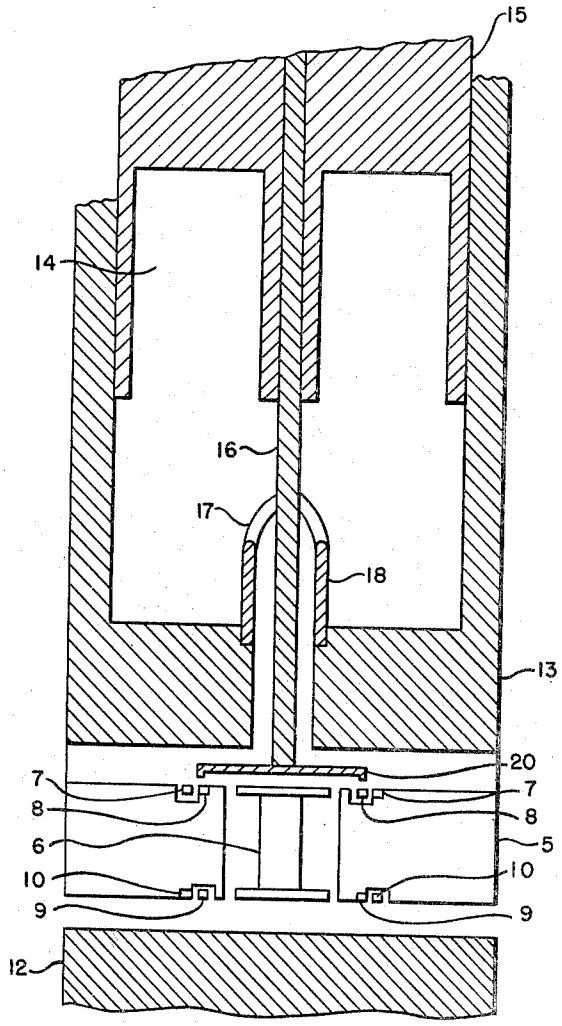
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TUNABLE MAGNETRON OSCILLATOR

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TUNABLE MAGNETRON OSCILLATOR

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1

My invention relates in general to electrical apparatus and more particularly to magnetron oscillators.

In the art of ultra-high frequency and microwave energy generation by means of magnetron oscillators it is often desirable to couple auxiliary resonant devices to a magnetron in order to effect stabilization of, or controlled alteration in, the frequency of the generated oscillations. Where the individual resonators of a multi-cavity magnetron are strapped together, as is frequently the case, it is possible to couple external apparatus very tightly to the magnetron through the straps.

Previously, such coupling has always necessitated mechanical attachment of one or more leads to the straps of the magnetron. If the points of attachment are not symmetrically located on the straps, it has been found that angular distortion of the radio-frequency fields in the electronic interaction space results, with possible impairment of performance. Furthermore, in the upper range of frequencies in use at the present time it becomes increasingly difficult to make lead connections to the straps because of the extremely small dimensions of the magnetron components.

Accordingly, it is one object of my invention to provide means of coupling to a magnetron.

Another object is to provide means of symmetrically coupling to a strapped magnetron.

Still another object is to provide a readily adjustable means of coupling to a magnetron.

Yet another object is to provide means of coupling to the straps of a magnetron without making mechanical attachments to the straps.

A further object is to provide a tunable magnetron oscillator.

A still further object is to provide a novel tuning or stabilization cavity for a magnetron oscillator.

Briefly, my invention accomplishes these and other objects which will be apparent to those skilled in the art by utilizing capacitive coupling between the magnetron straps and a disk-like member aligned in a plane parallel thereto. A rod attached to the disk passes into a cavity resonator constructed within one of the pole pieces of the magentron magnet. A coaxial line composed of the rod and the pole piece connects the resonator and the disk.

The principles and operation of my invention will be more apparent upon reference to the following specification, claims, and to the drawing, the single figure of which represents a cross-

2

sectional view of a magnetron and tuning apparatus therefor.

Referring now to this figure, a standard multicavity magnetron anode 5 and cathode 6 are shown. Anode 5 is double-strapped at both ends with rings 7, 8, 9, and 10. The magnetic field for the magnetron is supplied by a magnet the pole pieces 12 and 13 of which are shown. Pole piece 13 is hollowed out to form a cavity resonator 14 and a sliding plug 15 is inserted therein. A rod 16 extends through plug 15, being supported by the plug and by a glass member 17 which is not sealed to the rod 16 but is sealed to a sleeve 18, the latter being preferably of the alloy known by the trade name Kovar, and which in turn is seated in pole piece 13. Rod 16, then passes through a hole 19 bored in pole piece 13 and at the extremity of the rod is attached a circular plate 20, the periphery of which extends farther toward the magnetron straps than does the center. The disk is substantially the diameter of strap 8.

In the operation of the device the inherent capacity between strap 8 and plate 20 couples oscillatory energy into the coaxial conductor formed by pole piece 13 and rod 16. Glass seal 17 does not inhibit the passage of energy into resonant cavity 14, hence oscillations are set up therein. The resonant frequency of cavity 14 is readily adjusted by sliding plug 15 toward or away from the magnetron anode. Hence the magnetron may be tuned within a predetermined bands of frequencies. The degree of coupling between the resonant cavity and the magnetron is governed by the spacing between plate 20 and strap 8. This spacing may be varied by sliding rod 16 toward or away from the magnetron anode. This variability is valuable in practice since the degree of coupling can be held constant despite unavoidable variations in the dimensions of the various parts of the assembly.

The cavity resonator 14 is not the only possible frequency determining means nor is a coaxial line necessary to conduct energy from disk 20. The auxiliary resonator may, for example, be a resonant section of transmission line or a cavity resonator external to the apparatus, and the connector may be a single wire directly attached to the energy pick-up means and run out through the side of the device. Indeed, it is feasible to use a pick-up other than disk-shaped, as long as there is sufficient capacity between strap 8 and the pick-up to provide adequate coupling. However, in practice a disk which may be spaced apart

from the strap between 0.005 and 0.020 inch has been found satisfactory.

It will be understood that what has been described hereinbefore is a preferred embodiment of my invention but adaptations and modifications may be made therein without departure from the principles of my invention. Hence, I claim all such modifications and adaptations as may fall fairly within the spirit and scope of the hereinafter appended claims.

What is claimed is:

1. In a magnetron oscillator a segmented anode electrode, at least one strip of conducting material joining at least a portion of said anode segments, a conducting member in spaced relationship with respect to said anode electrode and which is movably positioned adjacent to said conducting strip, said conducting member being capacitively coupled to said conducting strip, a cavity resonator, and means coupling said conducting member to said cavity resonator whereby the frequency of oscillations created in said magnetron oscillator is determined by the resonant frequency of said cavity resonator.

2. In a magnetron oscillator a segmented anode electrode, a ring-like conducting member joining at least a portion of said anode segments, a movable circular conducting member of substantially the same diameter as said ring-like member in spaced relationship with respect to said anode electrode and which is positioned adjacent to said ring-like member, a cavity resonator, and means coupling said circular member to said cavity resonator whereby the frequency of oscillations generated by said magnetron oscillator is determined by the resonant frequency of said cavity resonator.

3. Apparatus in accordance with claim 2 wherein in addition there is provided a magnet positioned adjacent to said anode electrode, one of the poles of said magnet being chambered to form said cavity resonator.

4. Apparatus in accordance with claim 2, further including means movable into said cavity resonator for tuning said cavity resonator, thereby enabling the frequency of oscillation of said magnetron to be varied in a predetermined fashion.

5. A magnetron oscillator comprising a segmented anode electrode, a ring-like strap connected to at least a portion of said anode segments, a disk-like member in spaced relationship with respect to said anode electrode, means movably positioning said disk-like member adjacent to said strap so that said disk-like member remains symmetrical to said strap throughout the entire range of its movement and electrical changes in said strap produce corresponding changes in said disk-like member through the capacity therebetween, a tunable cavity resonator, and means extending through a wall of said cavity resonator coupling said cavity resonator only to said disk-like member, said cavity resonator being completely closed except for said coupling means extending therethrough.

6. In a magnetron oscillator, a segmented anode electrode, a ring-like member joining at least a portion of said anode segments, a disk-like member of substantially the same diameter as said ring-like member, said disk-like member being arranged concentrically with said ring-like member and in spaced relationship with respect to said anode electrode, whereby electrical changes in said ring-like member are transferred to said disk-like member through the inherent capacity therebetween, a cavity resonator, and means coupling said cavity resonator to said disk-like member, said cavity resonator being completely enclosed except for an opening for said coupling means.

7. The magnetron oscillator defined in claim 6, further including means movable into said cavity resonator for tuning said cavity resonator.

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