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MAGNETRON

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FIG. 1.

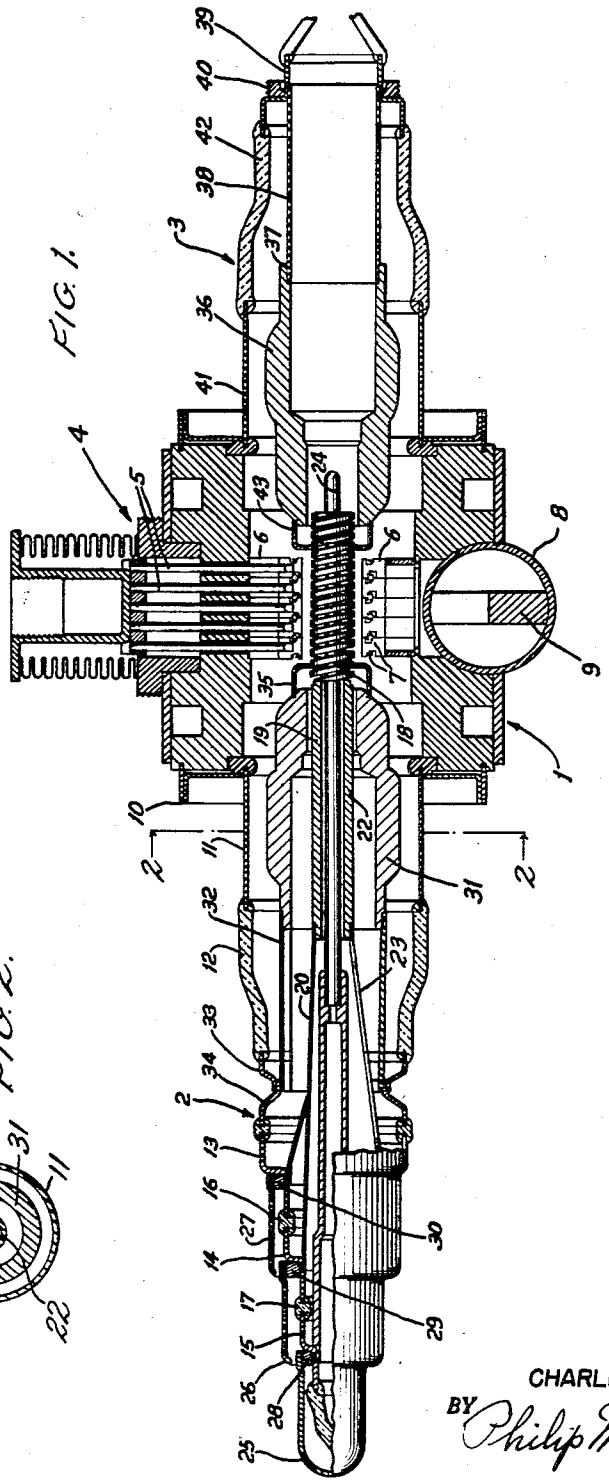
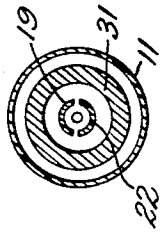


FIG. 2.



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MAGNETRON

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This invention relates to generators of microwave energy and particularly to electron discharge devices such as magnetrons.

More specifically, this invention relates to the construction and disposition of magnetic pole pieces positioned within the magnetron body.

According to known practice, the magnetic field in a magnetron is produced by magnetic pole pieces positioned on opposite sides of the cavity resonators. Since the pole pieces are in physical contact with the anode block of the magnetron body, they are subjected to the potential existing on the anode block. Imposing this potential on the pole pieces introduces certain disadvantages during the operation of the magnetron. For example, since the pole pieces are in close proximity to the cathode, which is negative with respect to the pole pieces, there will exist a certain amount of leakage current to the pole pieces; this reduces the efficiency of the magnetron. Further, since the pole pieces are electrically connected to the magnetron body, the pole pieces cannot easily be used as an electrode to modulate the output energy from the cavity resonators; this reduces the versatility of the magnetron. Another disadvantage of the known construction is found during the processing of the tube when it is desired to obtain as perfect a vacuum as possible. The pole pieces during the processing operation are, in effect, parasitic and therefore retain certain gas producing impurities which are harmful during the operation of the magnetron.

It is an object of this invention to construct and so position the pole pieces that the efficiency and versatility of the magnetron are improved; and further, that the processing of the magnetron may be performed more rigorously and efficiently.

In accordance with the invention there are provided pole pieces mounted inside the magnetron body and positioned on opposite sides of the cavity resonator system. The invention is characterized by constructing and positioning the pole pieces so that they are electrically separated from the magnetron body. Thus any desirable potential may be imposed on the pole pieces to:

(1) Prevent leakage current;

(2) Use the pole pieces as an electrode to modulate the output energy; and

(3) Process the magnetron while imposing on the pole pieces a positive potential during the evacuation so that a more complete evacuation of the absorbed gases from the various metals may be achieved.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood, by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawing wherein Figure 1 shows in cross-section an embodiment of the magnetron showing the construction and position of the pole pieces; and Figure 2 is a sectional view made along the line 2—2 of Fig. 1.

Since the invention resides in the construction and disposition of the pole pieces positioned in the magnetron, the other portions of the magnetron will be described only briefly and to the extent necessary for an understanding of the invention.

Referring now to the drawing the reference character 1 represents the body of the magnetron to which other parts are brazed or otherwise suitably fastened to form a structure capable of being evacuated. On one side of the body is a cylindrical extension 2 while on the other side there is a similar but shorter cylindrical extension 3, both extensions being brazed to the body 1. These two cylindrical extensions 2 and 3 form envelope members fastened to opposite sides of the body of the magnetron.

The magnetron is tuned in accordance with known tuning means 4 comprising a plurality of plungers 5 which are movable into or out of resonating cavities formed by a plurality of vanes 6. The cavities are formed by brazing a plurality of vanes 6 around the inner diameter of the body 1, as shown. In the embodiment shown quadruple strapping 7 is provided to prevent mode jumping.

The output energy is extracted from the magnetron in accordance with known methods, through the horn 8, which includes an impedance transformer 9. The energy from the horn may be transferred to a waveguide in accordance with well known means. The details of the output coupling means 8 may be found in my Patent 2,512,901, filed November 1, 1945, and issued June 27, 1950.

On the aforementioned cylindrical extension 2 is mounted the cathode support assembly. Since this assembly is not part of my present invention, but is described in Pat. No. 2,474,263, filed November 1, 1945, and issued June 28, 1949, it will be only briefly described here. A support cup 10 is brazed to the extension 2 and to a tubular sealing member 11. This member and other members which are part of the metal to glass seal for insulating the cathode supporting members one from another is preferably made of Kovar or other suitable material. Sealed to the member 11 is an insulating portion 12 preferably of glass followed by a series of three metal cups 13, 14 and 15, separated by glass portions 16 and 17. Two of the metal cups are attached to the supporting members of the cathode 18. The cathode comprises two filaments made preferably of thoriated tungsten, so mounted and energized as to constitute a bifilar filament. One end of one filament is connected to a semi-cylindrical member 19 which is in turn fastened to a conical or other conoidal shaped support 20, the latter being brazed to the metal cups 13 and 14. One end of the other filament winding is connected in a similar manner through another cylindrical sleeve member 22 and conical support 23 to metal cup 13. The other ends of each filament are connected to a rod 24. Power for energizing the cathode may be applied as required by connecting the power supply leads to the terminals 25, 26 and 27; these terminals being screwed onto threaded rings 28, 29 and 30 respectively. The rings are brazed to the metal cups to ensure good electrical connections throughout.

The pole piece 31, positioned on one side of the cavity resonator and mounted inside the magnetron body surrounds the semi-cylindrical members 19 and 22 without making electrical contact therewith. The pole piece is supported at one end by a cylindrical member 32 fastened to the junction of a pair of metal cups 33 and 34 respectively. The cylindrical member 32 is fastened to one end of the pole piece 31 to rapidly conduct the heat from the pole piece. At the opposite end of the pole piece 31 there is connected an end hat 35 to concentrate the emitted electrons from the cathode 18 to the interaction space between the cathode and the anode. Similarly on

the other side of the cavity resonator is positioned a pole piece 36 supported at one end 37 to a metal cylinder 38 which is fastened to a metal cup 39. The metal cup 39 represents a terminal over which power may be supplied to the pole piece 36. For example, a power supply lead may be threaded onto a threaded ring 40 to ensure proper contact therewith. The input terminal 39 is separated from a tubular sealing member 41 by an insulating portion 42. The pole piece 36 also comprises an end hat 43 for the same purpose as end hat 35.

The pole pieces 31 and 36 are so called electrically floating with respect to the other potentials applied to the magnetron during operation. That is, the pole pieces are electrically separated from the magnetron. Since the pole pieces are separated, it is seen that any desirable potential may be imposed on either or both pole pieces. By way of example, in the shown embodiment, a potential may be applied to the pole piece 36 over the terminal 39.

In the processing of the magnetron, the tube may be more rigorously processed because the pole pieces may be maintained at a positive potential during the evacuation. Therefore a more complete evacuation of the absorbed gases from the various metals may be achieved.

In the operation of the magnetron the pole piece 36 may be used as an electrode to which a variable modulating potential may be applied with respect to the cathode so that frequency modulation of the energy generated in the magnetron may be readily attained.

Leakage current is prevented by applying a voltage to the pole piece so that it will be at cathode potential and therefore will not draw cathode current.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation of the scope of my invention as set forth in the objects thereof and in the accompanying claims.

What is claimed is:

1. A magnetron comprising a supporting body, a cavity resonator system located inside said body, a pair of envelope members fastened to opposite sides of said body each having conductive portions insulated from said body, and a pole piece of magnetic material positioned within each of said envelope members on opposite sides of said cavity resonator system for providing a magnetic field longitudinally through said resonator, characterized by means for mounting at least one of said pole pieces in electrically insulated relation with respect to said magnetron body, said means for mounting comprising conductive means connected to said pole piece and to said conductive portion of the respective envelope portion whereby a potential different from that of the body may be applied to said pole piece.

2. A magnetron according to claim 1 wherein said mounting means further includes conductive means for connecting the other of said pole pieces to said conductive portion of its respective envelope member.

3. A magnetron comprising a supporting body, a plurality of vanes mounted inside said body integrally therewith, the size and positions of said vanes forming together with said body a plurality of resonators, a pair of envelope members fastened to opposite sides of said body each having conductive portions insulated from said body, means positioned in said envelope members for providing a magnetic field to produce oscillations in said resonators, said means comprising a pair of pole pieces, one mounted within each of said envelope members, electrically separated from said magnetron body, and positioned on opposite sides of said resonators, and cylindrical conductive means interconnecting each pole piece and said conductive portion of the respective envelope member.

4. A magnetron comprising a conductive supporting body, a cavity resonator system within said body, a pair of envelope members sealed to opposite sides of said body and forming therewith the envelope of said magnetron, each of said envelope members having conductive portions insulated from said body, pole pieces of magnetic material respectively mounted within said pair of envelope members in electrically insulated relation with respect to said body and positioned wholly within said envelope to provide a magnetic field through said resonator, and conductive means to connect between each pole piece and the corresponding one of said conductive portions.

5. A magnetron comprising a hollow cylindrical conductive supporting body, a cavity resonator system within said body, a pair of envelope members sealed to opposite sides of said body and forming therewith the envelope of said magnetron, each of said envelope members having cylindrical conductive portions insulated from said body, a pair of pole pieces of magnetic material respectively mounted within said pair of envelope members in electrically insulated relation with respect to said body and positioned wholly within said envelope to provide a magnetic field through the hollow of said cylindrical body, and cylindrical conductive means to connect at one end to each pole piece and at the other end to the corresponding one of said conductive portions.

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