

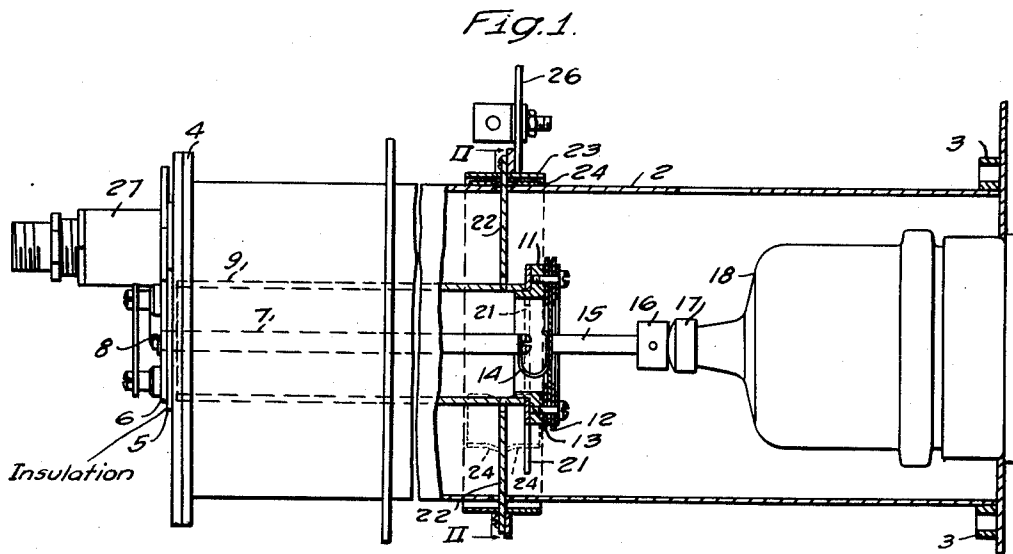
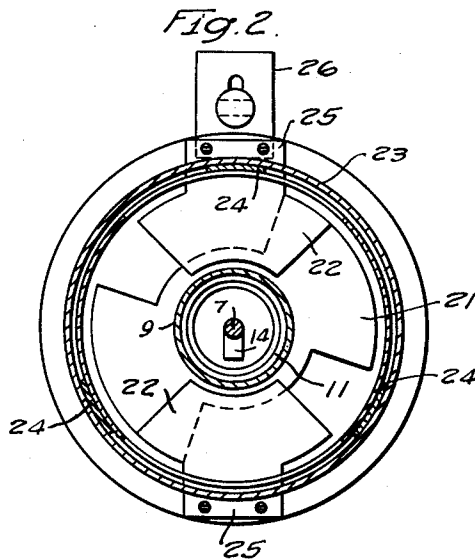
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A. A. MACDONALD ET AL

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CAPACITATIVELY TUNED CONCENTRIC LINE RESONATOR

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WITNESSES:
E. A. M. Lasky
New. G. Groome

INVENTORS
 Angus A. Macdonald
 and Roger F. Mathieu.
 BY
F. W. Lyle
 ATTORNEY

UNITED STATES PATENT OFFICE

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CAPACITATIVELY TUNED CONCENTRIC
LINE RESONATOR

Angus A. Macdonald, Catonsville, and Roger E. Mathieu, Baltimore, Md., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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Our invention relates to cavity resonators and, in particular, relates to a structure for cavity resonators of the concentric line type by which they may be readily varied in resonant frequency.

Cavity resonators for use in ultra high frequency oscillating circuits have been used heretofore which took the form of a short section of concentric transmission line closed at one end by a conducting wall, and provided with a displaceable piston of conducting material which formed a conducting bridge between the core and cylindrical wall, and which could be displaced along the core to vary the resonant frequency of the cavity. However, the construction just described adds certain undesirable features incident to the employment of a displaceable piston which had to make sliding contact with both the core and the surrounding cylindrical wall and usually had to be provided with spring contact members for that purpose. We have devised a form of concentric line cavity resonator in which the displaceable piston is replaced by a variable air-dielectric tuning capacitor, one set of plates in which is connected to the central core of the line and the other plates of which are connected to the cylindrical outer wall of the resonator.

One object of our invention is to provide a novel type of cavity resonator which is provided with convenient and simple tuning arrangements.

Another object of our invention is to provide a concentric-line-type cavity resonator which is well adapted to act as a tank circuit for an ultra high frequency electron tube such as an oscillation generator of a transmitter, or the local oscillator of a frequency transformer or heterodyning system.

Another object of our invention is to provide a novel type of cavity resonator suitable for constituting a resonant circuit for an ultra high frequency electrical system.

Other objects of our invention will become apparent upon reading the following description, taken in connection with the drawing, in which:

Figure 1 is a view, partly in cross-section and partly in elevation, of a cavity resonator embodying the principles of our invention; and

Fig. 2 is a sectional view along the line II-II in Figure 1.

Referring in detail to the drawing, an outer cylindrical sheath 2, which may be of any suitable sheet metal, is provided at one end with supporting lugs 3 by which it may be attached to any suitable panel or other supporting structure. The other end of the sheath 2 is closed by a partition 4 of conducting material which is provided

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with a central opening covered by an insulating plate 5 faced on its outer side by a metal plate 6 from which a rod 7 projects along the axis of the sheath 2. The outer end of the rod 7 is provided with a suitable terminal 8 by which it may be connected to a voltage source to be used in energizing an electron tube which will soon be described. The inside face of the end plate 4 supports a cylindrical conducting tube 9 coaxially with the sheath 2 so that the annular space intervening between the sheath 2 and tube 9 forms a resonant conductive cavity in which electrical oscillations may be induced in a manner well known in the ultra high frequency oscillation art. The inner end of the tube 9 is provided with a collar 11 to which is supported, by any suitable manner, a metallic plate 12 separated from the collar 11 by washer 13 of mica or other suitable insulating material. The above-described arrangement is such that the metal plate 12 is insulated from the collar 11 and tube 9. The inner end of the rod 7 is provided with a spring member 14 which makes contact with the adjacent face of the metal plate 12.

On the other face of the plate 12 is supported a second spring 15 provided with a terminal 16 adapted to engage the anode terminal 17 of an electrical discharge tube 18 which is to be positioned within the confines of the sheath 2. The discharge tube 18 may be supported at its other end by any suitable means conventional in the art such as a panel attached to the lugs 3.

The collar 11 on the tube 9 supports a metallic plate 21 in a plane normal to the axis of sheath 2 and comprising a pair of sector-shaped portions forming one set of plates of a variable capacitor used for tuning the resonant cavity between the tube 9 and sheath 2. In plane normal to the axis of the sheath 2 which is not far displaced from the above-mentioned plane containing the plate member 21, there are provided in the sheath 2 a pair of slots through which project a set of sector-shaped plates 22 which cooperate with the plates 21 to form the tuning capacitor above mentioned. The plates 22 are supported on an annular member 23 capable of sliding circumferentially about the cylindrical sheath 2 and resiliently supported thereon by a spring 24. The sector-shaped plates 22 are supported from the annular member 23 by small projecting tongues 25 which can slide in the above-mentioned slots in the sheath 2 when the annular member 23 is turned through an angle in sliding engagement with the surface of the sheath 2. The sector-shaped plates 22 are formed in a way well known in the tuning con-

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denser art so that the projected area of the sector-shaped plates 21 on the plates 22 varies when the annular member 23 is turned as above described, thereby varying the capacities of the condenser formed by the stationary plates 21 and movable plates 22.

The lugs 3 on sheath 2 may be connected to the cathode of tube 18 by grounding the latter thereto and the terminal 8 leading to the anode of tube 18 may be connected to a direct current supply having its negative terminal grounded to said cathode also. The resonant cavity between sheath 2 and tube 9 then constitutes a tank circuit coupled to the anode of tube 18 through the capacitance across the insulating washer 13 between tube 9 and plate 12.

A moment's consideration will show that the annular space between the inner cylinder 9 and the outer sheath 2 which intervenes between the movable plates 22 and the end plate 4 will constitute, in effect, a cavity resonator of the concentric-transmission-line-type, and the resonant frequency of this cavity resonator may be varied by turning the sliding annular member 23 about the axis of the sheath 2. A suitable terminal member 26, by which line conductors may displaceably be connected to the movable plates 22, forms a projection from the upper side of the plates 22.

It will be noted that the plate 12 constitutes a shield which largely excludes from the interior of the cylinder 9 any high frequency fields present in the above-mentioned resonator cavity and the space adjacent thereto beyond the stationary plates 21. Since it may be desired to transmit energy of the oscillations generated within the resonant cavity between the tube 9 and the sheath 2 to work circuits, the end plate 4 is provided with a terminal cylinder 27 through which a suitable transmission line of any type conventional in the art may attain access to the interior of the resonating cavity when desired.

It will be noted that the above-described structure possesses, as desirable features, the absence of sliding electrical contacts within the confines of the high frequency electrical fields, a smooth and reliable tuning action, a complete absence of drive gears with variable backlash, ready adaptability to vernier-scale, control of the angular position of the annular member 23 on the surface of the sheath 2, and simplicity of assembly and construction of the sector plates 21 and 22.

We claim as our invention:

1. A variable reactor of the concentric line

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type comprising a cylindrical sheath, a concentric tube within said sheath affixed thereto by an end wall, capacitor-plates supported at one end of said tube, and cooperating capacitor-plates supported on an annular member engaging the exterior surface of said sheath and rotatable about the central axis thereof to vary the capacitance between said capacitor-plates.

2. A variable reactor of the concentric line type comprising a cylindrical sheath, a concentric tube within said sheath connected thereto by an end wall, capacitor plates supported at one end of said cylindrical member, and cooperating capacitor plates supported on an annular member engaging the exterior surface of said sheath and rotatable about the central axis thereof to vary the capacitance between said capacitor plates, a conducting plate insulatingly supported on the end of said tube adjacent said capacitor plates, a resilient terminal adapted to contact an electrical discharge tube positioned within said sheath and supported on said conducting plate.

3. A variable reactor of the concentric line type comprising a cylindrical sheath, a concentric tube within said sheath connected thereto by an end wall, capacitor plates supported at one end of said concentric tube, and cooperating capacitor plates supported on an annular member engaging the exterior surface of said sheath and rotatable about the central axis thereof to vary the capacitance between said capacitor plates, a conducting plate insulatingly supported on the end of said concentric tube adjacent said capacitor plates, a resilient terminal adapted to contact an electrical discharge tube positioned within said sheath and supported on said conducting plate, and a current lead engaging said conducting plate itself insulatingly supported from said end plate and lying in the interior of said concentric tube.

ANGUS A. MACDONALD.

ROGER E. MATHIEU.

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