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ELECTRON DISCHARGE DEVICE OF THE MAGNETRON TYPE

Filed March 13, 1948

2 Sheets-Sheet 1

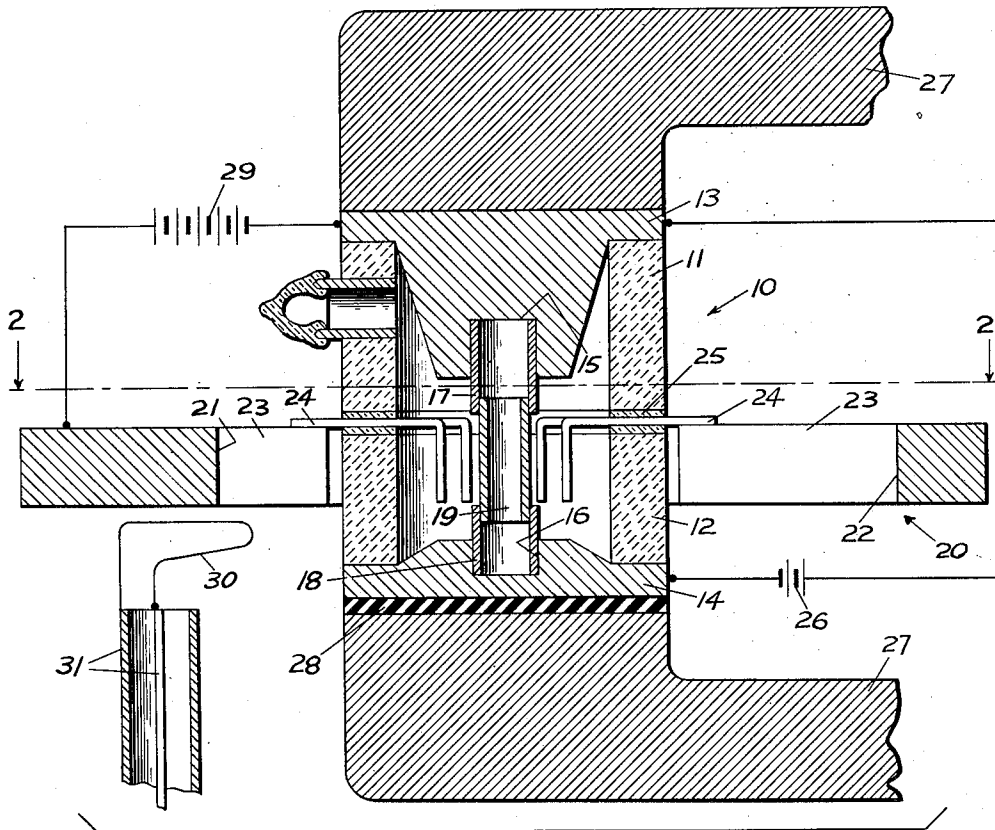


FIG. 1

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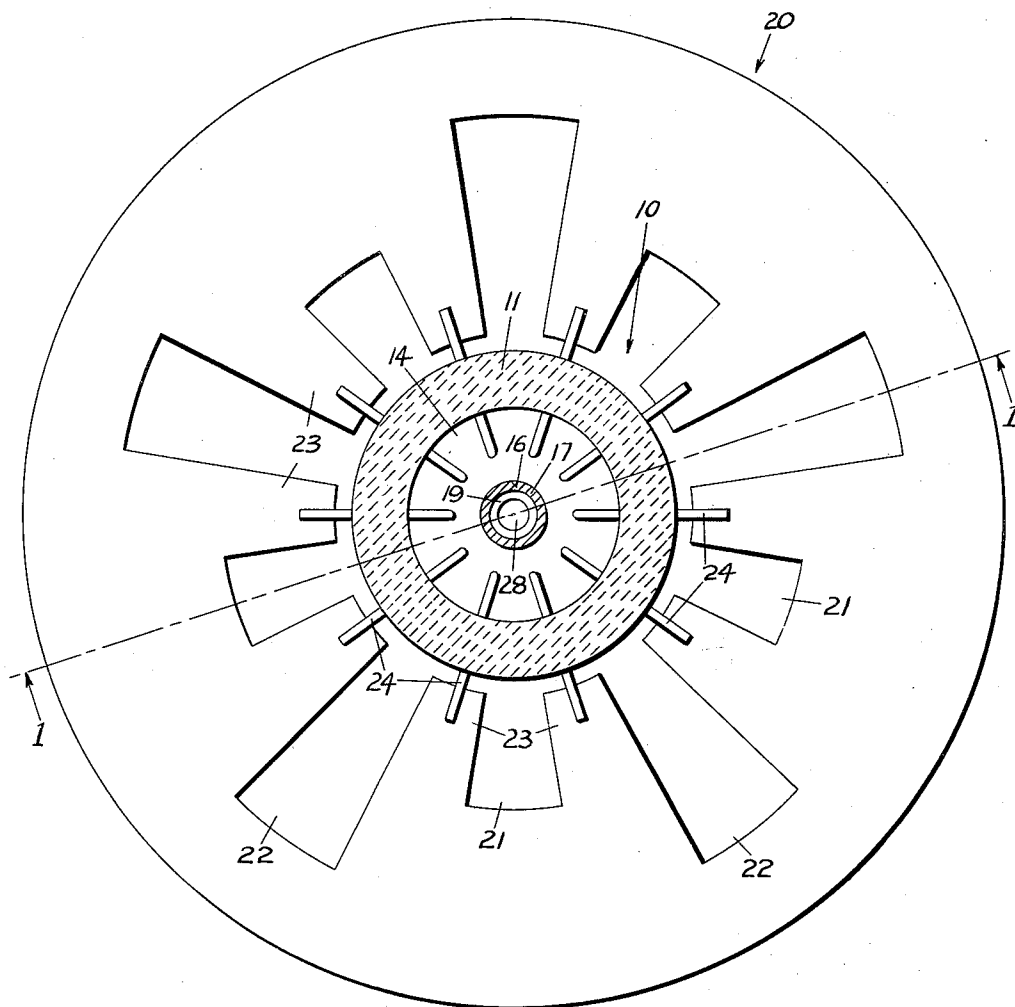


FIG. 2

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ELECTRON DISCHARGE DEVICE OF THE
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Application March 13, 1948, Serial No. 14,694

3 Claims. (Cl. 315—40)

1

This invention relates to electron-discharge devices, and more particularly to electron-discharge devices of the magnetron type.

Devices of the general character indicated usually include an envelope which also constitutes the anode structure and incorporates a plurality of cavity resonators. For devices intended to operate in the low centimeter region of the electro-magnetic spectrum, for example, below three centimeters, this type of construction presents manufacturing difficulties.

It is, therefore, among the objects of the present invention to provide a construction which more readily enables the manufacture of small size tubes of the type above referred to.

It is another object of the present invention, not only to simplify the technique of building small size magnetrons, but at the same time, to produce a small size tube in which there is good mode separation and is, therefore, efficient in operation.

These, and other objects of the present invention, which will become more apparent as the detailed description thereof progresses, are attained, briefly, in the following manner:

The envelope of the device of the present invention is generally cylindrical and is made of dielectric material. The ends of the envelope are sealed by pole pieces, and a cathode is supported within the envelope intermediate said pole pieces. An anode structure surrounds the cathode and is sealed through the envelope, said anode structure incorporating a plurality of cavity resonators. The anode structure includes a body of conductive material surrounding the envelope and is provided with a plurality of circumferentially spaced radial slots, and a plurality of conductive fingers secured to said body intermediate said slots and extending through said envelope into proximity with said cathode. This type of construction readily enables the manufacture of small size tubes, and, while not necessary, the body portion of the anode which is exterior of the envelope may be fashioned after a "rising sun" type of magnetron anode, whereby strapping may be eliminated while still retaining adequate mode separation.

In the accompanying specification there shall be described, and in the annexed drawings shown, an illustrative embodiment of the electron-discharge device of the present invention. It is, however, to be clearly understood that the present invention is not to be limited to the details herein shown and described for purposes of illustration only, inasmuch as changes therein may be made

2

without the exercise of invention, and within the true spirit and scope of the claims hereto appended.

In the drawings, Fig. 1 is a vertical sectional view, taken along line 1—1 of Fig. 2, substantially through the center of an electron-discharge device made in accordance with the present invention; and

Fig. 2 is a transverse sectional view, taken along line 2—2 of Fig. 1.

Referring now more in detail to the aforesaid illustrative embodiment of the present invention, with particular reference to the drawings illustrating the same, the numeral 10 generally designates an open-ended, cylindrical envelope made of dielectric material, for example, a ceramic. Said envelope is made, preferably, of two parts 11 and 12, the lower part preferably having its upper edge prepared for joinder with the upper part by sprinkling with powdered glass and then firing the same, while the lower edge of the upper part may be prepared for the joinder by sprinkling with powdered glass but leaving the same unfired until the parts are to be brought together in the manner as will hereinafter be more fully described.

The open ends of the envelope 10 are hermetically sealed by pole pieces 13 and 14, the opposed faces of said pole pieces being provided with recesses 15 and 16 receptive, respectively, of tubular, cathode-supporting members 17 and 18.

Centrally disposed in the envelope 10, as by being supported in the members 17 and 18, is a directly-heated, thoriated cathode 19, said cathode preferably being made as described in the copending application of John F. Hanson, Serial No. 753,864, filed June 11, 1947, now Patent No. 2,477,601, dated August 2, 1949, or the copending application of Percy L. Spencer, Serial No. 769,348, filed August 19, 1947, now Patent No. 2,473,550, dated June 21, 1949.

Surrounding the envelope 10 is an annular body 20 of highly conductive material, such as copper, said body being provided with a plurality of interior, circumferentially spaced radial slots 21 and 22, said slots preferably being alternately wide and narrow after the fashion of the so-called "rising sun" type of magnetron anode and being spaced by interiorly directed anode arms 23. Secured to the arms 23, as by soft soldering, is a plurality of L-shaped fingers 24 made, preferably, of molybdenum, said fingers extending through the envelope 10 into proximity with the cathode 19. The fingers 24 and the arms 23, to-

3

gether with those portions of the body 20 lying therebetween, define cavity resonators.

When the device is ready for assembly, the fingers 24, already secured to the slotted body 20, are rested upon the upper edge of the lower part 12 of the envelope 10, said edge having already been prepared as set forth in earlier portions of this specification. The upper part 11 of the envelope 10, which has its lower edge also prepared as previously indicated, is placed over the fingers 24, and the whole assembly is securely held in an appropriate jig. Upon suitable firing, the facing edges of the parts 11 and 12 of the envelope become fused, as indicated at 25, and hold the fingers 24 embedded therein.

Heating current for the cathode 19 may be provided by a source of voltage 26 connected, as shown, between the pole pieces 13 and 14. Said pole pieces may be secured to a horseshoe magnet 27, with an insulator 28 interposed between one of them, for example, the pole piece 14, and the magnet to prevent short circuiting of the source of voltage 26.

Power may be supplied the device by a source of voltage 29 connected, as shown, between the pole piece 13 and the body 20 of the anode structure.

When a device such as has been described is energized as indicated, it generates electrical oscillations of a wavelength determined, primarily, by the geometry of the elements making up the cavity resonators. These oscillations may be extracted by a coupling loop 30 positioned adjacent any one of the cavity resonators, said loop being, in turn, coupled, for example, to a coaxial transmission line 31.

This completes the description of the aforesaid illustrative embodiment of the present invention. It will be noted from all of the foregoing that the present invention provides a construction which enables the relatively easy manufacture of a small size tube of the magnetron type. It will further be noted that the technique of building such a tube is simple and that, although no strapping is employed in the tube, the construction lends itself to the use of the so-called "rising sun" type of anode in which there is good inherent mode separation.

Other objects and advantages of the present invention will readily occur to those skilled in the art to which the same relates.

4

What is claimed is:

1. An electron-discharge device comprising: an evacuated envelope including a cylindrical body of dielectric material and a pair of opposed pole pieces hermetically sealed to opposite ends of said body; a cathode disposed in said envelope and supported between said pole pieces; and an anode structure spaced from said cathode and incorporating a cavity resonator; said cavity resonator being hermetically sealed through said envelope and having portions interiorly and exteriorly thereof.

2. An electron-discharge device comprising: an evacuated envelope; a cathode disposed in said envelope; and an anode structure spaced from said cathode and including a pair of anode arms which, together with that portion of said anode structure lying therebetween, define a cavity resonator; said anode arms passing through said envelope and having portions interiorly and exteriorly thereof.

3. An electron-discharge device comprising: an evacuated envelope including a cylindrical body of dielectric material and a pair of opposed pole pieces hermetically sealed to opposite ends of said body; a cathode disposed in said envelope and supported between said pole pieces; and an anode structure spaced from said cathode and including a pair of anode arms which, together with that portion of said anode structure lying therebetween, define a cavity resonator; said anode arms being hermetically sealed through said envelope and having portions interiorly and exteriorly thereof.

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