Feb. 14, 1950 W. C. BROWN 2,497,436

ELECTRON DISCHARGE DEVICE

Filed April 26, 1947

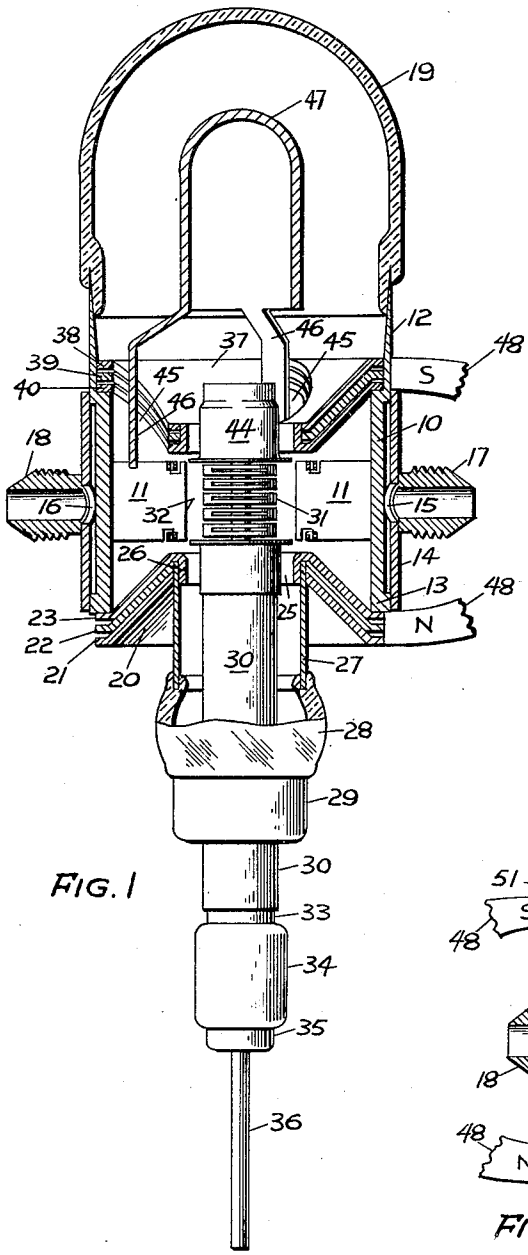


FIG. 1

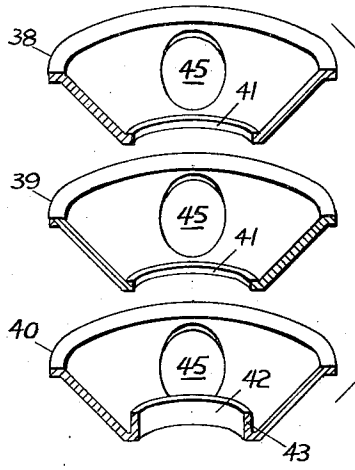


FIG. 2

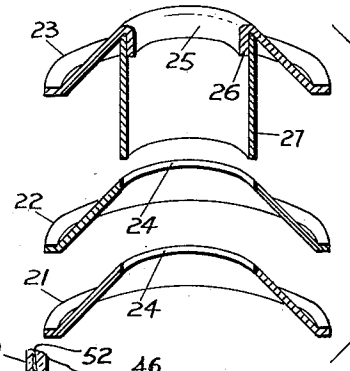


FIG. 3

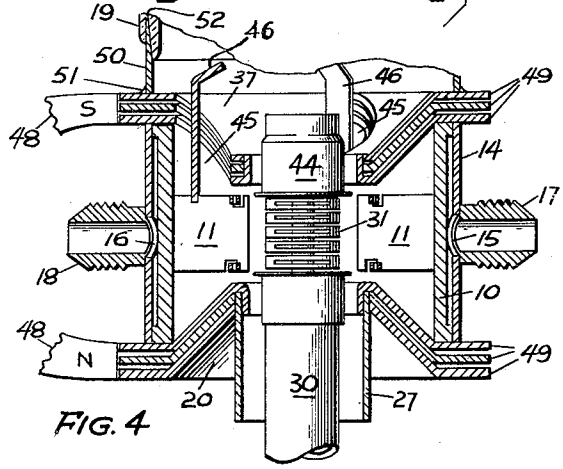


FIG. 4

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Patented Feb. 14, 1950 2,497,436

UNITED STATES PATENT OFFICE

2,497,436

ELECTRON DISCHARGE DEVICE

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Application April 26, 1947, Serial No. 744,087

6 Claims. (Cl. 250—27.5)

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This invention relates to electron discharge devices having a plurality of cavity resonators, and more particularly to those for generating oscillations for short wave length.

One of the objects of the present invention is to provide a device of the type referred to which shall have improved pole pieces, the construction of which represents a considerable saving in the cost of assembly and material.

Other and further objects and advantages of the present invention will become apparent, and the foregoing will be understood in relation to the following exemplification thereof, reference being had to the drawing in which:

Fig. 1 is a central, longitudinal section of an electron discharge device incorporating an illustrative embodiment of the present invention;

Figs. 2 and 3 are exploded partial perspective views of the present invention; and

Fig. 4 illustrates a modification of the illustrative embodiment of Fig. 1.

Referring now more particularly to Fig. 1, the numeral 10 represents an electrically-conductive tubular member, preferably of copper, which together with a plurality of vanes or anode arms 11 make up the anode structure of an electron discharge device known as a magnetron. Said anode arms are preferably made of copper. Extending outwardly from said tubular member 10 are annular portions 12—13. Surrounding said annular portions 12—13 is a second tubular member 14, preferably of copper, which, combined with said first-named tubular member 10, forms a hollow cooling jacket. Attached to a pair of apertures 15—16 in said second-named tubular member 14 are threaded nipples 17—18 adapted to be attached to a source of cooling liquid to be circulated within the jacket formed by said tubular members 10 and 14.

The annular portion 12 is gradually tapered and to said tapered portion is sealed a vitreous dome 19. To the lower annular portion 13 is attached a laminated pole piece 20, preferably of steel and consisting of a plurality of dishlike members 21—23, so designed as to nest one within the other. The members 21—22 are provided with apertures 24, see Fig. 3, while the member 23 is provided with an aperture 25 which has been upset to provide a shallow annular shoulder 26. Surrounding and attached to said last-named shoulder 26 is a third tubular member 27, preferably of a metal having the property of being readily sealed to any vitreous material such as glass. The other end of said tubular member 27 is hermetically sealed to a short length

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of glass tubing 28, which in turn is fastened to a ferrule 29. Preferably, said ferrule is made of the same material as the member 27 and is attached to a cathode lead-in structure 30, said lead-in structure supporting an electron-emissive cathode 31, positioned intermediate and parallel the edges 32 of the anode arms 11, said lead-in 30 and cathode 31 being made accessible to the interior of the tubular member via the apertures 24—25 of the pole piece 20.

The member 30 is attached to an annular member 33, said last-named member being attached to a second length of glass tubing 34 which in turn is connected to a second ferrule 35, said ferrule being attached to an inner cathode lead-in 36. Preferably the annular members 33 and 35 shall be of the same material as the member 27 while the inner cathode lead-in 36 may be made of tungsten.

Since both inner and outer lead-in conductors 30 and 36 together with the pole piece 20 are hermetically sealed to said tubular member 10, they form, in combination with the vitreous dome 19, a hermetically sealed enclosure.

Within said enclosure and disposed opposite said pole piece 20 is a second pole piece 37, consisting of similar dishlike members 38—40 of similar material and having apertures 41—42 see Fig. 2, the member 40 having its aperture 42 upset to form an annular shoulder 43, extending upwardly from the dishlike configuration of said member 40. The last-named apertures provide the necessary space for the upper supporting member 44 of the cathode 31.

The pole piece 37 is, for example, silver-soldered within the annular portion 12 of the tubular member 10, said pole piece having a plurality of apertures 45 in the inclined portion thereof for the extension therethrough of a plurality of prongs 46. Said prongs are attached to a plurality of anode arms 11, the opposite ends of said prongs terminating in a dome-like member 47 which functions as an electromagnetic radiator of energy conducted thereto from the cavity resonators not shown formed by the wall of the tubular member 10 and the anode arms 11 attached thereto, when said device is suitably energized.

Means for magnetizing the pole pieces 20 and 37 are provided by external means such as a permanent magnet 48 suitably attached thereto. In this particular embodiment, the south pole of the magnet 48 is separated from direct contact with the pole piece 37 by the annular portion 12. The reluctance introduced by this slight separation

is negligible and can be discounted. However, a modified embodiment is shown in Fig. 4 which serves to overcome the last-named situation completely and which will be discussed in connection with said figure.

In Figs. 2 and 3 the pole piece is illustrated in an exploded view. The various parts 21—23 and 38—40 are stamped out in the desired shape and then nested one within the other and brazed or welded together as desired.

The apertures 24 in the members 21—22 are made sufficiently large to slip over the tubular member 27. In stacking this particular group of members, it would be preferable to weld or braze the tubular member 27 to the annular shoulder 26 first and then slip the members 20—22 over said tubular member 27 and braze or weld them in place. The apertures 41 in the members 38 are of a size sufficient to accommodate the upset portion 43 of the member 40.

Although only one aperture 45 is shown in each of the inclined portions of members 41—42, it should be understood that the number of such apertures is determined by the number of prongs 46 extending from the energy-transferring member 47.

Fig. 4 illustrates a modification of the embodiment shown in Fig. 1. In this particular embodiment, the lips 49 of the members of the pole pieces 20 and 37 are extended beyond the tubular member 14. Said pole pieces are assembled in the same manner hereinbefore described and are then attached to the respective open ends of the tubular members 10 and 14, for example, by silver soldering or other suitable means. This particular construction provides the means whereby the external magnetizing source 48 is connected directly to the pole pieces 20 and 37 and so eliminates the reluctance path present in the construction illustrated in Fig. 1. In this modification an annular member 50 is attached to the uppermost member of the pole piece 37, for example, by silver soldering as represented by numeral 51. The annular member 50 is tapered along one edge 52 thereof and the vitreous dome 19 hermetically sealed to this tapered edge.

The embodiments of the present invention which have been illustrated and described have been selected for the purpose of setting forth the principles involved. It will be obvious, however, that the invention may be modified to meet various conditions which may be encountered in different specific uses, and it is therefore intended to cover by the appended claims all such modifications which fall within the spirit and scope of this invention.

What is claimed is:

1. An electron discharge device comprising: a tubular member; and a laminated pole piece disposed in said tubular member; said pole piece including a plurality of nested, dish-like stampings having centrally apertured bottom walls; the bottom wall of one of said stampings being upset and forming an annular shoulder axially aligning the remaining stampings.

2. An electron discharge device comprising: a tubular member; and a laminated pole piece disposed in said tubular member; said pole piece including a plurality of nested, dish-like stampings having centrally apertured bottom walls and flanged portions extending exteriorly of said tubular member from the side walls thereof; the bottom wall of one of said stampings being upset and forming an annular shoulder axially aligning the remaining stampings.

3. An electron discharge device comprising: a tubular member; and a pair of laminated pole pieces disposed at opposite ends of said tubular member; each of said pole pieces including a plurality of nested, dish-like members having centrally apertured bottom walls and integral lips extending exteriorly of said tubular member from the side walls thereof.

4. An electron discharge device comprising: a tubular member; and a pair of laminated pole pieces disposed at opposite ends of said tubular member; each of said pole pieces including a plurality of nested, dish-like members having centrally apertured bottom walls and integral lips extending exteriorly of said tubular member from the side walls thereof; one of the dish-like members of each of said pole pieces having its bottom wall upset and forming an annular shoulder axially aligning the remaining dish-like members.

5. An electron discharge device comprising: a tubular member; a plurality of anode arms extending inwardly from said tubular member; a laminated pole piece extending inwardly from said tubular member and being disposed adjacent said anode arms; and an electrically conductive member connected to one of said anode arms; said pole piece being apertured to permit the passage therethrough of said electrically conductive member.

6. An electron discharge device comprising: a cathode; an anode structure, spaced from said cathode, and incorporating a cavity resonator; an output device coupled to said cavity resonator; and a pair of laminated pole pieces extending inwardly from said anode structure on opposite sides of said cavity resonator; both of said pole pieces being centrally apertured to accommodate said cathode, and one of said pole pieces being additionally apertured to permit the passage therethrough of said output device.

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