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ELECTRON DISCHARGE DEVICE

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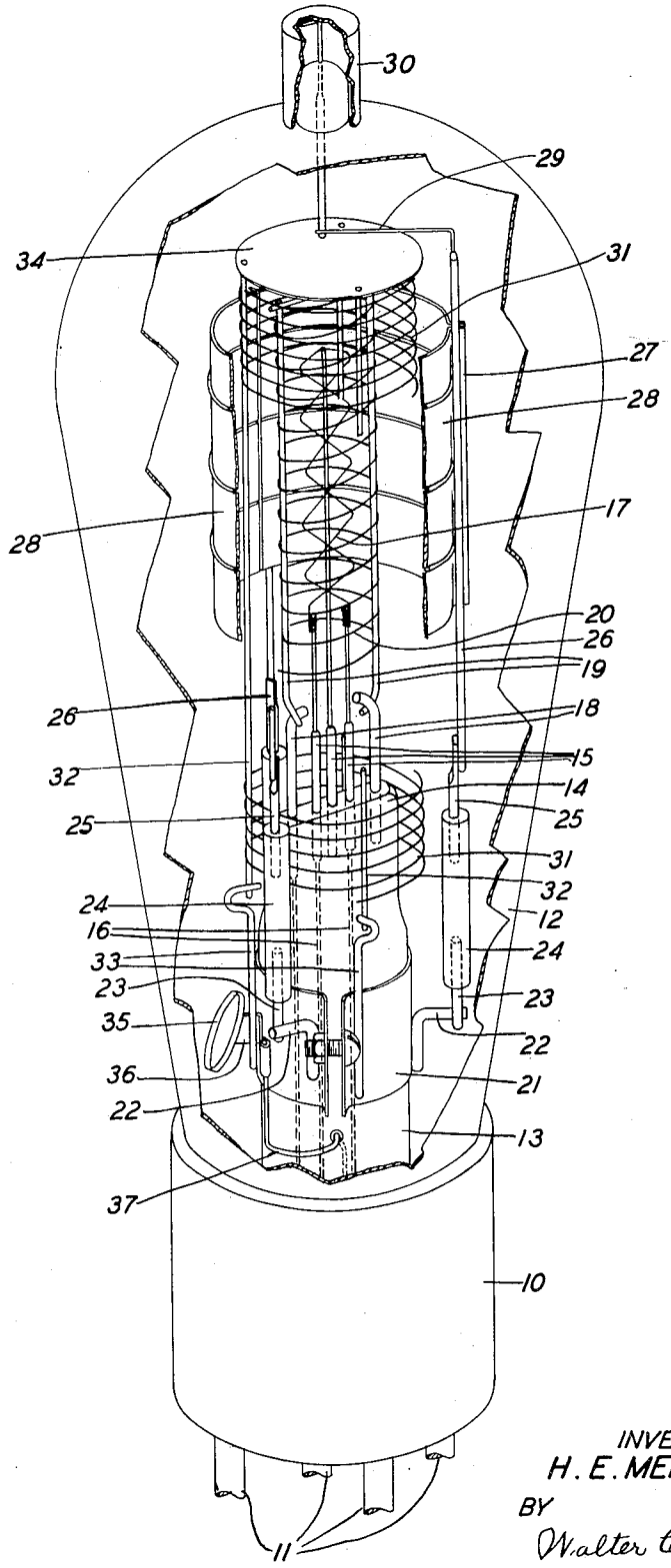

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ELECTRON DISCHARGE DEVICE

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5 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices of the screen or shield grid type.

In an electron discharge device commonly known as the shield or screen grid type, there are several internal electrodes, one of which is in the form of a grid arranged to shield the control electrode or grid from the anode. In such devices the shielding should be thorough and the electrodes should be maintained in their proper spaced relation in order that the static and dynamic characteristics of the device will be maintained uniform and that the inter-electrode capacity will be reduced to a value which will not seriously affect the normal operation of the device. It has been found that when electron discharge devices of the construction known heretofore are employed as amplifiers in radio frequency circuits, the electrostatic capacity between the anode and the control grid leading-in wire affects the operation of the device. In the range of radio frequencies the capacity is of sufficient magnitude to cause the device to oscillate and hence to function improperly.

An object of the present invention is to reduce the internal capacity between the anode and the control grid leading-in wire to such a value that it will not affect the normal operation of the device as an amplifier in radio frequency circuits.

Another object of this invention is to improve the operating characteristics of electron discharge devices used in radio frequency systems.

The electron discharge device of this invention comprises an enclosing vessel having a stem from which all the elements are supported. The leading-in wires for the cathode and control electrode or grid are embedded in a press portion of the stem, and the cathode and control electrode or grid are supported on rigid wires attached to the leading-in wires. The screen grid and anode are mounted concentrically with respect to the cathode and the control electrode on rigid upright metallic rods attached to a split metallic band clamped about the stem. In order to more completely shield the control electrode from the anode and also to shield the control electrode leading-in wire from the anode, the shield grid is extended beyond the end of the control grid and the anode to encircle the press portion in which the control electrode leading-in wire is embedded. This construction reduces the anode-control electrode and anode-control electrode leading-in wire capacities to values which will not affect the operation of the device in radio frequency systems and further improves the static and dynamic characteristics of the device.

The various features of the invention will be more clearly understood from the following detailed description with reference to the accompanying drawing in which the single figure is a perspective view of an electron discharge device made in accordance with this invention with portions of the enclosing vessel and of the shield grid and anode broken away to show the electrode structure in detail.

Referring now to the drawing, the electron discharge device comprises an insulating base 10 carrying a plurality of terminal pins 11 for associating the device with an electrical circuit, and an enclosing evacuated vessel 12 of vitreous material. The vessel 12 is cemented or otherwise suitably attached within the base 10 and has a reentrant substantially cylindrical stem portion 13 extending lengthwise of the device and formed with a flat press portion 14.

A plurality of rigid short wires 15, preferably of molybdenum, certain of which are welded to the cathode leading-in wires 16, are inserted in the press 14 and support a double-wound helical thoriated tungsten filamentary cathode 17. Two rigid wires 18, one of which serves as a leading-in wire for the control electrode or grid are likewise embedded in the press 14 and have welded thereto rigid molybdenum uprights 19 on which a helical molybdenum wire grid 20 is wound and arranged concentrically with a filamentary cathode 17.

A split metallic band 21 is clamped about the stem 13 and supports both the anode 28 and the shield electrode to be described in detail hereinafter. A plurality of equally spaced angle formed molybdenum wires 22 are welded to the band 21 and have in turn welded thereto rigid wire stubs 23. The stubs 23 are fused in one end of support insulators 24, preferably of pyrex glass. Similar metallic stubs 25 are fused in the other end of the insulators 24 and are welded to molybdenum uprights 26. The uprights 26 are each welded to flanges 27 on a multi-section cylindrical molybdenum anode 28 disposed concentrically about the filamentary cathode 17 and control electrode or grid 20. The outer surface of the anode 28 is preferably roughened by a carborundum blast to increase the heat radiating capacity thereof. A leading-in wire 29 is welded to one of the uprights 26, as shown, sealed in the vessel 12, and fixed to a metallic cap 30, cemented to the vessel 12.

A shield or screen grid 31 is supported from

the band 21 concentric with the filamentary cathode 17, control grid 20 and anode 28 by molybdenum rods 32 welded to hook members 33 which are in turn welded to the band 21. The screen grid 31 is preferably disposed in close spaced relation to the control grid 20 and is either treated by a carbonizing process after it is constructed or made of carbonized molybdenum wire so that the screen will absorb some electron current at all times and secondary emission therefrom will be substantially prevented. The screen grid may be carbonized by spraying the wire with carbon and then heating the wire until the carbon either forms a fine adherent coating or reacts with the molybdenum to form a carbide.

A metallic disc or plate 34 is welded to the end of the rods 22 and serves to shield the end portion of the filamentary cathode 17 and control grid 20 more completely from the anode 28. This electrode structure wherein the shield grid 31 and anode 28 are both supported from the band 21 clamped about the stem 14 simplifies the construction and assembly of the device, facilitates the exact positioning and spacing of the electrodes and decreases the number of leading-in wires in the press portion of the stem.

It has been found, particularly in radio frequency amplifier circuits, that the electrostatic capacity between the cathode, the control grid leading-in wire and the anode in an electron discharge device is of material importance and may seriously affect the operation of the device. At very high frequencies, for example, the control grid leading-in wire-anode capacity may be of sufficient magnitude to cause the device to oscillate and thereby operate improperly. To overcome this difficulty in accordance with this invention the shield or screen grid 31 is extended beyond the end of the filamentary cathode 17 and control grid 20 and encircles the press portion 14 of the stem 13. The extension of the grid 31 completely shields the filament and the control grid leading-in wires from the anode and greatly reduces the electrostatic capacity therebetween.

An annular getter mount 35 is supported from the band 21 by a metallic extension 36. A wire 37 connected to one of the terminal prongs 11 is sealed in the side of the stem 13 and welded to the extension 36 and serves as the leading-in wire for the shield or screen grid 33.

Although a specific embodiment of the invention is disclosed it is to be understood that the invention is not limited thereto and that modifications may be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. An electron discharge device comprising an enclosing vessel having a stem, a cathode, a grid and a plate electrode mounted on said stem, a shield electrode interposed between said grid and plate electrode, and a leading-in wire for said grid embedded in said stem, said shield electrode comprising a helical wire extending around said stem and said leading-in wire at one end and extending beyond the anode at the other end.

2. An electron discharge device comprising an enclosing vessel having a stem, a cathode and a control electrode mounted on said stem, a collar clamped about said stem, an anode insulatingly supported from said collar and concentrically disposed about said cathode and control electrode, and a shield electrode supported from said collar and disposed between said control electrode and said anode.

3. An electron discharge device comprising an enclosing vessel having a stem, a cathode and a control electrode mounted on said stem, leading-in wires for said electrodes embedded in said stem, a collar clamped about said stem, an anode insulatingly supported from said collar and concentrically disposed about said cathode and control electrode, and a shield electrode supported from said collar and disposed between said control electrode and said anode, said shield electrode having a portion encircling said stem and said leading-in wires.

4. In an electron discharge device an enclosing vessel having a stem, a control grid mounted on said stem, a leading-in wire for said control grid embedded in said stem, a collar clamped about said stem, a plurality of parallel supports extending from said collar, and a helical shield electrode mounted on said supports and encircling said control grid, said shield electrode having an integral helical portion surrounding said stem and said leading-in wire.

5. An electron discharge device comprising an enclosing vessel having a stem at one end, a cathode and a control electrode mounted on said stem, leading-in wires for said cathode and said control electrode embedded in said stem, a collar clamped about said stem, an anode insulatingly supported from said collar and encircling said cathode and control electrode, a leading-in wire for said anode sealed in said vessel at a point remote from said one end, a helical shield electrode supported from said collar and disposed between said control electrode and said anode, having an integral helical portion encircling said stem, and a metallic disc mounted on said shield electrode and disposed between said control electrode and said anode leading-in wire.

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