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ELECTRON DISCHARGE DEVICE OF THE MAGNETRON TYPE

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FIG. 1.

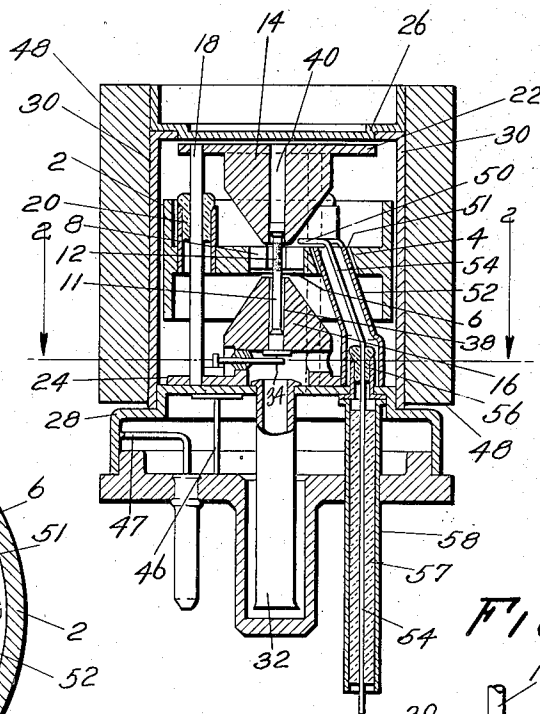


FIG. 4.

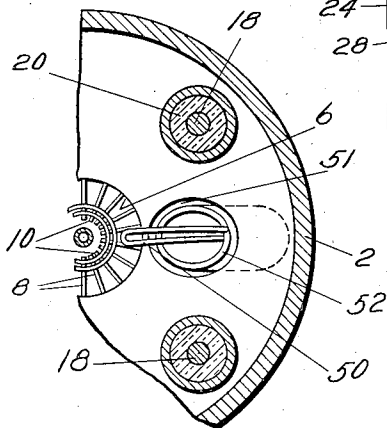


FIG. 2.

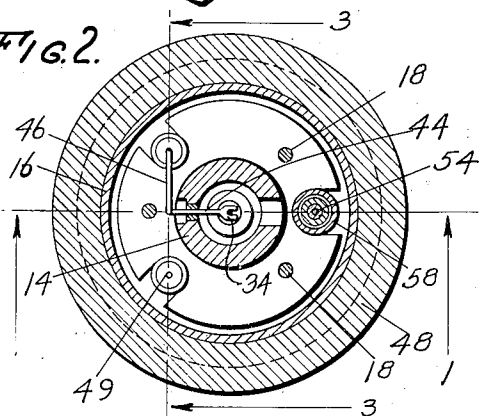
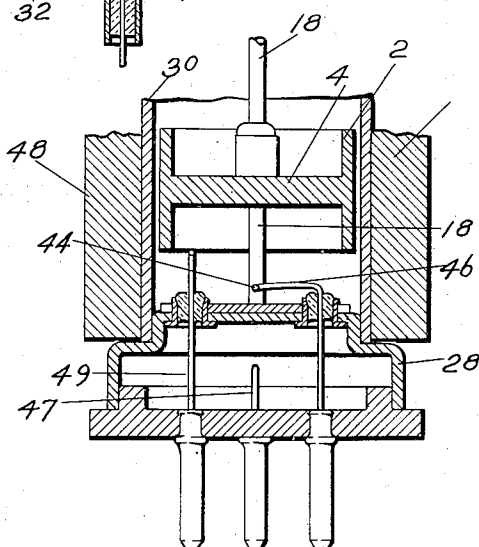


FIG. 3.



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UNITED STATES PATENT OFFICE

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ELECTRON DISCHARGE DEVICE OF THE
MAGNETRON TYPE

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1 Claim. (Cl. 315—39)

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This invention relates to electron discharge devices, such as magnetrons, for example, and more particularly to those of small dimensions and relatively low power.

One of the objects of the present invention is to provide an electron discharge device of the general type above referred to in which certain parts are preliminarily assembled and secured in the correct relative positions they are to occupy in the completed device, the resultant unit then being mounted in the device.

Another object of the present invention is to provide an electron discharge device of the general type referred to having a special arrangement of coaxial line for conducting the oscillations generated by the device out of the latter.

These and such other aims and objects of the invention as may hereinafter appear will be best understood from the following description taken in connection with the accompanying drawing of one embodiment of the invention herein given for illustrative purposes.

In the drawing:

Fig. 1 is a vertical section on line 1—1 of Fig. 2 of an electron discharge device incorporating one illustrative embodiment of the invention;

Fig. 2 is a horizontal section on line 2—2 of Fig. 1;

Fig. 3 is a vertical section on line 3—3 of Fig. 2; and

Fig. 4 is a horizontal section on line 4—4 of Fig. 1.

The illustrative embodiment of the invention shown in the drawing comprises an anode structure consisting of a cylinder 2 and a control wall 4 projecting from its inner surface and provided with a central circular aperture 6, to the wall of which is soldered a plurality of radially disposed, suitably spaced, plates or arms 8. (See Fig. 4.) Said cylinder 2 and wall 4 will preferably be made of copper. The said plates 8 may be stamped out of a sheet of highly conductive copper and their inner ends constitute anode faces 10 which form electron-receiving portions and cooperate with the cathode 11 having its active portion 12 supported substantially centrally of and coextensive with said anode faces. Pole pieces 14 and 16 are provided at opposite sides of said aperture 6 and concentrically with the latter. In accordance with the present invention said anode structure is supported by electrically conductive rods 18 which are sealed through porcelain seals 20 (only two of which are shown) in said wall 4, their ends being soldered in flanges 22 and 24 of said pole pieces 14 and 16, respec-

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tively. Headers 26 and 28, of steel or other suitable magnetic metal, are soldered to the two ends respectively of a cylinder 30 of electrically conductive non-magnetic metal, such as copper, for example, possessing a relatively high coefficient of thermal conductivity, thus forming with said headers an envelope containing all the parts so far described, and which can be evacuated through a pipe 32 which is then sealed. The flange 24 of pole piece 16 is spot-welded to said header 28, the other header 26 being slightly spaced from the pole piece 14.

The cathode 11 will preferably be of the indirectly heated thermionic type comprising a hollow cylinder of electrically conductive metal, nickel for example, containing a heater wire 34, and the active portion 12 of said cathode may be coated with an electron-emissive substance, such as oxides of the alkaline earth metals. The slightly enlarged lower end of said cathode 11 fits tightly in the lower end of a bore 38 extending centrally through said pole piece 16 and in alignment with a similar bore 40 in the upper pole piece 14. The upper end of said cathode is received in said bore 40 of said pole piece 14, said bore 40 being of the same diameter as said bore 38, and the upper end of the cathode being enlarged to the same extent as its lower end in order to fit said bore 40 so that the cathode is thus securely centered and electrically connected to said pole piece 14. The pole piece may be copper plated to increase its conductivity. The heater wire 34 extends axially of the cathode, its upper end being connected to the inner surface of the enlarged upper end of said cathode and its other end to a conductor 44 connected to a lead-in conductor 46. From said pole piece 14, the heater wire circuit continues through the header 28 to the lead-conductor 47. The anode lead-in conductor is shown at 49 sealed through said heater 28. (See Fig. 3.) A cylindrical magnet 48 for exciting the pole pieces 14 and 16 may surround the copper cylinder 30.

If the above described electron discharge device be energized, and the pole pieces 14 and 16 be excited by a suitable magnet, such as that above referred to, oscillations will be generated in said device which may be led out of the device by a coupling loop extending into the anode structure above the space or resonator cavity between two of said anode arms 8. In accordance with the present invention one end of said coupling loop 50 is connected to the inner end of a tubular structure comprising a conducting pipe 52 (see Fig. 1) extending through an opening 51 in said

wall 4 of the anode structure and spaced from the inner wall of said opening, said pipe being hermetically soldered at its other end around a circular opening through the wall of said header 28. A second conducting pipe 58 is soldered at one end around said opening 51 in continuation of said pipe 52. The other end of said loop 50 is connected to a conductor 54 which extends axially of said two pipes 52 and 58 and is sealed through a glass seal 56 carried by said header 28, said conductor 54 forming with said pipes 52 and 58 a coaxial line through which the high frequency oscillations generated by the device may be conducted to any suitable utilization circuit. In accordance with the present invention electrically non-conductive means will preferably be provided to keep said conductor 54 centered in said pipe. Said means may conveniently consist of a suitable insulating material 57, such as polystyrene.

Each pair of anode arms 8 forms with the portion of wall 4 between them an oscillating cavity or cavity resonator. A capacitance exists between the cathode and the end faces of said anode arms and also between the side walls of each cavity resonator. The conductive path around each cavity resonator afforded by the walls thereof constitutes an inductance. The anode therefor is so designed and spaced relatively to the cathode that said inductances and capacitances constitute tuned circuits.

In accordance with the present invention the device will preferably be assembled as follows:

The anode structure 2, 4, 8, pole pieces 14 and 16, and the supporting rods 18 are first assembled in the proper relative positions they are to occupy in the completed device and are then placed in a jig and soldered together in a suitable furnace and in one operation so as to form a unit. The base assembly comprising the header 28 with the conducting pipes 52 and 58 welded thereto as previously described, and containing the conductor 54, sealed in the lower end of said pipe 52, and the conductors 46 and 49 sealed through said header 28, is then secured to said unit by spot-welding the flange of the pole piece 16 centrally to the inner surface of said header 28, after first passing the upper end of pipe 52 through the opening 51 in said wall 4 of the anode structure and bending the projecting coupling loop 50 so that it shall overhang a cavity resonator, as shown in Figs. 1 and 4. The cathode 11 with the heater wire 34 therein and connected thereto, as previously described, will also be inserted in proper position in the bores 38 and 40 of the two pole pieces 16 and 15, respectively, before spot-welding the flange 24 of the pole piece 16 to the inner surface of said header 28. The top header having been welded or soldered to the upper end of the cylindrical casing 30, the lower end of the cylindrical casing 30

can now be welded to the marginal portion of said header 28 thus completing the assembly of the device.

By assembling the parts in their correct relative positions, as above described, and then mounting them as a unit in the envelope instead of separately in the latter, the correct relative positions of the parts in the finished article are assured. Owing to the diminutive size of the device and the restricted space into which the different parts must be mounted, assembling the parts separately in the casing would be very difficult and it would be particularly difficult to insure their being in their correct relative positions.

Wherever the expression "a plurality" occurs it is to be constituted as meaning two or more.

I am aware that the present invention can be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present description to be considered in all respects as illustrative and not restrictive, reference being had to the appended claim rather than to the aforesaid description to indicate the scope of the invention.

What is claimed is:

An electron discharge device comprising a cathode, an anode structure including a wall having a plurality of electron-receiving portions adjacent said cathode, a cavity resonator interconnecting each pair of adjacent electron-receiving portions, a tubular structure extending through an aperture in said wall in spaced relationship to said wall, a conductor extending axially of said tubular structure, an output loop adjacent one of said cavity resonators, one end of said loop being electrically connected to said tubular structure and the other end of said loop being connected to said conductor, and insulating means engaging said conductor and the inner wall of said tubular structure for centering said conductor in said tubular structure.

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