Jan. 18, 1938. V. L. RONCI 2,105,506

ELECTRON DISCHARGE DEVICE

Filed Feb. 4, 1936

FIG. 1

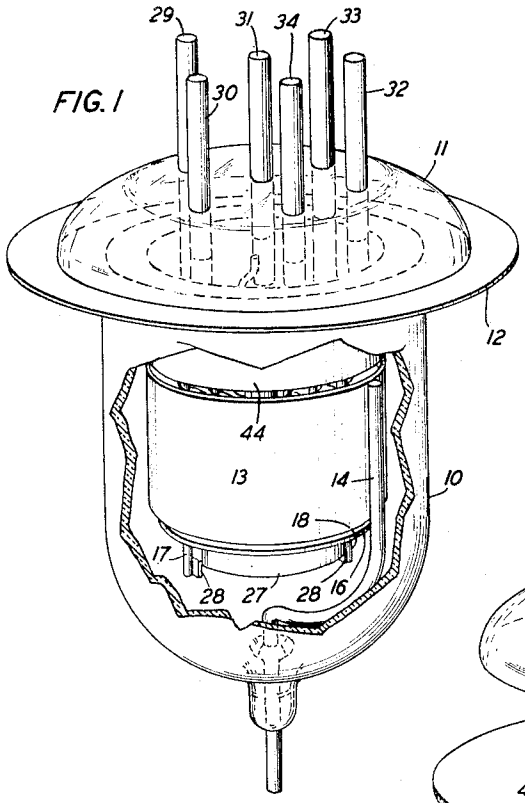


FIG. 4

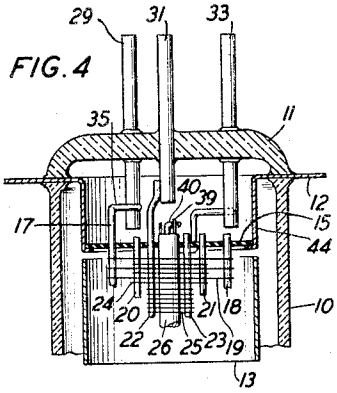


FIG. 2

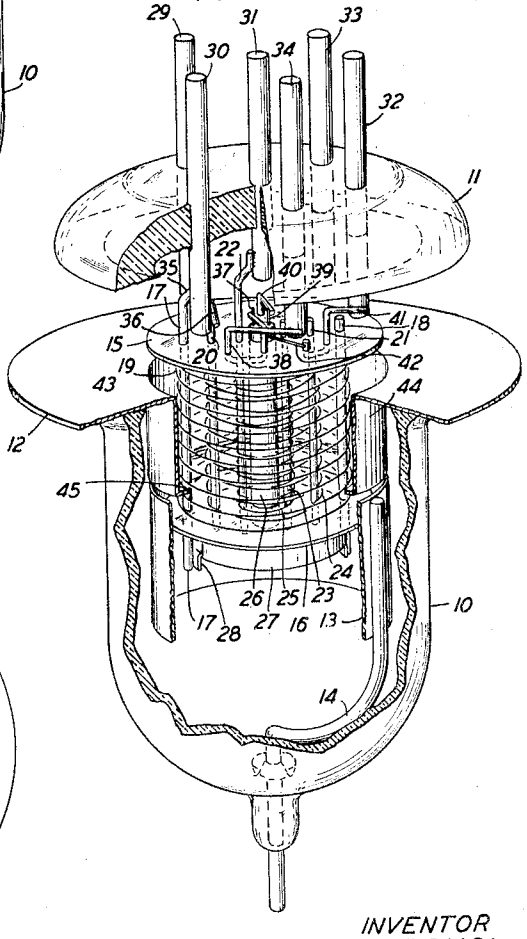
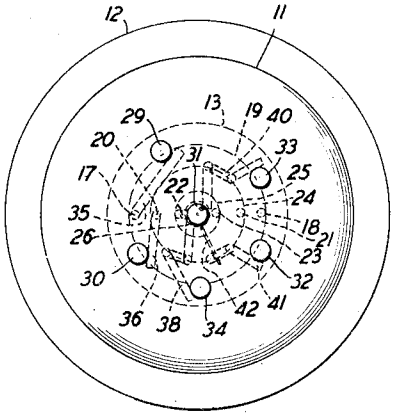


FIG. 3



INVENTOR
V. L. RONCI

BY
Walter C. Kiesel

ATTORNEY

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ELECTRON DISCHARGE DEVICE

Victor L. Ronci, Brooklyn, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application February 4, 1936, Serial No. 62,255

13 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices adapted to amplify and generate ultra-high frequency impulses.

One object of this invention is to facilitate and to simplify the assembly and fabrication of electron discharge devices.

Another object of this invention is to insure positive alignment of a unitary electrode assembly with respect to an electrode separate from the assembly, in electron discharge devices.

In one illustrative embodiment of this invention an electron discharge device of the "acorn type" comprises a vitreous enclosing vessel including a dished or bell-shaped envelope or shell and a cap or crown at the open end of the envelope or shell. A cylindrical anode is supported coaxially within the envelope. A unitary electrode assembly including insulating spacers, a cathode and one or more grids is supported by the cap or crown, the several electrodes being within and preferably coaxial with the anode. The envelope or shell and the cap or crown are hermetically sealed to an annular disc shield which provides an external contact and mounting surface for the device.

In accordance with one feature of this invention, the electrode assembly may be utilized as a means for aligning this assembly with respect to the anode. To this end, the disc shield is provided with a cylindrical cap portion extending into the envelope or shell and coaxial with the anode, the cylindrical portion having an annular seat or flange adjacent the anode. The cylindrical portion of the shield is of the same diameter as one of the insulating disc spacers in the unitary electrode assembly, and may be used as a guide therefor. In the fabrication of the device, the electrode assembly is inserted into the shell until the guiding disc spacer is seated upon the annular flange or seat on the disc shield and the cap or crown is seated upon the peripheral contact and seating surface of the disc shield. The envelope and the cap or crown are then fused to the disc shield to form a hermetic seal therewith and a complete enclosure for the electrodes.

This invention, it will be apparent, enables the facile assembly of electron discharge devices and provides a structure wherein the shield performs the dual function of electrostatically segregating the input and output terminals of the device and accurately aligning the unitary electrode assembly with respect to the anode.

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

Fig. 1 is a perspective view in elevation of an electron discharge device constructed in accordance with this invention, a portion of the enclosing vessel being broken away to show the internal structure more clearly;

Fig. 2 is a partly exploded view of the electron discharge device illustrated in Fig. 1, showing the relation of the elements of the device prior to the positioning of the electrode assembly within the vessel, portions of the enclosing vessel, anode, and shield being broken away to show details of construction more clearly;

Fig. 3 is a plan view of the device shown in Figs. 1 and 2, illustrating the space relation of the leading-in conductors for the electrodes of the unitary assembly and their electrical association with these electrodes; and

Fig. 4 is a view in cross-section of the device of this invention showing the alignment of the unitary electrode assembly with the anode.

Referring now to the drawing, the electron discharge device shown is of the "acorn type" and comprises an enclosing vessel including a dished vitreous shell or envelope 10 and a vitreous crown or cap 11 both of which are hermetically sealed to a metallic disc shield, for example, of copper, designated generally as 12. The vitreous members may be sealed to the shield 12, for example, by heating the shield by high frequency induction, as described in my copending application, Serial No. 62,253 filed February 4, 1936, whereby the cap 11 and shell 10 are fused to the metallic shield.

A cylindrical anode 13 is positioned within the shell or envelope 10, preferably coaxially therewith, and is supported by a metallic rod or wire 14 sealed into the shell or envelope at the end thereof, the rod or wire 14 serving as the leading-in conductor for the anode.

A unitary electrode assembly is supported by the cap or crown 11 and comprises a pair of spaced insulating members 15 and 16, for example, mica discs, mounted upon rigid metallic uprights or rods 17 and 18 which support a helical screen or suppressor grid 19. Extending between the insulating spacers 15 and 16 and supported thereby are a plurality of pairs of rods or wires 20, 21 and 22, 23 which carry, respectively, a helical shield grid 24 and a helical control grid 25. An equipotential cathode 26 also extends between and is supported by the spacer discs 15 and 16. Preferably the various electrodes

of the unitary assembly are arranged coaxially with each other and with the anode 13. The portions of the cathode and of the rods or wires 20 and 23, inclusive, extending beyond the spacer disc 16 are enclosed by a metallic cap or shield 27 having integral tabs 28 suitably affixed to the uprights or rods 17 and 18, and are effectively screened thereby from the anode 13 and its leading-in conductor 14.

The unitary electrode assembly is supported from the cap or crown 11 by a plurality of rigid wires or rods 29 to 34, inclusive, which are sealed in the cap or crown and serve as leading-in conductors for the several grids and the cathode. As shown in Figs. 2 and 3, the rods or wires 17 and 20 are connected electrically to the leading-in conductors 29 and 30, of the suppressor grid 19 and screen grid 24, respectively, by metallic stubs or tie wires 35 and 36, respectively. The leading-in conductor 31 is secured directly to the rod or wire 22. One end 37 of the heater element for the cathode 26 is connected to the leading-in conductor 34 by a bent wire 38 extending through and mounted on the insulating spacer 15, and the other end 39 of the heater element is connected to the leading-in conductor 33 by a similarly mounted bent wire 40. The cathode 26 is connected to the leading-in conductor 32 by a rigid bent wire 41 mounted on the disc 15 and a short flexible wire 42 secured to the cathode and the wire 41.

The disc shield 12, as shown clearly in Fig. 2, comprises an annular flange or seating portion 43 and an integral cylindrical or sleeve portion 44 within the shell or envelope 10, having an annular flange or seat 45 at its inner end. The cylindrical or sleeve portion 44 is of the same diameter as the end spacer disc 15 of the electrode assembly and serves as a guide therefor.

In the fabrication of the device, the flange 43 is seated upon the open end of the shell or envelope 10 and held in coaxial relation with the anode 13. The unitary electrode assembly is inserted into the shell or envelope with the end disc 15 in the cylindrical sleeve 44 and is lowered until the spacer disc 15 is immediately adjacent the seat or flange 45 and the cap or crown 11 rests upon the flange or seat 43. Subsequently the cap or crown 11 and the shell or envelope 10 are fused to the flange 43 to form a hermetic seal therewith. As the cap or crown 11 lowers upon being heated, the disc 15 also lowers until it seats upon the flange 45 and thereby positions the electrode assembly with reference to the anode. It will be apparent from the above description and the illustration of Fig. 4 that the unitary electrode assembly is accurately aligned with reference to the anode without the use of gauges or the like and the fabrication of the device is thereby simplified and expedited.

In the completed device the cylindrical sleeve 44 encompasses the internal portions of the leading-in conductors for the cathode and the control and shield electrodes and together with the flange portion 43 forms an effective shield between these conductors and the anode and the leading-in conductor therefor whereby the input and output circuits are segregated and deleterious interaction therebetween is prevented.

Although a specific embodiment of the invention has 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 this invention as defined in the appended claims.

What is claimed is:

1. An electron discharge device comprising an envelope having an opening therein, an electrode within said envelope and supported thereby, a metallic member positioned at said opening and having an open-ended guiding sleeve extending into said envelope, and an electrode assembly insertable into said sleeve through said opening and disposed within said envelope, said assembly including a member slidably fitted in said sleeve.

2. An electron discharge device comprising a dished shell having an open end, an electrode mounted within said shell, a metallic member having a portion seated on said open end and a hollow portion extending into said shell, and an electrode assembly within said shell including an insulating member fitted in said hollow portion.

3. An electron discharge device comprising a shell open at one end, a cylindrical anode within said shell and supported thereby, a metallic chamber affixed to said open end having a cylindrical sleeve coaxial with said anode and extending into said shell, and an electrode assembly including an electrode positioned coaxial with respect to said anode and a disc seated in said sleeve.

4. An electron discharge device comprising a shell having an open end, an electrode mounted within said shell, a metallic member seated on said open end and having a guide portion extending into said shell, and an electrode assembly in said shell including a plurality of electrodes and an insulating member spacing said electrodes, said insulating member being engaged by said guide portion and positioned thereby.

5. An electron discharge device comprising a vessel having a shell portion and a cap portion, an annular metallic disc interposed between and sealed to said shell and cap portions, an anode supported in said shell portion, said metallic disc having a recessed annular portion within said shell, and an electrode assembly seated in said recessed portion.

6. An electron discharge device comprising an enclosing vessel having a vitreous shell portion and a vitreous cap portion, a metallic member including an annular disc portion disposed between and sealed to said shell and cap portions and an annular seating portion within said shell, an anode within said shell, and an electrode assembly within said shell including an insulating member seated on said annular portion.

7. An electron discharge device comprising an enclosing vessel having a vitreous shell portion and a vitreous cap portion, a cylindrical anode within said vessel, a metallic member having an annular portion between said shell and cap portions and hermetically sealed thereto, and having a cylindrical sleeve portion extending into said shell and positioned coaxially with said anode, said sleeve portion having an annular seating flange thereon, and an electrode assembly within said anode including an insulating disc positioned by said sleeve portion and seated upon said annular flange.

8. An electron discharge device comprising an enclosing vessel including a vitreous shell and a vitreous cap, a cylindrical anode within said shell and supported thereby, a metallic member having a portion between said shell and cap and sealed thereto and a cylindrical guiding sleeve extending into said shell and coaxial with said anode, an electrode assembly within said vessel including an insulating spacing disc for said electrode as-

sembly fitted in said sleeve, and means supporting said assembly from said cap.

9. An electron discharge device comprising an enclosing vessel including a vitreous shell and a vitreous cap, an anode within said shell and supported thereby, a metallic shield having a portion between said cap and said shell and sealed thereto and having a sleeve portion within said shell, a unitary electrode assembly within said shell including a plurality of electrodes in cooperative relation with said anode and a disc fitted in said sleeve, and leading-in conductors for said electrodes sealed in said cap and supporting said assembly.

10. An electron discharge device comprising a vitreous shell having an open end, an anode within said shell and supported thereby, means sealing said open end including a metallic member having an open-ended guiding portion within said shell, and an electrode assembly insertable into said shell through said guiding portion, said assembly being seated on and positioned with respect to said anode by said guiding portion.

11. An electron discharge device comprising an enclosing vessel including a shell and a cap, a metallic member including a portion between and sealed to said cap and shell, a guiding portion on said metallic member extending into said shell, said guiding portion having a flange thereon, an electrode within said shell and supported thereby, an electrode assembly within said shell including a plurality of electrodes in cooperative relation with said first electrode and an insulating member spacing said plurality of electrodes, said insulating member being seated upon said flange and positioned by said guiding portion, and leading-in conductors for said plurality of electrodes sealed in said cap and supporting said electrode assembly.

12. An electron discharge device comprising an enclosing vessel including a shell having an open end, an electrode assembly within said shell, leading-in conductors for the electrodes of said assembly extending from said open end, and means closing said open end including a metallic shield having a cylindrical portion within said shell and encompassing said leading-in conductors, said assembly including an insulating spacer for said electrodes, fitted within said cylindrical portion.

13. An electron discharge device comprising an enclosing vessel including a shell and a cap, a cylindrical anode within said shell and supported thereby, a metallic shield including an annular portion between said shell and cap and sealed thereto and a cylindrical portion extending into said shell in alignment with said anode, said cylindrical portion having one end adjacent said anode and provided with an annular flange at said one end, an electrode assembly including a cathode, a grid and an insulating disc spacing said cathode and said grid, said disc being seated on said flange and positioning said cathode and grid within said anode, and leading-in conductors for said cathode and said grid extending through said cylindrical portion and sealed in said cap.

VICTOR L. RONCI.