Dec. 1, 1936. C. E. FAY 2,062,302

ELECTRON DISCHARGE DEVICE

Filed Nov. 1, 1934

FIG. 1

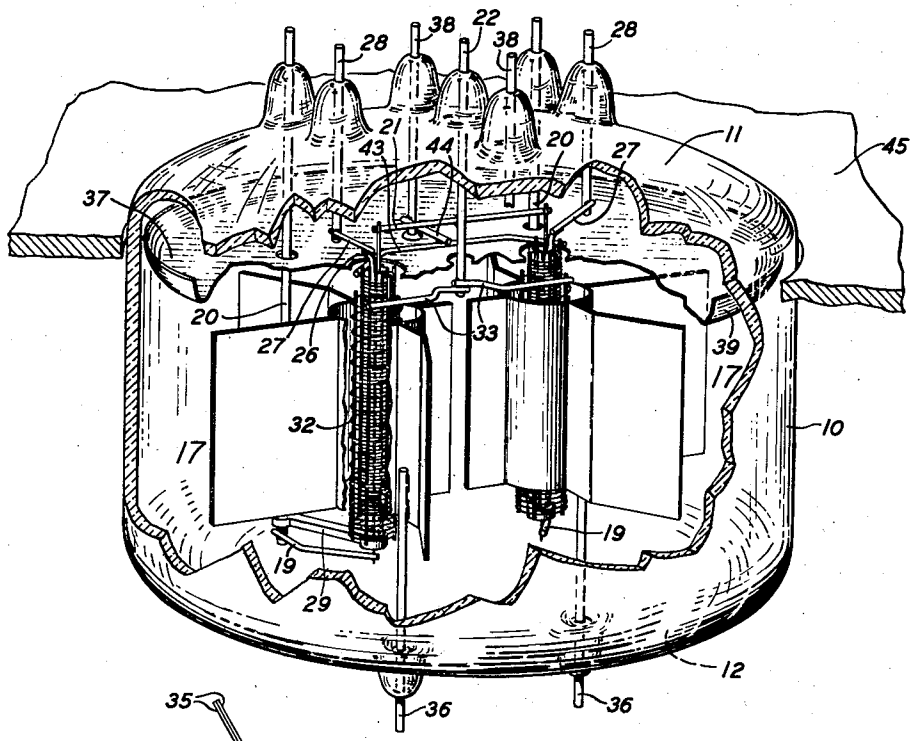

FIG. 2

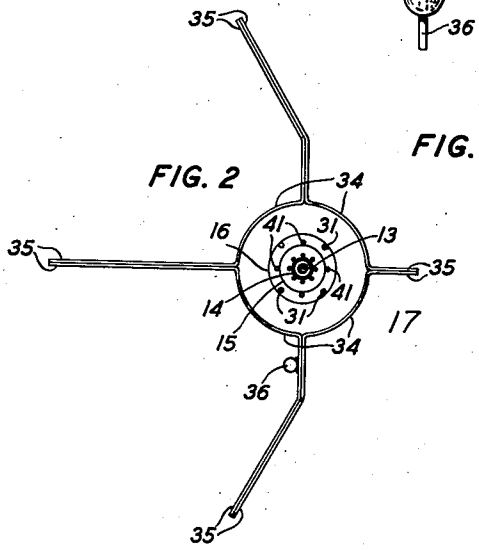

FIG. 3

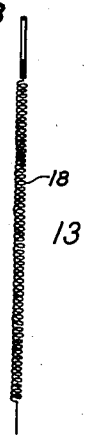

FIG. 4

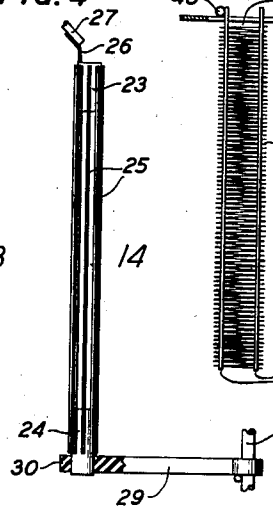

FIG. 5

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ELECTRON DISCHARGE DEVICE

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6 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices and more particularly to such devices of the shielded grid type adapted for the amplification of ultra-high frequency impulses.

One object of this invention is to amplify efficiently currents and voltages of ultra-high frequencies.

Another object of this invention is to shield effectively the input electrode and terminals of an electron discharge device from the output electrode and terminals.

Still another object of this invention is to expedite the electrical association of the electrodes in electron discharge devices having a plurality of individual electrode units within a single enclosing vessel.

In one embodiment of this invention, an electron discharge device comprises an enclosing vessel having a plurality of pentode units therein, each unit including a cathode, an anode, a control grid between the cathode and anode, and a shield grid and a suppressor grid disposed between the control grid and the anode. The control grids of the several units are individually mounted on metallic members or rods supported from a wall of the enclosing vessel. The anodes also are individually supported from the opposite wall of the vessel. The suppressor grids are electrically connected and mounted by a metallic member or rod supported from the same wall as the control grid support members. The shield grids are mounted on a single metallic plate or disc extending across one end of the electrode units and to immediately adjacent walls of the enclosing vessel, the plate or disc serving to screen the control grid supports and terminals from the anode supports and terminals. In order to further shield the control grid terminals from the anode terminals, an external metallic member is provided which surrounds the enclosing vessel and is disposed substantially coplanar with the plate or disc supporting the shield grids.

The invention and the 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 of an electron discharge device illustrative of this invention, portions of the enclosing vessel and of the anode of one electrode unit being broken away to show structural details more clearly;

Fig. 2 is an end view of one of the electrode units showing the configuration and disposition of the electrodes;

Fig. 3 is an enlarged detail view of the cathode of each of the electrode units;

Fig. 4 is an enlarged detail view of the control grid and the supports therefor; and

Fig. 5 is another enlarged detail view showing the association of the screen grid electrode and the plate or disc support therefor.

Referring now to the drawing, the electron discharge device comprises an enclosing vessel **10** having end walls **11** and **12** and enclosing two pentode units. Each of the pentode units includes an incandescible cathode **13**, a control grid **14**, a shield grid **15**, a suppressor grid **16**, and an anode **17**, the two units being disposed with their longitudinal axes parallel. The electrodes in each unit preferably are positioned as closely together as is mechanically and electrically feasible.

Each cathode **13** comprises a helix **18**, which may be of thoriated tungsten, secured at one end to a tie member **19** extending from a wire or rod **20** sealed in the end wall **11** of the enclosing vessel. Preferably, the tie members **19** are resilient so that a slight tension is applied to the helices **18** and their linear form is maintained. The two cathodes are supported at the other end from a wire or rod **21** secured to a support **22** also sealed in the end wall **11** of the enclosing vessel.

Each of the control grids comprises a pair of cylindrical metallic end members or collars **23** and **24**, between which a plurality of wires **25** extend, the wires being secured to the end members or collars as by welding. The wires **25** are disposed parallel to one another and are arranged in a cylindrical boundary about the respective cathodes. A metallic wire or strip **26** is secured to the end member or collar **23** and to a short rigid wire **27** which is secured in turn to a support wire or rod **28** sealed in the end wall **11** of the enclosing vessel. Each control grid assembly is maintained in proper position with respect to the corresponding cathode at the lower end, by an insulator **29** mounted upon one of the cathode wires or rods **20**, the insulator **29** having an aperture adjacent its end **30** through which the collar or end member **24** extends.

The suppressor grid in each electrode unit comprises a plurality of parallel wires **31** carrying a helical grid **32** which is disposed coaxially with the corresponding cathode. Two of the wires **31** of each suppressor grid assembly are secured to a rigid cross wire or rod **33** which, in turn, is secured to the cathode support rod **22**. Preferably, in the operation of the device, the cathode

support rod 22 is connected to the negative pole of the source of cathode heating current so that the suppressor grids are maintained at substantially zero potential with respect to the other grids and the anode.

The anodes comprise a plurality of arcuate sections 34 each provided with large surface flanges 35. Corresponding flanges on adjacent sections are secured together in face to face relation, as by welding, to provide a cylindrical portion which is disposed about the corresponding suppressor grid and coaxial therewith and with the corresponding cathode. The flanges 35 preferably are made as large as is feasible in order to effectively dissipate heat from the electrodes during operation of the device. As clearly shown shown in Fig. 2, two pairs of the flanges on each anode are bent outwardly so that the heat will be radiated away from the electrode units toward the side walls of the enclosing vessel. Each anode is supported by a rigid wire or rod 36 secured to one of the flanges 35 and sealed in the end wall 12 of the enclosing vessel.

A metallic plate or disc 37 is supported by a pair of wires or rods 38 sealed in the end wall 11 of the enclosing vessel and extends across one end of the electrode units and to immediately adjacent the side walls of the enclosing vessel 10. Preferably, the plate or disc is provided with a turned edge or peripheral flange 39 to prevent distortion thereof by heat during the operation of the device. The plate or disc 37 is provided with suitable apertures through which the cathode rods 20 and 22 and the control grid rods 28 pass. It is provided also with apertures 40 for allowing passage of two groups of parallel wires 41 which carry helical shield or screen grids 42. As clearly shown in Fig. 2, each of the screen grids 42 is disposed between a corresponding control grid and suppressor grid and coaxially with respect to a corresponding cathode. Two of the parallel wires 41 of each group are secured to a cross rod or wire 43 lying on and secured to one surface of the disc or plate 37 and connected to one of the support rods or wires 38 by a wire stub 44.

The disc or plate 37 effectively segregates and shields the input conductors of the device from the anode conductors 36 so that the device may be operated at very high frequencies. In order to insure further and substantially complete shielding, the device may be mounted on a metallic partition or external shield 45 which is disposed substantially coplanar with the disc or plate 37.

Although a specific embodiment of the invention has been shown and described, it is to 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, a cathode, an anode encompassing said cathode, a plurality of grid electrodes encompassing said cathode, a leading-in conductor for said anode extending through one end of said enclosing vessel, leading-in conductors for said cathode and one of said grid electrodes extending through the opposite end of said enclosing vessel, a metallic shield positioned between said ends and at substantially right angles to the longitudinal axis of said grid electrodes, said shield being electrically connected to and supporting another of said grid electrodes, and a single leading-in conductor supporting said shield from said opposite end of said vessel.

2. An electron discharge device comprising an enclosing vessel, a plurality of electrode units within said enclosing vessel, said units being disposed with their longitudinal axes substantially parallel and each including a cathode, an anode, and a grid electrode cooperatively disposed with respect to said cathode and anode, leading in conductors for said anodes extending from one end of said vessel, leading in conductors for said grids extending from said vessel at points remote from said one end, and a metallic disc extending adjacent one end of said units and supporting said grid electrodes, said disc shielding said grid conductors from said anode conductors.

3. An electron discharge device comprising an enclosing vessel, a metallic shield extending across said vessel and to immediately adjacent walls thereof and dividing it into two compartments, an electrode assembly in one of said compartments including a cathode, an anode, a control electrode between said anode and cathode, and a shield electrode, said shield electrode being electrically coupled to said metallic shield and extending immediately thereadjacent, a leading-in conductor for said anode sealed in said enclosing vessel and disposed in said one compartment, and supporting means for said control electrode disposed in the other compartment, said supporting means serving as a leading-in conductor.

4. An electron discharge device comprising an enclosing vessel, a cathode, an anode, a control electrode, a leading-in conductor for said anode extending through one end of said enclosing vessel, a leading-in conductor for said control electrode extending through the opposite end of said enclosing vessel, a metallic shield extending across one end of said anode and control electrode and to immediately adjacent lateral walls of said vessel whereby said conductor for said control electrode is electrically segregated from said anode and the leading-in conductor therefor, a support suspended from and carried by said shield, and a screen electrode carried by said support.

5. An electron discharge device comprising a plurality of electrode units each including a cathode, an anode, and a plurality of grid electrodes intermediate said cathode and said anode, means electrically connecting one grid electrode of one unit with the corresponding grid electrode of another unit, a support secured to said means, a disc extending across one end of said electrode units and supporting other corresponding of said grid electrodes, and a support for said disc.

6. An electron discharge device comprising a plurality of electrode units each including a cathode, a control electrode, a screen electrode, a suppressor electrode, and an anode, leading-in conductors individually supporting said control electrodes, a single leading-in conductor supporting said suppressor electrodes, leading-in conductors individually supporting said anodes, and means including a metallic disc supporting and electrically connecting said screen electrodes, said disc shielding the leading-in conductors for said control electrodes from the leading-in conductors for said anodes.

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