July 31, 1945. J. G. BEARD 2,380,496

ELECTRON DISCHARGE DEVICE

Filed Nov. 29, 1943

Fig. 1.

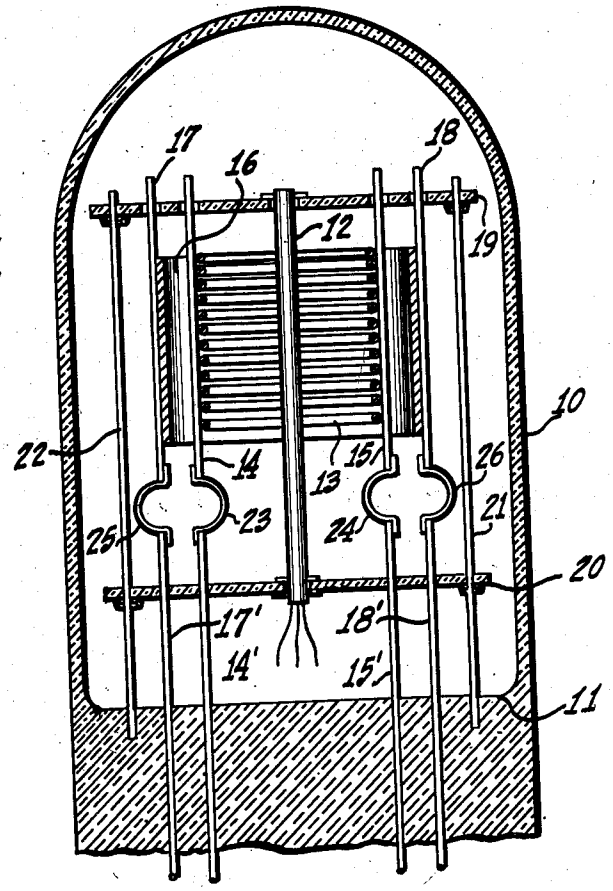
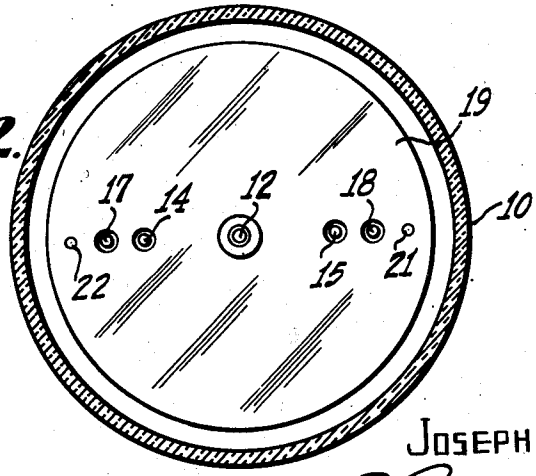


Fig. 2.



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ELECTRON DISCHARGE DEVICE

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6 Claims. (Cl. 315—59)

My invention relates to electron discharge devices and more particularly to such devices useful in oscillators.

During operation of an electron discharge device changes in temperature of the tube elements occur, particularly during the warm-up period. This results in changes in spacing between the various electrodes and thus causes a change in the inter-electrode capacities. Particularly when the device may be used in an oscillator, these capacity changes cause a shift in the frequency of operation of the oscillator, resulting in instability which may be quite pronounced at the higher frequencies.

In the past, efforts have been made to compensate for these changes due to thermal expansion and contraction of the tube elements by the use of bimetallic strips attached to the tube elements or adjacent the tube elements. However, all of these arrangements are subject to the fault that a considerable time lag exists between the increase or decrease of the inter-electrode capacity resulting from the change in temperature of the tube elements and the following inter-electrode capacity compensation.

It is, therefore, a principal object of my invention to provide an electron discharge device of improved design particularly useful as an oscillator.

Another object of my invention is to provide an electron discharge device which has stable operating characteristics under varying operating temperature conditions.

More specifically it is an object of my invention to provide such a device in which the inter-electrode capacity changes due to thermal expansion and contraction of the electrode elements are automatically compensated for within the device.

It is a further object of my invention to provide such a device in which automatic compensation for change in interelectrode capacity is provided and in which the time lag is eliminated or substantially eliminated.

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 longitudinal section of an electron discharge device made according to my invention and Figure 2 is a top view of the electrode mount assembly shown in Figure 1.

In accordance with my invention I provide an evacuated envelope 10 having a flat press 11 through which are sealed the various electrode leads and supports for the mount. The mount comprises preferably an indirectly heated cathode 12 surrounded by a grid 13 provided with side rods 14 and 15 and an anode 16 having side rods 17 and 18. These electrodes are mounted between a pair of insulating spacer members 19 and 20 for example of mica and which are supported from the press by means of the support rods 21 and 22. The spacer member 19 has enlarged apertures through which the side rods extend to permit relative movement of the side rods and the spacers.

The support and leads 14' and 15' for the grid are electrically connected to the side rods 14 and 15 by means of the thermostatic loop elements 23 and 24. The anode side rods are also connected to the leads 17' and 18' by means of the thermostatic loops 25 and 26.

During operation should the grid expand due to heat absorbed from the cathode, the grid will increase in diameter and thus move closer to the anode. This increases the inter-electrode capacity between the grid and anode. If the grid and anode were moved longitudinally with respect to each other, so that there would be partial uncovering of the grid and anode, the inter-electrode capacity could be reduced to the inter-electrode capacity of these electrodes during the cold condition and thus stabilized. It is to accomplish this purpose that the grid is supported on the thermostatic members 23 and 24, which by absorbing heat from radiation and through side rods 14 and 15 expand and cause the grid to move upwardly with respect to the spacer 19 and anode 16 to partially uncover so that the inter-grid-anode capacity remains substantially constant.

On the other hand, if the anode should expand due to absorption of heat it will move away from the grid, thus reducing the inter-grid-anode capacity. However, heat transmitted through the anode side rods 17 and 18 to the thermostatic loops 25 and 26 will cause these loops to expand thus moving the anode longitudinally upward to again register with the grid, thus increasing the inter-electrode capacity between these two electrodes, and again maintaining the inter-electrode capacity constant. Upon cooling the reverse process takes place.

Thus with a device of the kind described, inter-electrode capacities remain substantially constant, thus making the device particularly suitable for a stable oscillator.

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 plurality of electrodes, said electrodes being mounted to have relative longitudinal movement, supporting means for said electrodes and thermostatic means between said electrodes and said supporting means for causing relative longitudinal movement of said electrodes upon temperature changes of said electrodes, said movement being in a direction tending to neutralize the change of capacity caused by heating the electrodes.

2. An electron discharge device having a plurality of electrodes and including a grid and an anode, supports for said grid and anode and thermostatic means positioned between said supports and said grid and anode for causing relative longitudinal movement of said grid and anode upon temperature changes within the said electrodes, the relative longitudinal movement of said grid and anode being in a direction tending to neutralize the change of capacity caused by heating said grid and anode.

3. An electron discharge device having a cathode surrounded by a grid and an anode, supports for said grid and anode, and thermostatic supporting loops positioned between said supports and said grid and anode for causing relative longitudinal movement of said grid and anode upon changing of temperature of said electrodes, said longitudinal movement being in a direction tending to neutralize the change of capacity caused by heating said grid and anode.

4. An electron discharge device including an envelope having a press, support and lead wires extending from said press, a mount supported from said press and including a pair of spaced insulating supports, a cathode, grid and anode supported between said insulating supports, and having relative longitudinal movement, and loops of thermostatic material connected between said support and lead wires and said grid and said anode and causing relative longitudinal movement of said grid and anode in a direction tending to neutralize the change of capacity caused by heating of the grid and anode.

5. An electron discharge device having an evacuated envelope and having a mount comprising a coaxial grid and anode, said grid and anode being provided with side rods, support and lead-in wires for supporting said grid and anode and loops of thermostatic material connected between said support and lead-in wires and the side rods of said grid and anode for causing relative longitudinal movement of said grid and anode in response to temperature changes of said grid and anode, said relative longitudinal movement being in a direction tending to neutralize the change of capacity caused by the heating of said grid and anode.

6. An electron discharge device having an evacuated envelope and having a mount comprising a coaxial grid and anode, said grid and anode being provided with side rods, support and lead-in wires for supporting said grid and anode, and loops of thermostatic material connected between said support and lead-in wires and the side rods of said grid and anode for causing relative longitudinal movement of said grid and anode in response to temperature changes of said grid and anode, and insulating spacer members between which said cathode, grid and anode are mounted, at least one of said spacer members being provided with apertures larger than the side rods of said grid and anode and through which said side rods extend to permit longitudinal movement of said electrodes, said relative longitudinal movement being in a direction tending to neutralize the change of capacity caused by heating of said grid and anode.

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