Aug. 2, 1938. V. L. RONCI 2,125,317

ELECTRON DISCHARGE DEVICE

Filed Feb. 4, 1936

FIG. 1

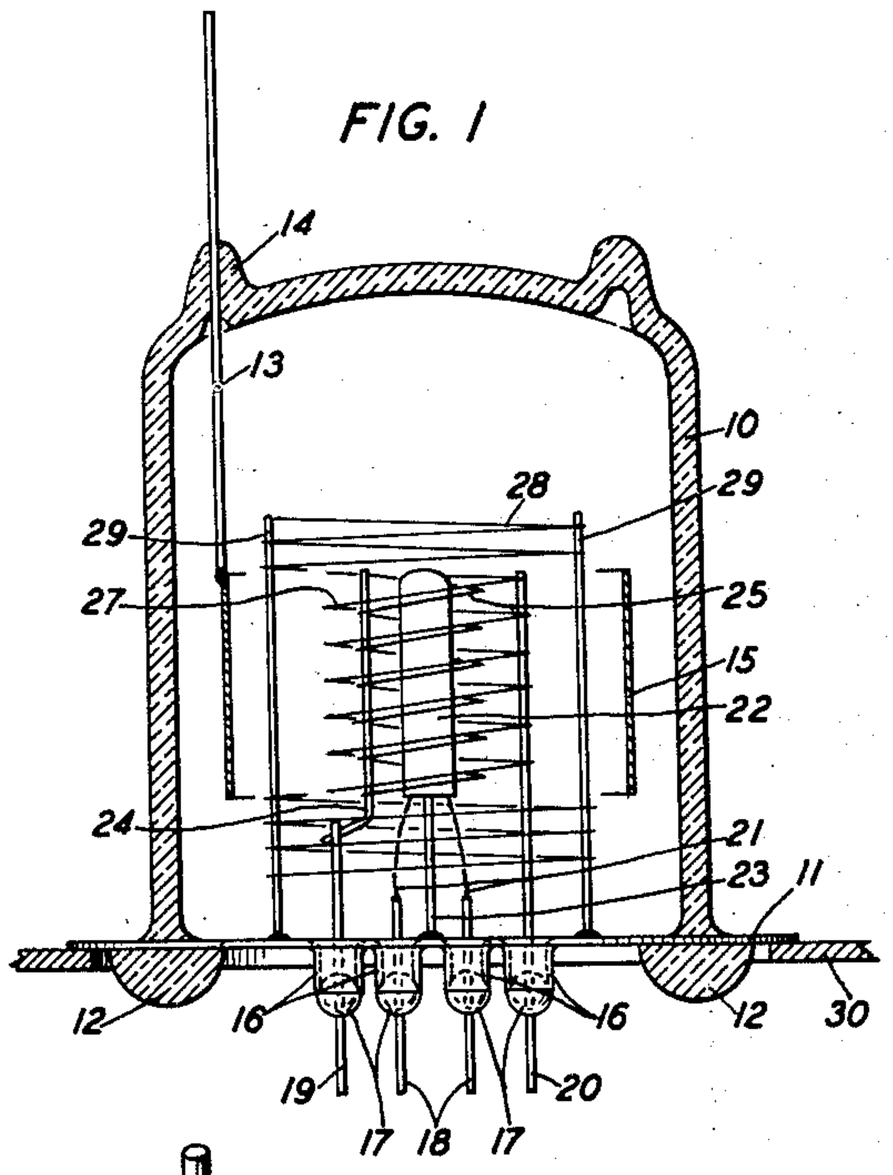


FIG. 2

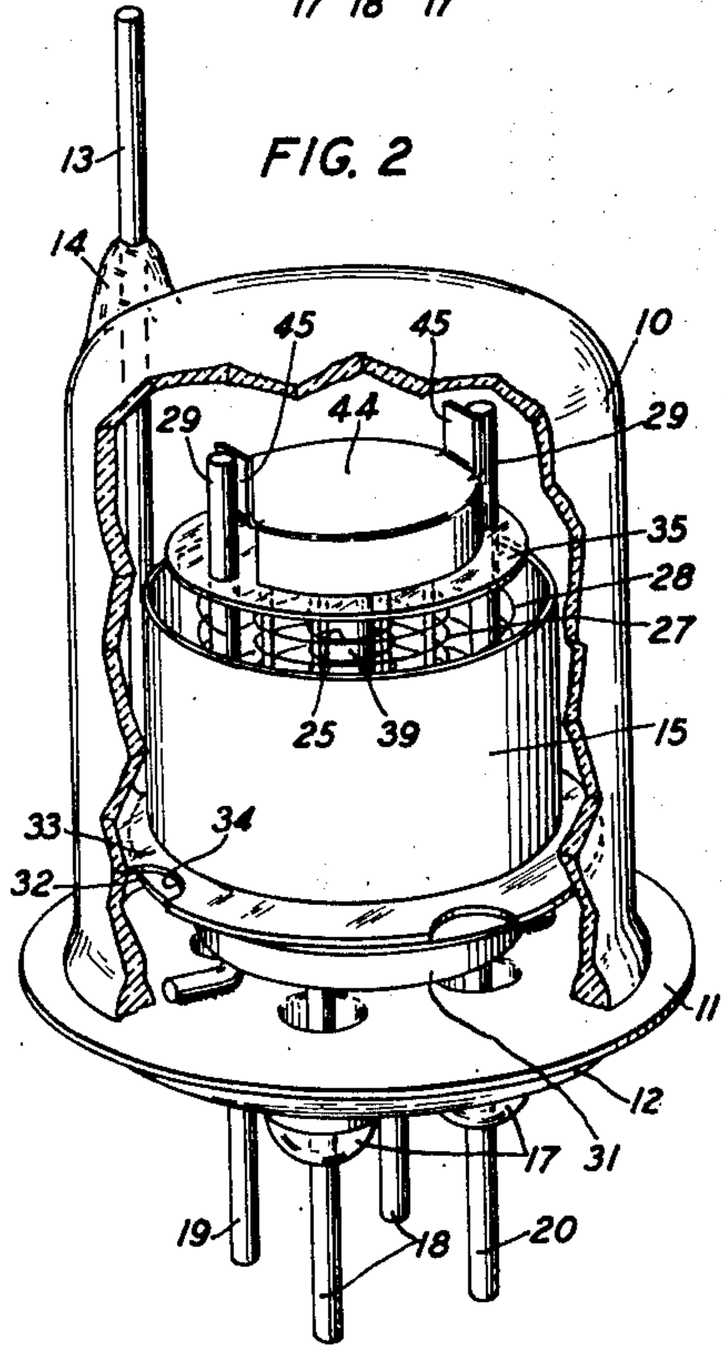


FIG. 3

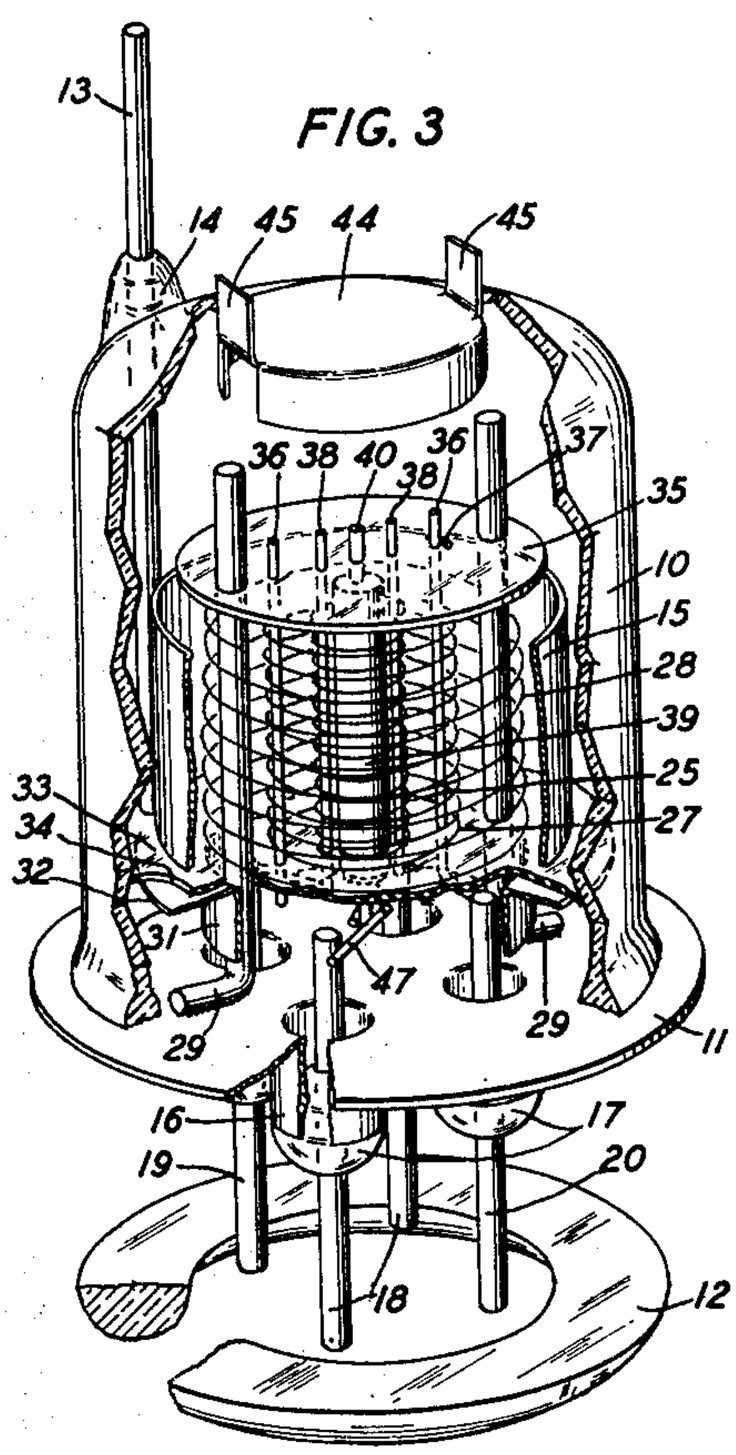


FIG. 5

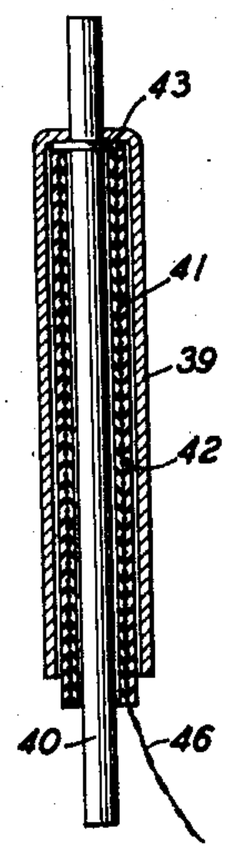
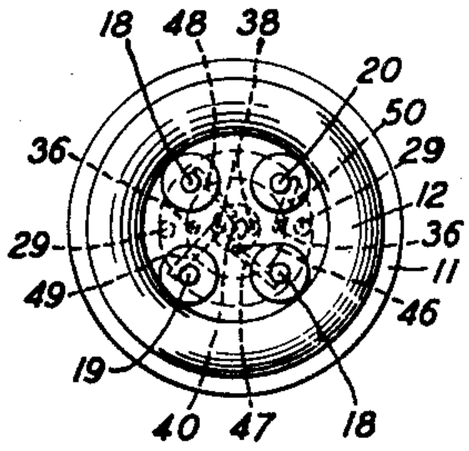


FIG. 4



INVENTOR
V. L. RONCI

BY Walter C. Kiesel

ATTORNEY

Patented Aug. 2, 1938 2,125,317

UNITED STATES PATENT OFFICE

2,125,317

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. 62,254

2 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices suitable for the generation and amplification of ultra-high frequency impulses.

In ultra-high frequency systems employing electron discharge devices, the high frequency electrostatic fields set up by the potentials applied to the electrodes of the discharge devices cause interference in the system by undesired interaction between the input and output circuits of the discharge devices. This interference reduces the sensitivity of the system and impairs the stability of the amplifier, oscillator or other generating or translating apparatus in the system.

One object of this invention is to eliminate interference by electrostatic fields between the input and output circuits of electron discharge devices.

Another object of the invention is to completely shield the terminal conductors in the input circuit of the discharge device from the output circuit terminal conductor.

In one illustrative embodiment of this invention, an electron discharge device comprises a unitary main electrode assembly including a metallic closure member or disc which serves as a shield. The disc is hermetically sealed to a dished or bell-shaped vitreous envelope in which a cylindrical anode is mounted. The disc is provided with integrally formed eyelets which are sealed by glass beads carrying conductors supporting the individual electrodes, such as the cathode and one or more grids, of the main assembly. The electrodes also may be assembled as a unit on the disc and are held in uniform spaced relation by insulating spacers at both ends of one of the grids, for example, the shield or suppressor electrode, and the internal electrodes are completely shielded from stray fields within the device.

One feature of this invention relates to the fabrication of the device whereby all the electrodes but the anode may be assembled as a unit on the shielding disc and the enclosing vessel carrying the anode subsequently may be sealed to the disc to form a compact and efficient structure.

Another feature relates to the combination of the device with an external shield structure whereby the internal disc shield may be placed in physical contact with the external shield to insure complete and positive shielding between the input and output circuits.

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

Fig. 1 is an elevational view in cross-section of an electron discharge device illustrative of one embodiment of this invention and showing the relationship of the electrodes in the device;

Fig. 2 is an elevational view in perspective of an electron discharge device illustrative of another embodiment of this invention, a portion of the enclosing vessel being broken away to show the internal structure more clearly;

Fig. 3 is a partly exploded view in perspective of the electron discharge device shown in Fig. 2, portions of the enclosing vessel, anode and the unitary electrode assembly being broken away to show details of construction more clearly;

Fig. 4 is a plan view, to a reduced scale, showing the association of the leading-in conductors with the electrodes of the unitary electrode assembly in the discharge device shown in Figs. 2 and 3; and

Fig. 5 is a detail view in cross-section of the cathode embodied in the discharge device shown in Figs. 2 and 3.

Referring now to the drawing, the electron discharge device shown in Fig. 1 comprises an enclosing vessel including a vitreous dished or bell-shaped envelope or portion 10 and a metallic disc 11, for example of copper, closing the open end of the envelope 10. The envelope 10 and a vitreous backing ring 12 may be fused to the disc 11 by heating the disc by high frequency induction as described more fully in my copending application, Serial No. 62,253, filed February 4, 1936. A metallic rod or wire conductor 13 is sealed into the envelope 10 at the top thereof, as indicated at 14, and supports a cylindrical anode 15.

The metallic disc 11 is provided with a plurality of integral eyelets or sockets 16, into each of which a vitreous bead 17 is sealed. The vitreous beads 17 have sealed therein metallic wires or rods 18, 19 and 20 which serve as leading-in conductors for electrodes of the device. The wires or rods 18 are connected electrically to end extensions 21 of a heater element for the cathode 22, the cathode being coaxial with the anode 15 and supported from the disc 11 and electrically connected thereto by a rod or wire 23. The rod or wire 19 is secured to and supports a rigid metallic rod or wire 24 which carries a helical wire control electrode or grid 25 encompassing the cathode 22 and coaxial therewith. Similarly, the rod or wire 20 supports a helical wire shield or screen grid 27 encompassing and coaxial with

the control grid 25. The shield or screen grid 27 is encompassed in turn by a helical wire shield or suppressor grid 28, only a portion of which is shown, supported by and electrically connected to the disc 11 by rigid metallic uprights or rods 29.

In the fabrication of the device shown in Fig. 1, all of the electrodes except the anode are fabricated in a unitary assembly with the disc 11. The beads 17 may be sealed in the sockets 16, for example, by high frequency heating of the disc as described in my copending application aforementioned. The electrodes of this assembly, namely, the cathode 22 and grids 25, 27 and 28, are positioned in proper relation within the anode 15 and the disc 11 is seated upon the edge of the envelope 10. Subsequently, the envelope 10 and backing ring 12 are fused to the disc 11 as stated hereinbefore to form a hermetic seal therewith.

As shown clearly in Fig. 1, the disc 11 is of greater diameter than the envelope 10 and may be seated upon an external metallic shield 30. The disc 11 and shield 30, it will be clear, effectively screen the leading-in conductors 18, 19 and 20 from the leading-in conductor 14 for the anode so that the input circuit is substantially completely shielded from the output circuit of the device and undesired interaction between these circuits is prevented. If desired, an annular insulating disc, not shown, may be positioned between the disc 11 and shield 30 so that these members may be at different potentials although still performing their shielding function.

Inasmuch as all the electrodes but the anode may be fabricated as a unitary assembly exteriorly of the envelope 10 and may be fixed in proper relation to the anode 15 by a single operation, the fabrication of discharge devices is materially simplified and expedited. Furthermore, it will be apparent that in a device constructed in accordance with this invention, the length of the leading-in conductors for the cathode and the several grids may be made very short so that the inductances of these conductors will be very small and the device may be used efficiently at ultra-high frequencies.

In the construction illustrated in Figs. 2 and 3, which are enlarged approximately five times for clarity, the several electrodes of the unitary assembly are maintained in their proper space relation by insulating spacer members and additional shields are provided for segregating the input and output electrodes. As shown in these figures, the rods or wires 29 carrying the suppressor grid 28 are suitably secured, as by welding, at one end to the disc 11 and support a metallic collar or ring shield 31 having an annular flange 32 which extends to immediately adjacent the inner wall of the envelope 10. Seated upon the flange 32 is an insulating spacer 33, for example, of mica, which may be provided with peripheral recesses 34 to render the edge of the disc more resilient and thereby compensate for variations in the inner diameter of the envelope 10. Another insulating spacer disc 35, which also may be of mica, is affixed, as by a friction fit, to the rods or wires 29 adjacent the free ends thereof.

The screen grid 27 is carried by two metallic uprights or rods 36 which extend through the insulating spacers 33 and 35, one of the rods 36 being held against longitudinal movement by a metallic stub 37 secured thereto and resting upon the insulating spacer 35. Similarly, the control grid 25 is carried by a pair of metallic uprights or rods 38 which are fitted at opposite ends into apertures in the insulating spacers 33 and 35.

The cathode embodied in the device illustrated in Figs. 2 and 3, as shown more clearly in Fig. 5, comprises an outer metallic sleeve 39 having a coating of thermionic material thereon, which is carried by and electrically connected to a central metallic standard 40. The standard 40 is encompassed by a heater wire 41 which is embedded in or coated with insulating material 42, one end 43 of the heater wire being secured to the standard. The cathode is supported between the insulating spacers 33 and 35, the standard 40 extending through central apertures in these spacers and the insulator extension 42 abutting against the lower spacer 35.

The portions of the rods or wires 36 and 38 and the standard 40 extending above the insulating spacer 35 are substantially enclosed by a metallic cap 44 which is seated upon the insulating spacer 35 and is provided with integral tabs 45 secured, as by welding, to the rods or wires 29 of the suppressor grid. The cap 44 forms a shield between the elements enclosed thereby and the anode and its support 13, thereby effectively screening these elements electrostatically from the anode.

As shown more clearly in Fig. 4, the end 46 of the heater wire 42 is electrically connected to one of the rods or wires 18 by a short wire or stub 47, and the standard 40 which serves as a leading-in conductor for both the cathode 39 and the heater wire 41, is connected electrically to the other rod or wire 18 by a short wire or stub 48. Similarly, one of the rods or wires 38 carrying the control grid is connected to the rod or wire 19 by a short wire or stub 49, and one of the rods or wires 36 carrying the shield grid is connected to the rod or wire 20 by a short wire or stub 50.

In the fabrication of the device shown in Figs. 2 and 3, the cathode 39 and grids 25, 27 and 28, together with the insulating spacers 33 and 35, collar 31 and disc 11 may be assembled as a unitary structure. The electrodes may then be inserted into the envelope 10 in proper coaxial relation with the anode 15 and the envelope sealed hermetically by fusing the envelope and the backing ring 12 to the disc 11.

This construction provides a high degree of shielding between the anode and the other electrodes so that the input and output elements and circuits are effectively segregated. The cap 44, as previously mentioned, effectively shields the upper ends of the cathode and grid supports from the anode. Similarly, the collar 31, 32 effectively shields the lower ends of the cathode and grid supports from the anode. Also, the disc 11 together with the external shield 30, as shown in Fig. 1, effectively screens the leading-in conductors for the cathode and the control and screen grids from the anode and the leading-in conductor therefor. Hence, undesired interaction between the input and output circuits of the device is prevented and stable and efficient operation of the device is obtained.

Although specific embodiments of this invention have been shown and described, it will be understood, of course, that 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 enclosing vessel including a dished vitreous portion and a metallic closure disc sealed to the edge of said vitreous portion, a cylindrical anode within said vessel and supported by a leading-in

conductor sealed in said vitreous portion, and a unitary electrode assembly supported from said disc including a cathode and a grid within said anode, a support carrying said grid and secured to said disc, and an insulating member spacing said cathode and said support, said insulating member having portions engaging said vitreous portion to position said assembly with respect to said anode.

2. An electron discharge device comprising an enclosing vessel including a dished vitreous portion and a metallic closure disc sealed to the edge of said vitreous portion, a cylindrical anode within said vessel and supported by a leading-in conductor sealed in said vitreous portion, and a unitary electrode assembly including a cathode, a plurality of grids, metallic supports for one of said grids secured to said disc, and an insulating disc carried by said supports and spacing said cathode and said grids with respect to each other, said insulating disc having a flexible peripheral portion engaging said vitreous portion to position said assembly with respect to said anode.

VICTOR L. RONCI.