Oct. 27, 1959 H. K. JENNY 2,910,620

MAGNETRON TUNING CAVITY AND WAVEGUIDE COUPLER

Filed Oct. 15, 1957

Fig. 1

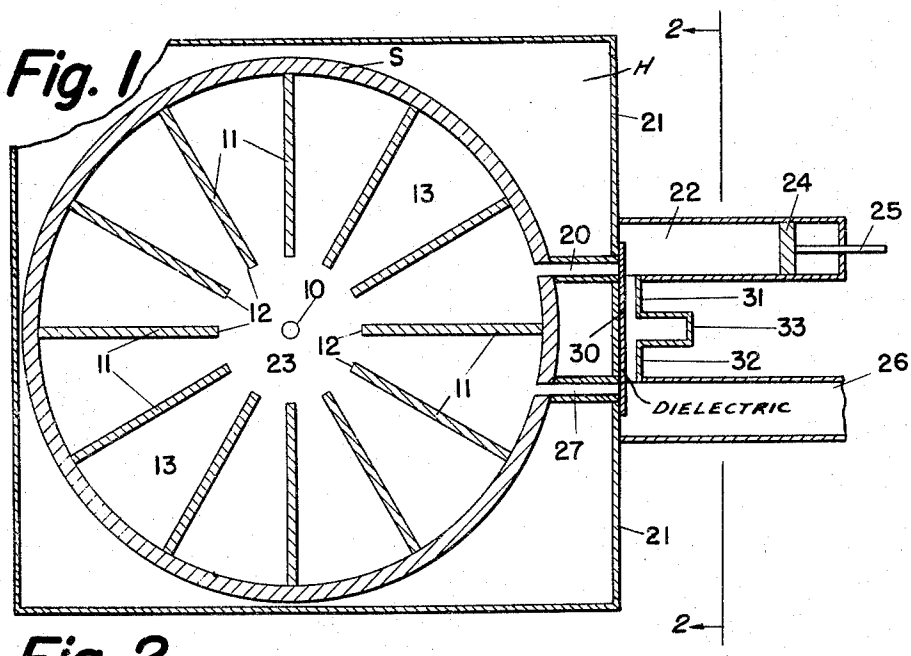


Fig. 2

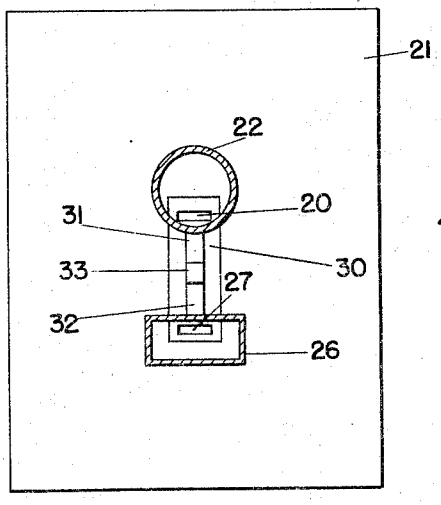


Fig. 3

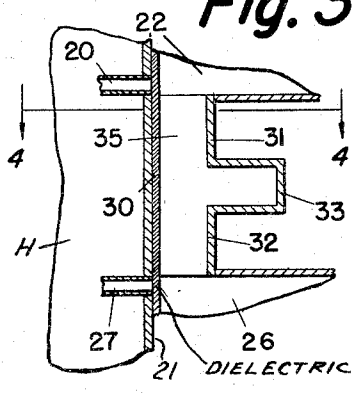
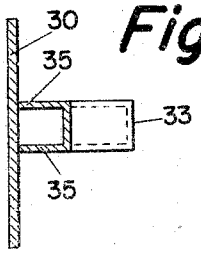


Fig. 4



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2 Claims. (Cl. 315—39)

This invention relates to a magnetron oscillator of the plural-anode cavity type and more particularly to an improved structural arrangement for coupling the tuning cavity and output waveguide with cavities of a magnetron for the transfer of oscillation energies.

A cavity type magnetron is quite satisfactory as an oscillator for the generation of radio frequencies having associated wavelengths in the centimeter range. The generated wavelength from such types of magnetrons is dependent upon the physical size of each anode cavity, and for short wavelengths, the anode cavities must be made correspondingly small.

One particularly useful form of such magnetron oscillator utilizes a central linear cathode with an anode structure comprising a group of cavity resonators disposed symmetrically about the central cathode. This type of magnetron is comparatively readily and inexpensively manufactured since the cavity resonators are formed by anode vanes which extend radially inward from an outer cylindrical wall, toward an axially disposed cathode. The cavities surrounding the cathode serve to fix the oscillation frequency of the magnetron and are determinative of the oscillation wavelengths.

Since it is often necessary that a magnetron generate oscillations having wavelengths of one centimeter or less, it is apparent that the magnetron structural components must be quite small with the resultant difficulty in their assembly and fabrication. This becomes a particular problem since it is necessary to use small, compact vacuum-tight seals between the cavity resonators and the tuning cavity and also with the waveguide.

Accordingly, it is the broad object of this invention to provide a common and effective coupling arrangement for the transfer of oscillation energies from selected magnetron cavity resonators to the tuning cavity and waveguide.

Another object is to provide such a unitary coupling device which is further arranged to prevent intercommunication of oscillation energies between the waveguide and tuning cavity.

Briefly, this invention accomplishes these and other objects by utilizing a coupling member in the form of a panel which is constructed of mica, ceramic, glass or a synthetic material having equivalent low dielectric properties. The panel is disposed between independent conduits which are in communication with selected cavity resonators and connects the conduits with the waveguide and also the tuning cavity of the magnetron. In addition, a choke device in the form of three intercommunicating tubes is positioned between the waveguide and the tuning cavity of the magnetron and functions to prevent intermingling or transfer of oscillation energies between the tuning cavity and waveguide.

For a better understanding of the invention, reference may be had to the accompanying drawing, wherein:

Fig. 1 is a transverse sectional view of the invention, applied to one type of magnetron and associated tuning cavity and waveguide structure;

Fig. 2 is a slightly enlarged view taken along line 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a portion of Fig. 2; and

Fig. 4 is a view taken generally on the line 4—4 of Fig. 3.

Referring now to Fig. 1, there is shown a magnetron comprising a shell S of cylindrical shape enclosed within a housing H and having a cathode **10** positioned axially therein. A plurality of anode vanes **11** extend radially inwardly from the inner periphery of the shell S and have their inner edges **12** disposed in spaced relation with the cathode **10**. The anode vanes **11** are in effect partitions forming open end compartments **13** which function as a group of cavity resonators disposed generally symmetrically about the cathode **10**.

The tuning structure for the magnetron includes a conduit **20** of rectangular shape as shown, which communicates at one end with a selected cavity resonator **13** and has its other end communicating through a wall **21**. A tuning cavity **22**, is mounted adjacent the other face of the wall **21** and in general alignment with the conduit **20**. All of the resonators **13** are in communication by way of a central space **23** about the cathode **10** and consequently all of the cavity resonator frequencies will be controlled by the tuning cavity **22**. The tuning cavity **22** is provided with a plunger **24** having an operating arm **25** for adjusting the reactance of the tuning cavity **22** as desired. A second cavity resonator is similarly arranged as shown to communicate with a waveguide **26** by means of a second conduit **27** of rectangular shape which also communicates through the wall **21**.

A panel **30** of low dielectric material such as glass, mica, or ceramic, is mounted in abutting relation or surface contact with the outer face of wall **21** and the material of which the panel **30** is constructed has the property of transmitting oscillation energies from the cavity resonators **13** and the conduits **20** and **27** to the tuning cavity **22** and waveguide **26** and in effect provides a common coupling unit between the conduit **20** and the tuning cavity **22** and also between the conduit **27** and the waveguide **26**.

One end of each of conduits **20** and **27** is fitted in the shell S in sealed relation therewith while the other ends of the conduits are positioned to abut one face of the panel **30** and are preferably maintained in sealed relation with the one face of the panel as is shown in detail in Fig. 3. Similarly, the inner ends of the tuning cavity and the waveguide will be, as shown, disposed in abutting relationship with the other face of the panel **30** and preferably in sealed relationship therewith.

A choke means in the form of a T connection is shown in enlarged detail in Figs. 3 and 4 and comprises three communication tubular sections **31**, **32**, and **33** which are disposed between and provide communication between the tuning cavity **22** and waveguide **26**. The open end of section or leg **31** is in communication with the cavity **22** while the open end of section **32** is in communication with the waveguide **26**. The section **33** extends laterally from sections **31** and **32** and has a closed end while the walls **35** of sections **31** and **32** are slotted and have their edges positioned in abutting relation with the other face of panel **30** providing communication between the panel and the choke means and preventing energies from passing between the tuning cavity **22** and waveguide **26**.

The choke sections **31**, **32**, and **33** will be designed to be quarter wavelength of the oscillations in the cavity resonators **13** and the wavelength of the oscillations may be tuned by the tuning cavity plunger **24** as desired. The choke sections **31**, **32**, and **33** will offer infinite impedance to any oscillations which may try to pass between

tuning cavity 22 and waveguide 26. The section 33 has a closed end, as shown, which is remote from panel 30 and since the panel 30 communicates with both sections 31 and 32, the oscillation energies will not pass between the tuning cavity and waveguide.

While there has been described a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein within the scope of the invention, which is to be limited only by the appended claims.

What is claimed is:

1. A plural-anode cavity type magnetron having a shell and radial vanes extending inwardly therefrom providing a plurality of communicating oscillatory cavity resonators, a housing enclosing said shell, a panel of dielectric material disposed in surface contacting relation with one wall of said housing, a tuning cavity with a tuning plunger therein and having an open end abutting the outer face of said panel and a closed end, an output waveguide spaced from said tuning cavity and having one open end abutting said outer face of the panel and its other open end extending outwardly therefrom to supply magnetron oscillations to an external consumption device, choke means interconnecting said tuning cavity and said waveguide, a first energy transmitting conduit having one end in communication with one of said cavity resonators and its other end communicating through said one wall of the housing to be in abutting relation with the inner face of said panel and aligned with said tuning cavity, a second energy transmitting conduit having one end in communication with another cavity resonator and its other end communicating through said one wall of the housing to be in abutting relation with the inner face of the panel and aligned with said waveguide, said panel being effective to transmit oscillation energy from all of said communicating cavity resonators to both the tuning cavity and the waveguide and said choke means being effective to prevent the transfer of oscillation energy therebetween.

2. A plural-anode cavity type magnetron having a shell and radial vanes extending inwardly therefrom providing a plurality of communicating oscillatory cavity resonators, a housing enclosing said shell, a panel of dielectric material disposed in surface contacting relation with one wall of said housing, a tuning cavity with a tuning plunger therein and having an open end abutting the outer face of said panel and a closed end, an output waveguide spaced from said tuning cavity and having one open end abutting said outer face of the panel and its other open end extending outwardly therefrom to supply magnetron oscillations to an external consumption device, choke means comprising an open end conduit providing communication between said tuning cavity and said waveguide and having a slotted area abutting the outer face of said panel, a first energy transmitting conduit having one end in communication with one of said cavity resonators and its other end communicating through said one wall of the housing to be in abutting relation with the inner face of said panel and aligned with said tuning cavity, a second energy transmitting conduit having one end in communication with another cavity resonator and its other end communicating through said one wall of the housing to be in abutting relation with the inner face of the panel and aligned with said waveguide, said panel being effective to transmit oscillation energy from all of said communicating cavity resonators to both the tuning cavity and the waveguide and said choke means being effective to prevent the transfer of oscillation energy therebetween.

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