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RADIAL RESONANT CAVITIES

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Fig. 1
(PRIOR ART)

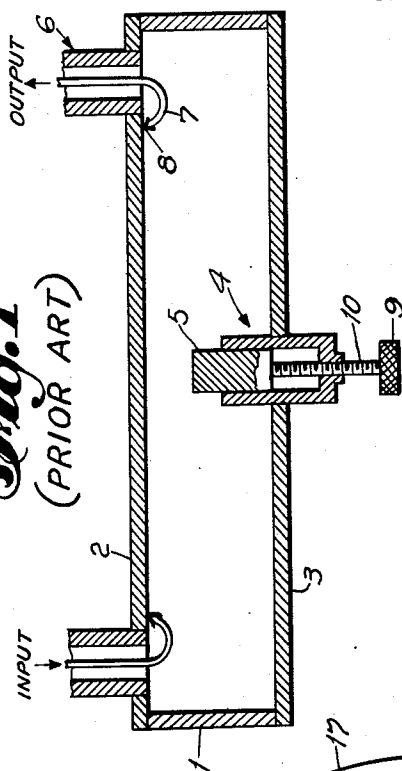


Fig. 2

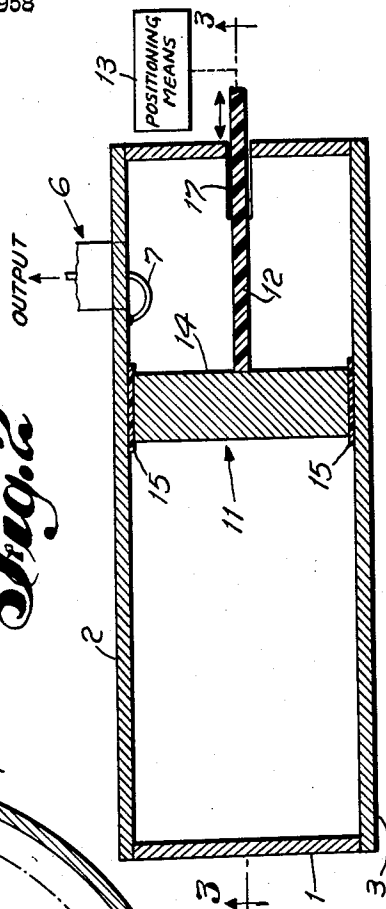


Fig. 3

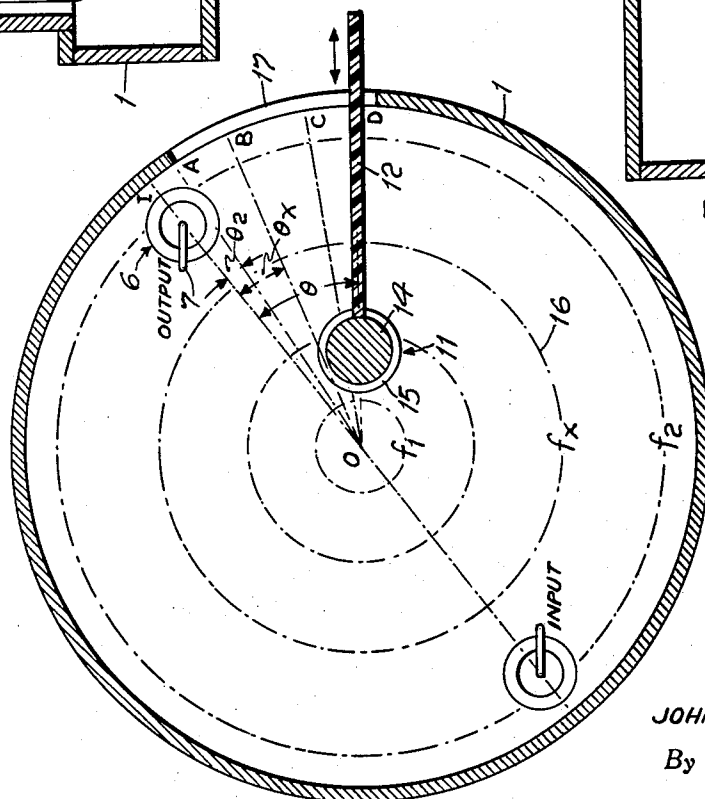


Fig. 4



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3,013,230

RADIAL RESONANT CAVITIES

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6 Claims. (Cl. 333-83)

This invention relates to radial resonant cavities and more particularly to tuning arrangements for radial resonant cavities.

An object of this invention is the provision of an improved tuning arrangement for radial resonant cavities.

Another object of this invention is the provision of a tuning arrangement for radial resonant cavities which reduces the cost of manufacture thereof to a fraction of the cost of conventional tuning arrangements heretofore employed in radial resonant cavities.

Still another object of this invention is the provision of a tuning arrangement for radial resonant cavities having the dual function of relatively easy, non-critical tuning of a radial resonant cavity through a given frequency range and optimizing of the amount of signal coupled from the cavity to the signal output over the tuning range.

A feature of this invention is to provide a capacitive slug disposed intermediate of and electrically coupled to the top and bottom end enclosing walls of a cylindrical radial resonant cavity and means to position said slug at any one of a number of selected points along a given radial line to tune the cavity.

Another feature of this invention is to provide an arrangement in conjunction with the capacitive slug to enable the selection of the given radial line along which the capacitive tuning slug is moved relative to the radial line along which the signal output means is disposed to thereby control the coupling of signal from the cavity to the output means.

The above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of a radial cavity illustrating the tuning arrangement known to the prior art;

FIG. 2 is a cross-sectional view illustrating an embodiment of the tuning arrangement in accordance with the principles of this invention;

FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 2; and

FIG. 4 is a cross-sectional view illustrating another embodiment of the capacitive tuning slug which may be employed in the arrangement of FIG. 2.

Referring to FIG. 1, the radial resonant cavity comprises a cylinder 1 and enclosing end plates 2 and 3 utilizing the tuning arrangement of the prior art illustrated generally by reference number 4. The tuning arrangement known to the prior art includes tuning plunger 5 which is moved into the cavity parallel to the central axis of cylinder 1. As illustrated, tuning plunger 5 may be disposed on the axis of cylinder 1 or it may be disposed in end plate 3 to be parallel to the central axis of cylinder 1. Tuning plunger 5 is disposed in a fixed position in the cavity and hence the ability to couple signal from the cavity to signal output means 6 including coupling loop 7 is a function of the fixed position in the cavity. This feature is undesirable in that there is required an additional adjustment such as an arrangement to change the location of coupling loop 7 as indicated by the arrow 8 on coupling loop 7 to obtain the desired coupling of signal from the cavity to output means 6. The axial insertion of plunger 5 by means of knob 9

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and threaded portions 10 is limited in the range of frequencies through which the cavity may be tuned and is rather critical of adjustment at low frequencies, that is, where plunger 5 is at its maximum penetration into the cavity.

Referring to FIG. 2 and employing the same reference characters as applied in FIG. 1 for common components, the improved tuning arrangement of this invention is illustrated as including a capacitive slug 11 which may be positioned at any one of a number of selected points along the radius of cylinder 1 by means of dielectric rod 12 which extends radially through the wall of cylinder 1. A positioning means 13, which may be a knob manually operable by an operator or other well-known mechanical or other arrangements, may be utilized to position capacitive slug 11 along the given radius of cylinder 1 to effect the desired tuning of the radial resonant cavity. In the embodiment illustrated in FIG. 2, capacitive slug 11 includes a metallic cylinder 14 having insulating end caps 15 disposed on the ends thereof. End caps 15 are composed of low-loss, low-dielectric constant material such as Teflon. The rod 12, which moves the slug to the desired radial position in the cavity, may be composed of a low-loss, low-dielectric constant material, such as Rexolite #1422 or polystyrene EH-2.

The slug 11 disposed between the top and bottom plates 2 and 3 of the cavity acts as a fixed capacitor. Tuning is a function of the height and diameter of slug 11 as well as the radial position in the cavity.

Referring to FIG. 3, there is illustrated therein a plurality of circular broken lines which represent the locus of tuning curves obtainable with the tuning arrangement of this invention. The effect of slug 11 on the tuning of the radial resonant cavity depends on its radial position in the electric field. The slug 11 will tune the cavity to a given frequency f_x anywhere on the circular path 16. The slug 11 has negligible effect on tuning near the wall of cylinder 1 where the electric field is small. Therefore, the broken line circle identified by f_2 indicates tuning at the highest frequency, while the broken line circle identified by f_1 describes the tuning at the low frequency end of the band and is centered in the area where the electric field is greatest. By selecting the proper point along a given radius of cylinder 1, it is possible to tune the radial cavity to the desired frequency, said frequency being present in the cavity on a circle having a radius equal to the distance slug 11 is from the center of cylinder 1.

Slug 11 tends to concentrate the electric field at its position in the cavity. Hence it is possible by selecting the proper radial line along which slug 11 is moved relative to the radial line output means 6 is located on to control the amount of signal coupled from the cavity to the output means 6. Hence by selecting angle θ between the radial line along which slug 11 is moved and the radial line OI along which output means 6 is disposed, the output signal coupling can be optimized for each frequency in the tuning range. Hence coupling loop 7 of output means 6 may be fixed in position and no adjustment thereof is required to control the coupling of the output signal from the cavity to the output means 6. For greatest coupling to the output means 6, the angle θ should be small such as indicated by angle θ_2 between radial line OI and OA. The amount of coupling as set forth hereinabove can be adjusted by adjusting angle θ to any given value such as represented by the angles between radial line OI and OB or OC or OD. One arrangement which permits the selection of the radial line upon which slug 11 is disposed with respect to the output means radial line is slot 17 which permits the sliding of slug 11 and rod 12 to the desired radial line to achieve the desired coupling of output signal to

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the output means. Positioning means 13 could also be arranged to accomplish the desired positioning in slot 17.

Referring to FIG. 4, there is illustrated therein another embodiment of slug 11 which may be substituted for slug 11 of FIGS. 2 and 3. In the embodiment illustrated in FIG. 4, slug 11 is composed of a low-loss, high-dielectric constant dielectric material 18, such as ceramic. This embodiment illustrated in FIG. 4 operates in substantially the same manner as described for slug 11 in conjunction with the embodiment thereof illustrated in FIGS. 2 and 3.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A tuning arrangement for a radial resonant cavity comprising an output means for said cavity disposed along a given radius of said cavity, a capacitive slug, means to position said slug along a radius of said cavity disposed at a predetermined angle to said given radius to tune said cavity and means to select the radius of said cavity to position said slug along to adjust said predetermined angle to control the coupling of signal from said cavity to said output means.

2. An arrangement according to claim 1, wherein said capacitive slug includes a metallic cylinder and dielectric material disposed at each end of said cylinder.

3. An arrangement according to claim 1, wherein said capacitive slug includes a cylinder of dielectric material.

4. A tuning arrangement for a radial resonant cavity having a cylindrical outer wall and top and bottom enclosing walls comprising an output means for said cavity

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disposed in one of said enclosing walls along a given radius of said cavity, a capacitive slug disposed intermediate of and in sliding contact relation with said top and bottom walls, means for moving said slug along a radius in said cavity disposed at a predetermined angle with respect to said given radius to tune said cavity, and means to select the radius of said cavity to move said slug along to adjust said predetermined angle to control the coupling of signal from said cavity to said output means.

5. An arrangement according to claim 4, wherein said capacitive slug includes a metallic cylinder and dielectric material disposed at each end of said cylinder and said moving means includes a dielectric rod connected to said cylinder and extending radially to the exterior of said cavity.

6. An arrangement according to claim 4, wherein said capacitive slug includes a cylinder of dielectric material and said moving means includes a dielectric rod connected to said cylinder and extending radially to the exterior of said cavity.

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