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O. H. SCHADE

2,175,704

ELECTRON DISCHARGE DEVICE

Filed Jan. 29, 1938

Fig. 1

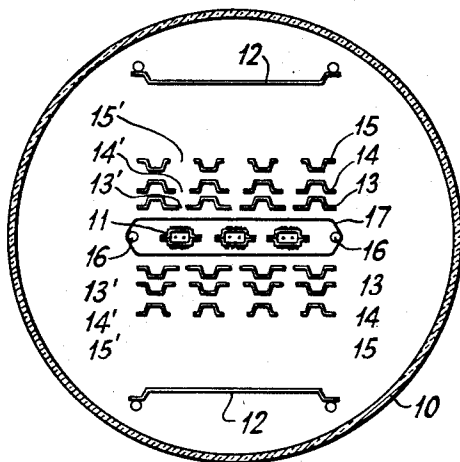


Fig. 4

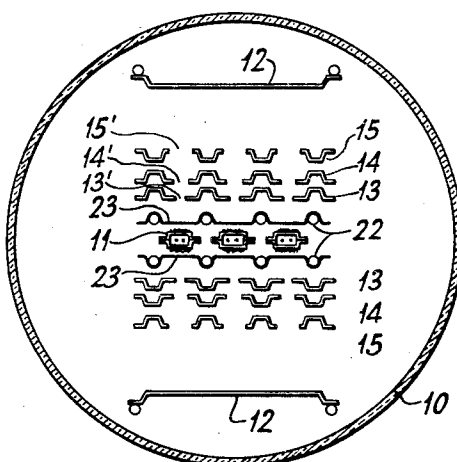


Fig. 2

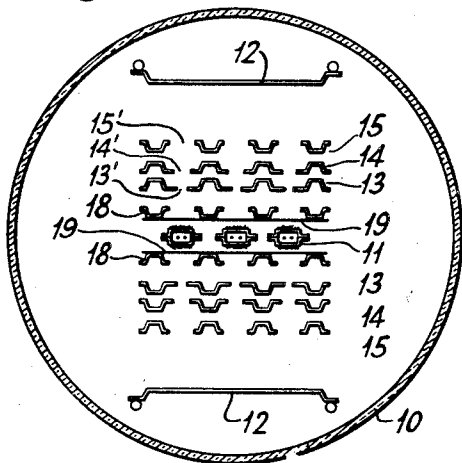


Fig. 5

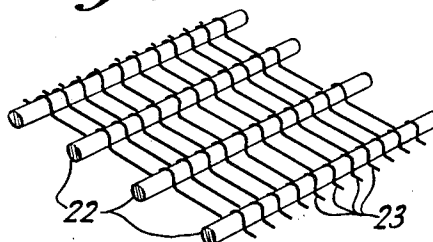


Fig. 6

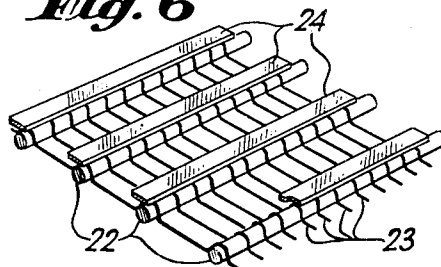
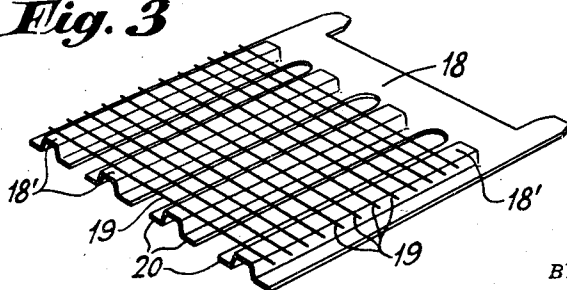


Fig. 3



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2,175,704

ELECTRON DISCHARGE DEVICE

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mesne assignments, to Radio Corporation of
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Application January 29, 1938, Serial No. 187,626

2 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, more particularly to improvements in so-called beam type tubes and grids for such tubes.

In one form of beam tube, such as shown and described in my co-pending application, Serial No. 150,891 filed June 29, 1937, and assigned to the same assignee as the present application, the mount includes a specially formed cathode comprising longitudinal parallel tubular members having on opposite sides electron emitting material for providing electron beams and an anode for receiving the electrons, and positioned between the cathode and the anode a plurality of flat grids having aligned slotted apertures, the electrode nearest the cathode preferably being used as the control grid. Such a tube is very efficient and provides low screen current but in some cases the trans-conductance of the tube is not as high as is desirable and in some cases a lower input capacity of the control electrode is desired, that is a lower capacity to cathode and screen. While more sensitive control may be obtained and hence transconductance of the tube increased by making the slots of the control grid narrower, increasing the number of slots and decreasing electrode spacings in proportion, such a tube results in other undesirable characteristics such as higher input capacity due to decreased spacing of the control electrode to other electrodes and greater difficulty in manufacture.

It is, therefore, a principal object of my invention to provide an electron discharge device of the so-called beam type having high transconductance, low inter-electrode and input capacity, and low screen currents, desirable characteristics for low noise radio frequency amplifier tubes. More specifically, it is an object of my invention to provide a tube of the type described having improved grid construction for improving the characteristics of electron discharge devices of the beam type.

According to my invention I provide between the cathode and the slotted electrodes an electrode provided with wires transverse to the longitudinal slots. This grid may be separate from the others or may be a combined control and beam forming electrode made of specially formed channel shaped members or longitudinal rods with specially formed transverse grid wires.

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 reference to the following description taken in connection with the accompanying drawing in which Figure

1 is a transverse section of an electron discharge device employing my invention, Figure 2 is a transverse section of an electron discharge device embodying a modification of my invention, Figure 3 is a perspective showing details of construction of a grid made according to my invention, Figure 4 is a transverse section of an electron discharge device employing a still further modification of my invention, Figure 5 is a perspective of a grid employed in the construction shown in Figure 4, and Figure 6 is a perspective view of a modification of the grid shown in Figure 5.

As shown in Figure 1 the electron discharge device comprises a cathode formed of a plurality of tubular members 11 coated on opposite sides for providing oppositely disposed beams of electrons which flow to the anode 12. Positioned between the cathode and anode are a plurality of parallel slot type grids specially formed from flat plates for forming the electrons into beams and controlling the flow of electrons between the cathode and the anode. They may comprise a beam forming electrode 13, an accelerating electrode 14 and a suppressor 15 with longitudinal slots 13', 14' and 15' in alignment. In accordance with my invention I position between the electrodes 13, 14 and 15 a grid comprising side rods 16 and the transverse grid wires 17. The grid may be helically wound and transverse to the slots and the ribbon-like electron beams between the cathode and the anode. This arrangement provides a beam type tube having a high transconductance, low input capacity and low screen current. Furthermore, a minimum interaction between the controlled beam formation of the slotted grids and the natural beam formation by the control grid wires results, permitting closer spacing between the focusing or beam forming electrode and the control electrode over that permitted when only wire grids were used.

In Figure 2 I show an electron discharge device employing a modified form of control electrode made according to my invention. As best shown in Figures 2 and 3 the control electrode 18 adjacent the cathode 11 comprises a member having longitudinally extending U-shaped channel members 18' to the closed bottoms of which are secured transverse wires 19. The channel members 18 may be provided with lips 20 forming well defined slots for assisting in the beam formation. In the arrangement shown the control electrode is provided with transverse wires 19 adjacent the emitting surfaces of the cathode 11, the lips being on the opposite side of the wires

19 from the cathode. This arrangement provides an electrode which gives the tube a high trans-conductance characteristic while at the same time having a beam forming function, making it also possible to eliminate a grid, if desired, and still produce the same results as the construction shown in Figure 1. These transverse wires may be welded or brazed to the channel members.

In Figures 4 and 5 I show an electron discharge device and a detailed view of the grid employed in this modification. The grid includes a plurality of longitudinally extending rods 22 having transverse wires 23. To give the grid a control as well as a beam forming characteristic, the transverse wires 23 are formed so that the transverse sections lie in a plane tangent to one side of the longitudinal wires. This grid may be made in the conventional manner as a helical grid and then cut along one side rod and formed to shape as shown in Figure 5. The longitudinal wires function in the manner of the channel members to provide beams between the rods. It may be desirable to obtain a more well defined beam action and this may be done as shown in Figure 6 where strips 24 are secured to the longitudinal rods 22 with the transverse wires 23 in between. The form shown in Figures 5 and 6 reduces the input capacity over the form shown in Figure 3 without sacrificing good heat conductivity. The form shown in Figures 5 and 6 could also be made, for example, continuously as flat members by a continuous process where the side rods or strips are fed and secured to the transverse wires as the transverse wires are being fed through a

machine for example. My invention may be applied to single or multi-beam tubes.

While I have indicated the preferred embodiments 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 cathode and anode, and a plurality of electrodes positioned between the cathode and the anode and comprising flat parallel members, each electrode having a plurality of longitudinally extending U-shaped channel elements, the bottoms of said channel members facing the cathode, the electrode adjacent the cathode being provided with a plurality of parallel transverse grid wires secured to the bottom of the U-shaped channel elements.

2. A grid for an electron discharge device comprising a member having a plurality of longitudinally extending U-shaped channel members, the legs of which are provided with lips lying in a common plane, and a plurality of parallel transverse wires secured to the bottoms of the U-shaped channel members.

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