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RESONATOR TUNER

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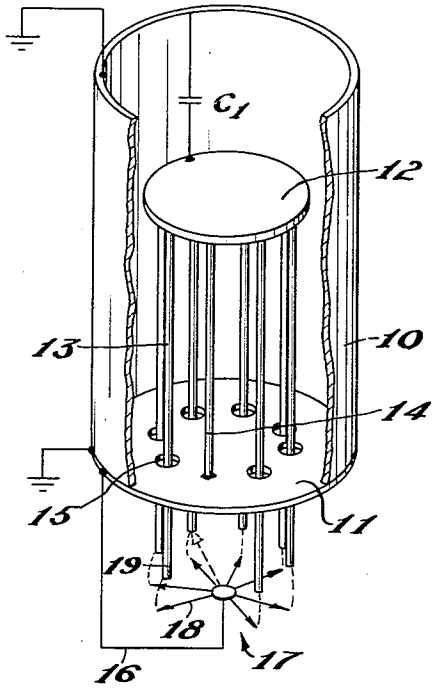

Fig 1

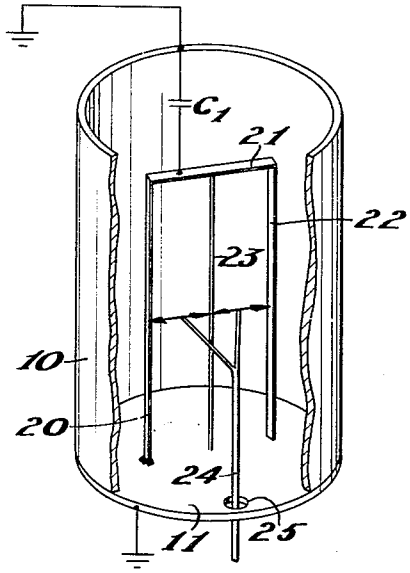

Fig 2

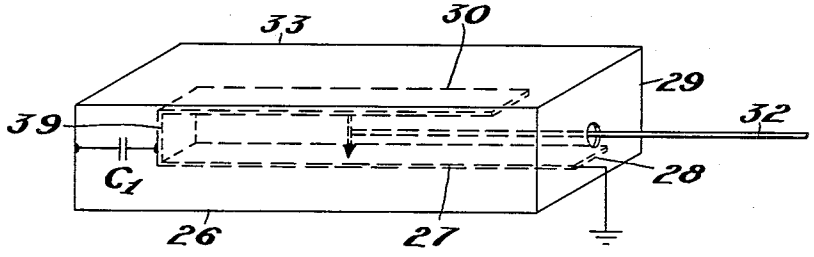

Fig 3

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RESONATOR TUNER

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This invention relates in general to high frequency tuners and in particular to cavity resonator tuners.

Cavity or coaxial resonators are used extensively at ultra high and very high frequencies as tuned circuits. It has been customary to construct cavity resonators with inner and outer conductors. They are shorted at one end and the lengths of the inner and outer conductors are such that the entire assembly will tune to a desired frequency with a certain value of loading capacity at the open end. Various methods have been used to make such elements continually tunable over a frequency range. One method is to use a shorting plunger between the inner and outer conductor that lengthens or shortens the effective length of the cavity. Another method is by using a variable condenser across the open end of the coaxial resonator.

An object of the present invention is to provide an improvement in tunable cavity resonators wherein a very accurate response may be obtained.

Further objects, features and advantages of the invention will become apparent from the following description and claims when read in view of the drawings, in which:

Figure 1 illustrates one modification of a coaxial tunable resonator according to my invention,

Figure 2 is a modification of my invention, and

Figure 3 illustrates a third modification.

Figure 1 illustrates a cylindrical member **10** which has a conducting disc **11** across one of the open ends. A shorting disc **12** is mounted to a plurality of downwardly extending wires **13**. One of the wires **14** is connected to the plate **11** and the remaining ones pass through openings **15** formed in the plate **11** so that they are insulated from it.

An end loading capacitor C_1 is connected between the upper end of the cylinder **10** and the disc **12**. The cylinder **10** is grounded.

A lead **16** extends from the cylinder **10** to a multiple switch, designated generally as **17**. The switch **17** has a plurality of movable members **18** that may be pivoted downwardly to engage the ends **19** of the rods **13**. The members **18** are connected together electrically.

Various combinations of the switches **18** engaging the lower ends **19** of the wires **13** cause the resonant frequency of the cavity resonator to change. As more wires are shorted together by the switches **18**, the characteristic impedance of the cavity is progressively reduced resulting in a higher resonant frequency. With the structure shown in Figure 1, the increments of frequency become smaller and smaller as more wires are shorted. The following

table illustrates the results obtained with different values of C_1:

Number of wires shorted to base	Load capacities used and resultant resonant frequencies		
	3 μμf.	9 μμf.	19 μμf.
	Mc.	*Mc.*	*Mc.*
1	232	195	160
2	310	262	210
3	375	315	245
4	above 400	358	275
5		410	300
6			320
7			332
8			345

The apparent action of the structure shown in Figure 1 is that when only one wire **14** acts as the inner conductor, the characteristic impedance of the cavity is high but as each successive wire is shorted the characteristic impedance is decreased and the resonant frequency goes up. One wire is used as an inner conductor and the other wires appear as capacity across the circuit. This capacity is reduced as the wires are shorted together and at the same time the characteristic impedance is lowered.

A modification of the invention is shown in Figure 2 wherein a U-shaped conductor comprises a first leg **20** that has its lower end shorted to a disc **11**. A transverse portion **21** is adjacent the opposite end of the member **20**, and a downwardly extending portion **22** terminates above the disc **11**.

A second conductor **23** extends downwardly from the member **21** and terminates above the disc **11**. A shorting plunger **24** engages the members **20**, **22** and **23**. As the shorting plunger **24** moves from member **11** toward member **21**, the conductors **20**, **22** and **23** are first in parallel, but when the shorting plunger reaches the member **21** the conductors **22** and **23** form capacity applied across the condenser C_1 and the only inductance in the circuit at this point is the conductor **20**.

The plunger **24** extends through an opening **25** formed in the disc **11** and may be manually or automatically moved longiutdinally of the cylinder **10**. As the shorting bar travels from adjacent the disc **11** toward the member **21**, the frequency will be tuned from a high to a low frequency. The effect is to change the characteristic impedance from low to a higher impedance.

A third modification is illustrated in Figure 3 wherein the cylinder has been replaced by a rectangular shield member **26**. A strip of conducting material **27** has one end **28** connected to an end **29** of the cover member and extends upwardly and downwardly to form a leg **30** which terminates above the end **29**.

The end loading capacitor C_1 is connected from the end **39** to the cover member. A shorting plunger **32** shorts from the leg **27** to the leg **30** and may be moved longitudinally thereof.

A sheet of mica may be placed between the leg **30** and the wall **33** of the cover member to decrease the characteristic impedance when the shorting bar is adjacent the end **29**. When the shorting plunger **32** is adjacent the end **29**, the characteristic impedance of the cavity is low and the frequency high. When the shorting plunger is near condenser C_1, member **30** and mica or other dielec-

tric between the member 30 and the wall 33 appear to be capacitive across C_1. The inductance of the center conductor is only the member 27 which is so spaced from the sides of the container so as to give a higher impedance. With such a structure, applicant has been able to tune from 280 to 360 megacycles.

It is seen that the invention described herein relates to an ultra high and very high frequency tuner wherein a continuous tuning characteristic may be obtained.

Although this invention has been described with respect to particular embodiments thereof, it is not to be so limited as changes and modifications may be made therein which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. A resonator tuner comprising, a hollow, conductive cylindrical member, a conducting disc attached to one end of said cylindrical member, a first wire having one end attached to said disc and extending into the confines of said cylinder, a shorting disc insulated from said cylinder and attached to the opposite end of said first wire, a plurality of other wires attached to said shorting disc and extending through said conducting disc, a plurality of openings formed in said conducting disc to allow said plurality of wires to extend therethrough, and a multiple switch connected to said conducting disc and including means to conductively connect the free ends of said plurality of wires.

2. A resonator tuner comprising, a hollow, conductive cylindrical member, a conducting disc attached to one end of said cylindrical member and formed with a plurality of openings, a shorting disc within said cylindrical member, a plurality of wires attached to said shorting disc, one of said wires attached to said conducting disc and the remainder of said wires extending through openings formed in said conducting disc, and a multiple switch with one side connected to said cylindrical member and formed with a plurality of contacts to conductively connect the free ends of said wires that pass through said conducting disc.

3. A tunable cavity resonator comprising, a hollow, conductive cylindrical member, a conducting disc attached across one end of said cylindrical member and formed with a plurality of openings, a shorting disc mounted within and insulated from said cylindrical member, a plurality of wires having one end attached to said shorting disc about its periphery, a first of said wires with its opposite end connected to said conducting disc, the remainder of said wires extending through the openings formed in said conducting disc and insulated therefrom, a multiple switch with a common side connected to said cylindrical member and a plurality of contacts to conductively connect, respectively, with the free ends of said wires, and a condenser connected between said shorting disc and said cylindrical member.

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