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RESONANT CAVITY MAGNETRON WITH MODE SUPPRESSING SHORT CIRCUIT CONNECTIONS

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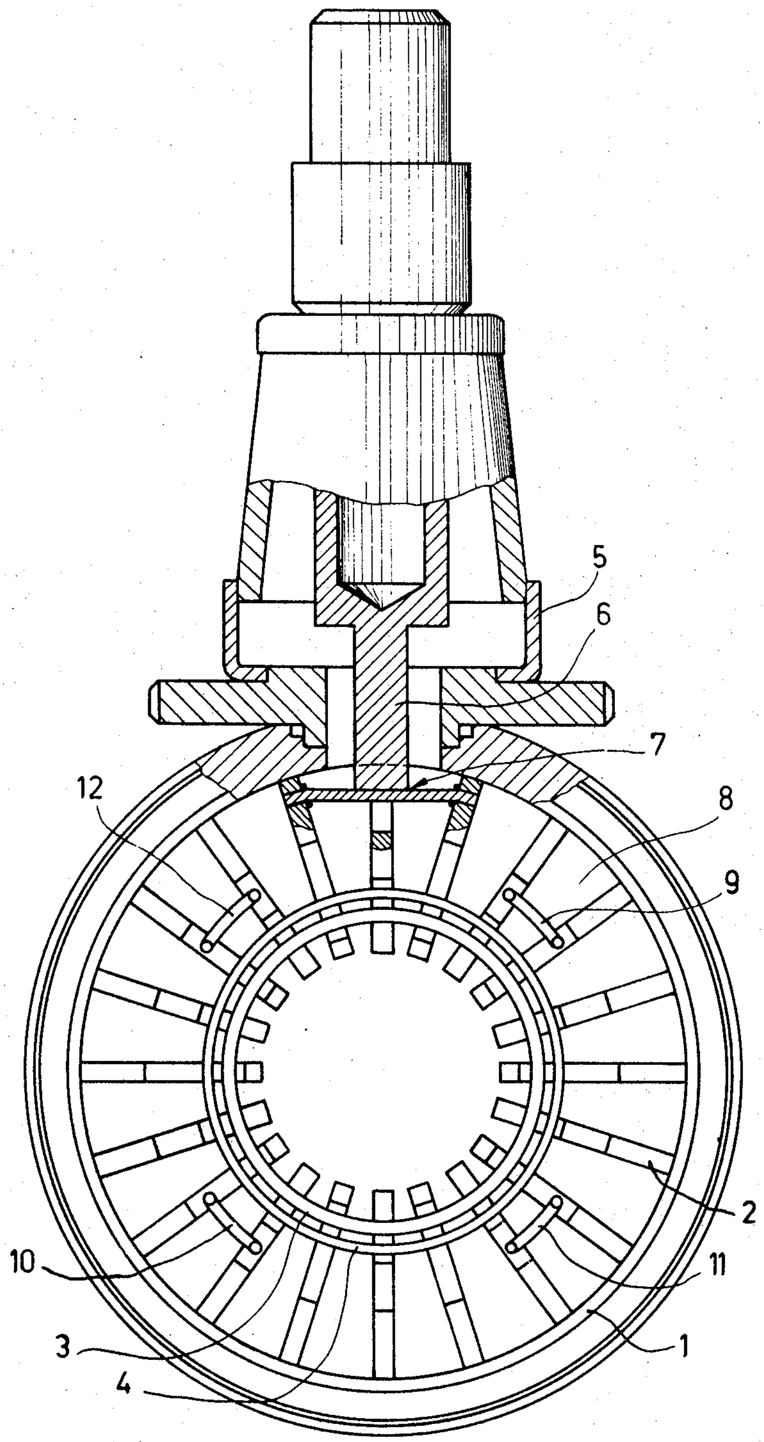

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RESONANT CAVITY MAGNETRON WITH MODE SUPPRESSING SHORT CIRCUIT CONNECTIONS

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ABSTRACT OF THE DISCLOSURE

A resonant cavity magnetron includes an anode block with a plurality of inwardly projecting spaced vanes defining resonant cavities therebetween. A cathode is positioned concentrically within the block and spaced from the ends of the vanes.

Alternate vanes are connected by straps which form equipotential connections. An output line is connected to selected vanes. Short circuit connections between pairs of vanes are positioned at angles of 45° or 135° to the output line, these short circuit connections lying between the equipotential straps and the ends of the vanes remote from the cathode.

The invention relates to a resonant cavity magnetron in which resonant cavities are formed by substantially flat anode vanes the end faces of which which face the cathode constitute the anode segments and in which annular equipotential connections which are located near to each other connect points located near the cathode on the axial end faces of alternate anode vanes in one or both end spaces.

A problem which always presents itself in magnetrons is to realize that oscillating occurs only or mainly in the π-mode and that the higher modes, particularly the $(\pi-1)$-mode, do not occur. The $(\pi-1)$ mode is the mode which in frequency is located nearest to the π-mode and which occurs in doublet.

In magnetrons for producing radar pulses bends in the equipotential connections are used, so as to orient the oscillation pattern of the two doublets of the $(\pi-1)$ mode in a particular manner with respect to the output coupling. Interruptions in the equipotential connections are also used sometimes.

It is also known to use interruptions in equipotential connections which are distributed axially between the anode vanes. The parts of the interrupted connection adjoining the interruption are then both connected to an anode segment so that in addition to the interrupted connection a bridged resonant cavity is obtained. Furthermore it is known to provide a coupling loop between two adjacent resonant cavities which does not influence the π-mode but does influence the $(\pi-1)$ mode.

In magnetrons for continuous operation, for example, for high-frequency heating, said measures are generally insufficient particularly in connection with the higher average powers and the high standing wave ratio which usually occurs. In addition, these magnetrons often have to operate with a supply having an unfiltered single phase or two-phase rectified mains voltage, so that, when the π-mode does not occur immediately, the danger exists that the anode voltage increases to the higher value which is favourable for the $(\pi-1)$ mode. Although the edge steepness of the supply voltage is a few orders of magnitude

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lower than in magnetrons for radar, these generally operate with a considerably lower standing wave ratio.

It is known to provide such continuously operating magnetrons with connection braces between anode vanes which bound an even number of resonant cavities, but this measure is not more than an extra equipotential connection which reduces the electronic efficiency.

According to the invention, in a resonant cavity magnetron in which the resonant cavities are constituted by substantially flat anode vanes the end faces of which face the cathode constitute the anode segments and in which annular equipotential connections which are located near to each other connects points located near the cathode on the axial end faces of alternate anode vanes in one or both end spaces, short circuit connections are provided in the end spaces on the axial end faces of the anode segments of one or more resonant cavities which are located at an angle of approximately 45° or 135° with the output line of the magnetron, said short circuit connections being located substantially centrally between the equipotential connections and the outside of the anode vanes.

The angle between the coupling-out line and the bridged resonant cavities also determines the frequency of the doublet of the $(\pi-1)$ mode and the radial position of the bridge determines whether the two doublets are coupled out to a more or less equal extent.

The number of short circuit connections in one end space may be equal to one single or two connections located diametrically opposite to each other of four connections located 2 by 2 diametrically opposite to each other at diameters intersecting at right angles. If required, another four may be provided in the other space.

In order that the invention may be readily carried into effect, one embodiment thereof will now be described in greater detail, by way of example, with reference to the accompanying drawing, the sole figure of which is an axial elevation on the anode system of a magnetron according to the invention.

Reference numeral **1** in the figure denotes the copper anode block in which 20 copper anode vanes **2** are soldered. The axial ends of the vanes are profiled so that they alternately contact the copper equipotential connections **3** and **4**. The output line of the magnetron is a coaxial system **5**, **6** the inner conductor **6** of which terminates on a transverse brace **7** which terminates on the outermost anode vanes of two adjacent resonant cavities. The resonant cavity **8** which is arranged at an angle of 45° with the output is bridged by a copper brace **9**. A second brace **10** may also be provided or in addition two braces **11** and **12**. If required, the system of the four braces may also be provided in the other end space.

Due to the braces it is realized that at a frequency of the π-mode of 2450 mc./s., the doublets of the $(\pi-1)$ mode which are then at 3000 and 3100 mc./s. are coupled out to substantially the same extent and with the same bandwidth.

What is claimed is:

1. A resonant cavity magnetron comprising an annular block having a plurality of symmetrically positioned inwardly projecting spaced vanes defining resonant cavities therebetween, a concentrically positioned cathode within said annular block spaced from the ends of said vanes, means connecting alternate vanes adjacent their ends facing the cathode to provide equipotential connections thereto, output means connected to the ends of selected vanes at their ends remote from the cathode, and at least one short circuit connection between two adjacent vanes between the equipotential connections and the ends remote from the cathode positioned at an angle of substantially 45° or 135° with the output means.

2. A resonant cavity magnetron as claimed in claim 1, characterized in that only one short circuit connection is provided at an angle of 45° with the output line.

3. A resonant cavity magnetron as claimed in claim 1, characterized in that two short circuit connections are provided which are located diametrically opposite to each other.

4. A resonant cavity magnetron as claimed in claim 1, characterized in that four short-circuit connections are provided in one or both end spaces and are located diametrically on two diameters intersecting each other at right angles.

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