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ELECTRON DISCHARGE DEVICE

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Fig. 1

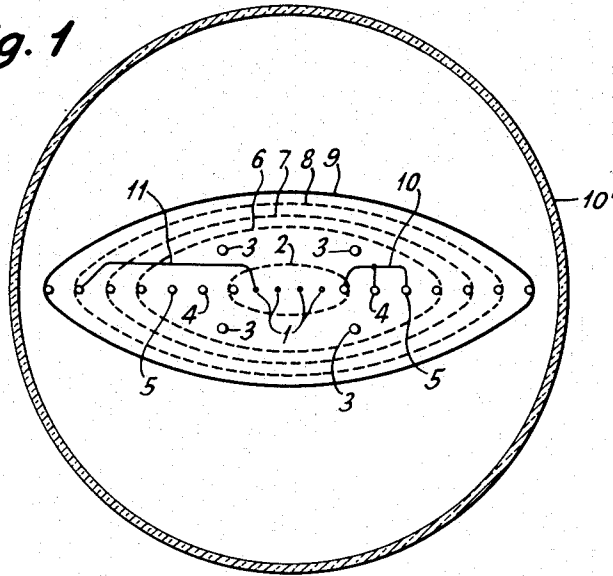
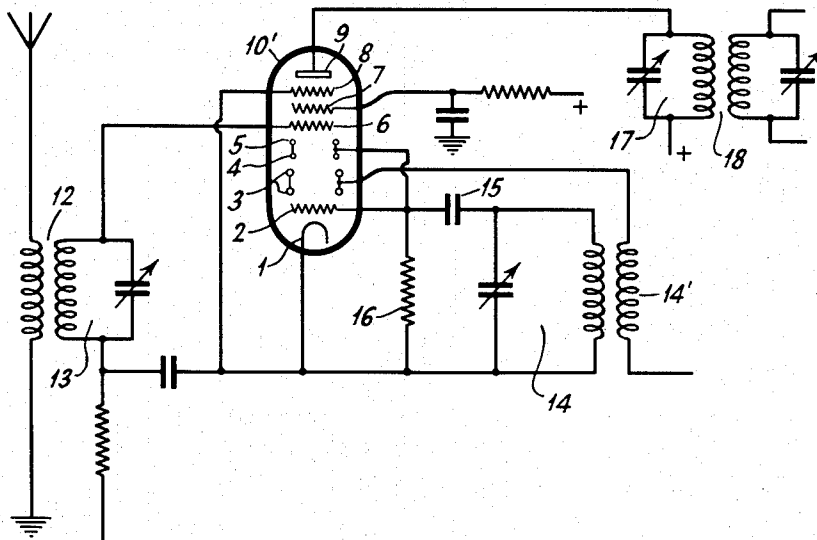


Fig. 2



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ELECTRON DISCHARGE DEVICE

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In the Netherlands April 9, 1940

5 Claims. (Cl. 250—27.5)

My invention relates to electron discharge devices, more particularly to such devices useful as a converter in superheterodyne circuits.

This invention relates to improvements in a circuit comprising a tube whose electrode system is formed by a cathode, an anode and at least five intermediate electrodes of which the first two constitute the oscillator electrodes and in which the oscillator anode is constituted by a few rods or plates which also ensure a uniform electron distribution, and the third electrode from the cathode is also rod- or plate-shaped. Around these electrodes in turn may be the second control grid, a screen grid and a suppressor grid. The invention also relates to a tube of this kind.

In one form of prior construction of the tube and circuit, the oscillator anode which is given a positive potential relatively to the cathode is constituted by a few rods located at the corners of a rectangle or a square. An oval-shaped or round electrode system as disclosed in the accompanying drawing is used. This has given satisfactory results. A few more rods can be arranged on the longer sides of the rectangle but according to the invention it has been found that it is not advantageous to use further rods at a comparatively high positive potential, arranged on the shorter sides.

According to the invention, it has been found as a matter of fact that in this electrode construction it is in some cases desirable that the electrons which during operation of the tube may return from in front of the second control grid should reach the rod-shaped oscillator anode directly and not oscillate back and forth around these rods and bring about so-called Barkhausen oscillations. Barkhausen operation does not render the tube well adapted for use in superheterodyne circuits.

Now, this difficulty is obviated by the use of a circuit and a tube according to the present invention in which rod- or plate-shaped elements are arranged immediately adjacent the plane of the oscillator anode between the rod-shaped elements of this anode and substantially in a plane passing through the cathode and the third electrode following the cathode, said elements being connected to a point of low potential, for example zero potential. It is thus ensured that the electrons which return in front of the second control grid no longer oscillate around the rods of the oscillator anode but, due to the presence of electrode parts placed at a low potential and arranged immediately adjacent the said positive

rods, reach the latter. In addition, a highly favorable electron distribution for the second control electrode is obtained by this combination of rods.

Various forms of construction of a tube according to the present invention are possible; thus, for example, two rods may be arranged immediately adjacent the plane of the oscillator anode, said rods being connected inside or outside the tube either to the control grid or to the third electrode following the cathode or again to the cathode itself. A very practical form of construction consists in connecting the rods and the third electrode from the rods to form a hair-pin-shaped body. It is, however, also possible to unite the said electrodes to form a single element by arranging small narrow plates between the plane of the second and the third electrodes instead of interconnecting two rods.

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 schematic top end view of an electron discharge device made according to my invention and Figure 2 is a schematic of the tube in Figure 1 and its associated circuit made according to my invention.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing, in which the electrode system of a tube according to the present invention is illustrated diagrammatically in Figure 1. In this tube a directly heated cathode 1 is surrounded entirely by the first control grid 2. The oscillator anode is constituted by four rods 3, immediately adjacent the plane of this electrode are arranged two rods 4 which are connected to the rods 5 of the third electrode, which, as in a tube according to the prior specification, serves to compensate the capacities, and to the first control grid. Instead of being united by interconnecting rods the electrodes 4 and 5 may be united to form small narrow plates which extend in the space between the planes of the electrodes 3 and 4. Lastly, there are in the tube a number of grids 6, 7 and 8 and an anode 9. The connection between the rods 4 and 5 and the grid 2 is represented diagrammatically by 10 and the connection of the suppressor grid 8 to the cathode 1 is diagrammatically illustrated by 11. These various connections may be arranged inside or

outside the tube. Although divergent voltages may be placed on the various electrode parts it has been found by the applicant that favorable results are obtained if the electrode 3 is given a voltage of the order of magnitude of 60 volts relatively to the cathode and, if the rods 4 are connected to the electrode 5 and the oscillator control grid 2, the potential of these electrodes relatively to the cathode may be of the order of magnitude of 75 volts.

In Figure 2 is shown the electron discharge device made according to my invention incorporated in its associated circuit.

As there shown the oscillator grid 2 is connected to the oscillator circuit 14 through a condenser 15 and resistor 16. The anode electrodes 3 are connected to the primary 14' of the transformer for providing feedback to the oscillating circuit 14. The electrodes 2 and 3 with the cathode 1 constitute the local oscillator electrodes. The auxiliary electrodes 4 and 5 are electrically connected back to the grid 2. The input circuit 13 is coupled to the antenna by means of the transformer 12, the grid 6 being connected to one side of the input circuit 13. The screen grid 7 is biased by a positive-voltage source and the suppressor 8 tied back to the cathode, the output being taken from the output circuit 17 coupled by means of transformer 18 to a load.

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 surrounded by a first control grid and an anode, oppositely disposed electrodes positioned on opposite sides of the cathode and between the control grid and anode and a second control electrode surrounding said cathode, first control grid and oppositely disposed electrodes, and auxiliary electrodes positioned between the oppositely disposed electrodes and the second control electrode and adapted to be maintained at a potential not greater than that of the first control electrode during operation of the electron discharge device.

2. An electron discharge device having a cathode surrounded by a first control grid, a second control grid and an anode, a pair of oppositely disposed anode electrodes positioned between the first and second control grids, and auxiliary electrodes positioned between the anode electrodes

and the second control grid and electrically connected to the first control grid, and comprising a pair of rods lying in a plane passing through the cathode.

3. An electron discharge device having a cathode, a control grid surrounding said cathode and having a pair of oppositely disposed side rods, a second control grid surrounding the first control grid and provided with oppositely disposed side rods lying in the same plane as the side rods of the first control grid, a screen grid and an anode surrounding said cathode and control grids, oscillator anode electrodes comprising rod-like elements positioned between the first and second control grids, and auxiliary electrodes positioned between the oscillator anode electrodes and said second control grid, said auxiliary electrodes lying in a plane passing through the side rods of said control grids, each of said oscillator anode electrodes comprising rod-like elements lying in a plane transverse to the plane passing through the control grid side rods.

4. An electron discharge device having a cathode comprising a plurality of filaments lying in a common plane, a pair of control grids surrounding said cathode, the first control grid having a pair of side rods lying in a plane passing through said cathode filaments, an anode surrounding said cathode and control grids, oscillator anode electrodes each comprising a plurality of rod-like elements, said oscillator anode electrodes being positioned on opposite sides of the first control grid between the side rods of the first and second control grids, auxiliary electrodes comprising a plurality of rod-like elements positioned between the oscillator anode electrodes and the second control grid, and an electrical connection between the first control grid and said auxiliary electrodes, the rod-like elements of each of said oscillator anode electrodes lying in a plane perpendicular to the plane passing through the cathode filaments.

5. An electron discharge device having a cathode surrounded by a first control electrode, a second control electrode and an anode, oscillator anode electrodes lying between said first and second control electrodes and each of said oscillator anode electrodes comprising a plurality of rod-like elements lying in a common plane transverse to an axis of said electron discharge device and lying on opposite sides of the first control electrode, an auxiliary electrode positioned between each of said oscillator anode electrodes and the second control electrode, said auxiliary electrode elements comprising a plurality of rod-like elements lying in a common plane transverse to the planes passing through rod-like elements of said oscillator anode electrodes.

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