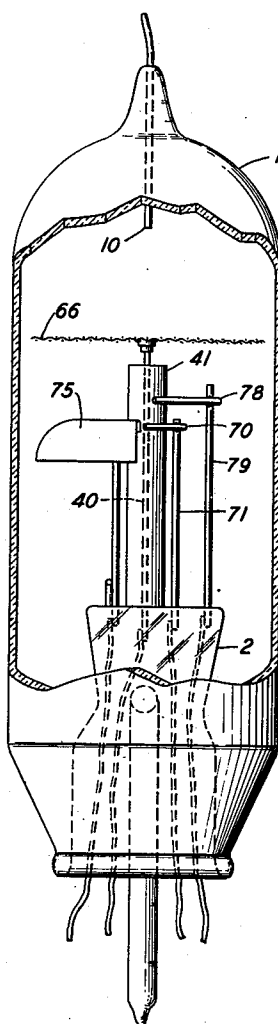


FIG. 5



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GASEOUS ELECTRON DISCHARGE DEVICE

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5 Claims. (Cl. 250—27.5)

This invention relates to gaseous electron discharge devices and more particularly to such devices wherein a plurality of cold electrodes are employed including a screen electrode.

In this type of screen grid tubes, in which, in addition to the anode, a cathode and a control electrode are employed, it has been found that for a given anode voltage the screen voltage necessary for transfer may change by 30 volts or more because of control gap current variation. In some circuits in which such tubes are used, it is either impossible or impractical to hold the control gap current within a narrow range and hence large swings of voltage on the screen electrode are necessary to get from non-transfer to transfer.

An object of this invention is, therefore, to improve and facilitate the operation of cold electrode gaseous electric discharge devices of the screen grid type.

In accordance with one feature of this invention, the difficulty aforementioned is overcome by the addition of an auxiliary anode between the cathode and the screen.

Another feature of the invention resides in employing a flat screen conforming to the shape of an enclosing envelope for the electrodes and extending across the envelope, thereby substantially dividing the envelope into two compartments, one containing the main anode and the other containing the cathode, control electrode and the auxiliary electrode.

The invention and various features thereof will be understood more fully from the following detailed description with reference to the accompanying drawings, in which

Fig. 1 is a perspective view of a discharge device illustrative of one embodiment of this invention, a portion of the envelope being broken away to show more clearly the internal structure;

Fig. 2 is a side view partly in section of the device of Fig. 1, a portion of the envelope being broken away;

Fig. 3 is a modified form of the device of Fig. 1 in which the control anode projects through the center of the cathode instead of being mounted at the side thereof;

Fig. 4 is a perspective view of another illustrative embodiment of this invention with a portion of the vessel broken away; and

Fig. 5 is a side view of the device of Fig. 4 with a portion of the vessel broken away to show more clearly the arrangement of the electrodes.

Referring now to Fig. 1 of the drawings, there is shown an envelope 1 having a reentrant stem

2 at one end from which a main cathode 3, a control anode 4, an auxiliary anode 5, and a screen electrode 6 are supported. A main anode 10 is supported at the other end of the envelope and is sealed into the tip 9.

The cathode 3 is a dished metallic disk and is coated on the side facing the anode 10 with a suitable electron emissive material, such as barium and strontium oxides. Arms 14 and 15 secured to the outer portion of the disk are fixed to wires 12 and 13, respectively, embedded in the stem 2. The control anode 4 in the form of a wire or rod is supported from a wire or rod 16 embedded in the stem 2, and is slightly bent at its end so that the end away from the support is juxtaposed to the center of the main cathode 3. The auxiliary anode 5 is in the form of a rod or wire. It is secured at one end, as by welding, to an upright wire or rod 20 embedded at one end in the press 2. The free end of the auxiliary anode extends over the area above the center of the cathode 3. The screen electrode 6 is supported between apertured mica disks 7 and 8, intermediate its center and periphery, on two uprights 22 and 23 embedded at their lower ends in the stem 2. The main anode 10 in the form of a wire or rod is sealed into the tip 9 of the envelope. All of the electrodes of the device may be of nickel or other suitable metallic material. The envelope contains a filling of argon gas at a pressure of 10 to 25 millimeters of mercury. A mixture of gases, such as argon and neon, may also be used. A tube 30 extending from the stem 2 is provided for exhausting the envelope. Sleeves 50, 51, 52 and 53 of insulating material, such as glass, surround the members 16, 20, 22 and 23, respectively.

In the operation of the device of this invention the auxiliary electrode 5 is supplied with a fixed positive potential with respect to the cathode 3 less than the breakdown value but greater than the sustaining value of the discharge gap and the current flowing in the gap is materially greater than the current in the control gap. The constant current flow in the auxiliary gap then determines the screen electrode voltage for transfer of the discharge to the main gap between the cathode 3 and the main anode 10. This voltage will have a low and constant value within narrow limits so that large swings of voltage are avoided. The partition type of screen electrode which shields the control and auxiliary discharges from the main anode prevents the escape of electrons into the main anode gap until the transfer func-

tion of the screen is desired by the application of the proper potential. One of the features of this construction is that a plurality of different values of potential must be applied to the various control gaps before the discharge is transferred to the main gap between the cathode and anode so that the device is of considerable value in electrical interlocking systems and various types of lockout circuits in telephone plants.

In Fig. 3 a modified form of the device of Figs. 1 and 2 is shown, the modification comprising providing the cathode 32 with an aperture at its center through which the control electrode 33 extends, the control electrode being embedded at its lower end in the press 2.

In Figs. 4 and 5 a further embodiment of the invention is shown in which the apertured or mesh screen electrode 66 is suitably fixed to and supported at its center by a rod or wire 40, embedded at its lower end in the stem 2, and is surrounded over substantially its entire length by a sleeve 41 of insulating material, such as glass, and in which the cathode 75 is in the form of an inverted semibowl with its bottom dished, the dished portion facing the main anode 10 being coated with a suitable electron emissive material. The rod or wire control electrode 70 is juxtaposed to the center of the cathode 75 and is suitably secured to a rod or wire 71 embedded in the stem 2. The auxiliary anode 78 in the form of a wire or rod is suitably secured to a rod or wire 79 embedded at the lower end in the stem 2.

Although specific embodiments of this invention have been shown and described, it will be understood, of course, that various modifications may be made therein without departing from the scope and spirit of the invention as defined in the appended claims.

What is claimed is:

1. A gaseous electric discharge device comprising an enclosing envelope, a cathode and an anode forming a main gap disposed in said vessel, a screen electrode extending across said gap, a control electrode adjacent said cathode, and an auxiliary anode separated from said main anode by said screen electrode.

2. A gaseous electric discharge device comprising an envelope having a stem at one end thereof, an anode within said envelope and supported from the other end thereof, a screen electrode extending substantially across said envelope, a cathode and a control electrode supported from said stem, and an auxiliary anode between said stem and said screen electrode.

3. An electric discharge device comprising an envelope having a filling of gas therein and a stem at one end thereof, a cathode and a control electrode supported from the stem, an anode supported from the other end of said envelope, a screen electrode between said cathode and anode and extending across said envelope, and an auxiliary anode.

4. An electric discharge device comprising an envelope having therein a filling of gas, a cathode, an anode and a screen electrode therebetween, and interposed between said screen electrode and said cathode in the order named proceeding from the cathode, a control electrode and an auxiliary anode.

5. A gaseous electric discharge device comprising an envelope having a stem at one end thereof, a main anode mounted in the other end thereof, a dished cathode, a control electrode and a screen electrode supported from said stem, said control electrode being disposed at the center of said cathode, and an auxiliary anode disposed between said cathode and said screen.

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