United States Patent

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[54] MICROWAVE RESONATOR COUPLING HAVING TWO COUPLING APERTURES SPACED A HALF WAVELENGTH APART

2 Claims, 2 Drawing Figs.

[52] U.S. Cl. 333/83, 333/73, 333/98
[51] Int. Cl. H01p 7/06, H01p 1/00, H03b 13/00
[50] Field of Search ..... 333/73, 73 (W), 83

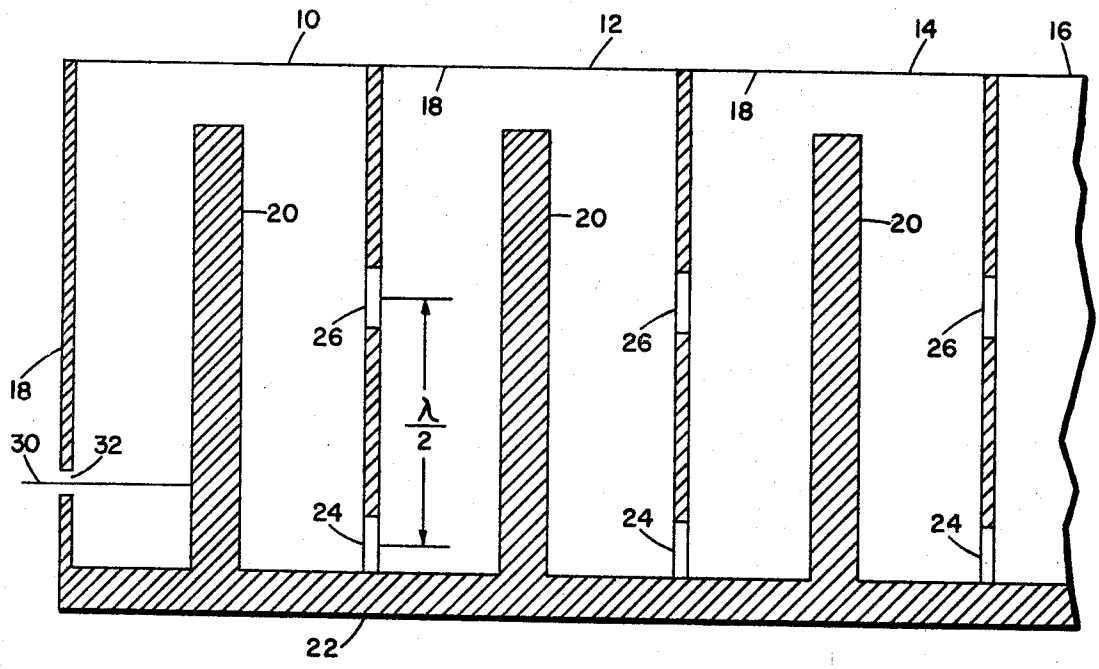
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ABSTRACT: Coupling is increased between microwave resonators by providing a plurality of holes in a common wall thereof, the holes being spaced one-half wavelength of the resonant frequency of the resonator.



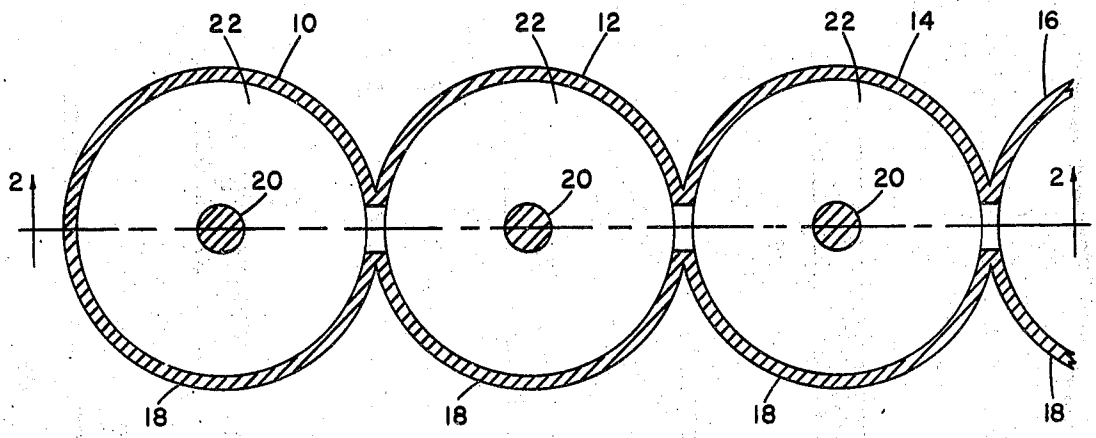


Fig. 1

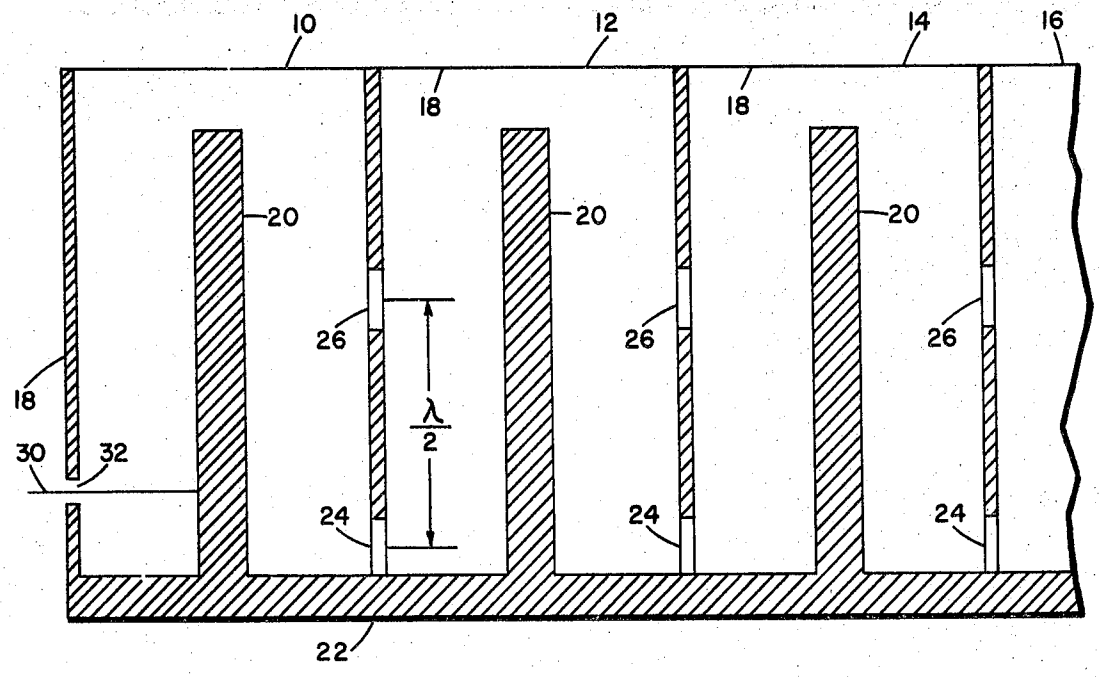


Fig. 2

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MICROWAVE RESONATOR COUPLING HAVING TWO COUPLING APERTURES SPACED A HALF WAVELENGTH APART

BACKGROUND

This invention relates to coupling between microwave resonators.

It is known to couple resonators having a common wall by providing a hole at a loop or antinode position in the common wall of the resonators. To increase the coupling, the hole size may be increased. However, upon too great an increase in the size of the hole, the hole itself may have its own resonant frequency, degrading the selectivity of the coupled resonators and adding spurious frequency selection. Therefore, by using one hole in a common wall of two resonators, sufficient coupling between the two resonators, as may be required to produce a broad band filter, is not obtainable without adverse effect on the frequency selection provided by the resonators.

SUMMARY

In accordance with this invention, a plurality of holes are provided in the common wall of a pair of resonators, the holes being half a wavelength apart. In this manner, sufficient coupling may be provided between the resonators to provide the required degree of coupling and yet no one of the holes needs to be large enough to itself have a resonant frequency in a range which can degrade the operation of the resultant filtering structure.

DESCRIPTION

This invention will be better understood upon reading the following description in connection with the accompanying drawing in which:

FIG. 1 is a section of resonators taken through a coupling hole at an angle of 90° with the axes of the coupled resonators, said resonators being coupled in accordance with this invention; and

FIG. 2 is a section of the coupled resonators of FIG. 1 on line 2–2 thereof.

Turning to the two FIGS., a plurality of resonators 10, 12 and 14, and a portion of a resonator 16, are shown. Each resonator is of conductive material or of material having conductive surfaces and comprises an outer cylindrical wall 18 and a central post 20 which is shorter than the outer wall 18.

The wall 18 and the post 20 are connected by a disclike plate 22. At the resonant frequency of each resonator 10, 12, 14, and 16, the inside surface of the pate 22 acts as a voltage node and a current antinode. The resonators 10, 12, 14, and 16 are arranged as shown in the FIG. to have a portion of the outer walls 22 of adjacent resonators 10 and 12, 12 and 14, and 14 and 16 in common. Just above the upper surface of each plate 22, a hole 24 is provided in the common portion of the wall 18 of the adjacent resonators 10, 12, 14, and 16. Also, at a half wavelength distance in an axial direction away from the hole 24, that is, at another current antinode, and also in the common portion of the walls, further holes 26 are provided. Each hole 24 and 26 is small enough so that it does not in itself, nor do the several holes 24 and 26 together, contribute their own resonances in or near the band of operation of the several resonators 10, 12, 14, and 16 to degrade the operation of the filter described. By the use of the two coupling holes 24 and 26 between each of the two adjacent resonators 10, 12, 14, and 16, the coupling between the adjacent resonators can be increased to the desired point whereby the resonators 10, 12, 14, and 16 become a band-pass filter. The wave to be filtered may be applied to the resonator 10 by any known means as by a wire 30 extending into the resonator 10 through the hole 32 in the outer wall 18 thereof, the wire being connected to the post 20.

While a plural hole coupling has been shown and described for resonators of the concentric type, a similar coupling may be provided for chamber-type resonators having no center post, in which case the inside end of the wire 30 may be left unconnected or may be connected to an inside surface of the resonators. While cylindrical-type resonators have been shown and described, other shapes of resonators may be coupled by plural hole coupling as here described. While three resonators are shown, two or more resonators may be provided and may be coupled as described.

I claim:

1. A plurality of coupled resonators:
each of said resonators having an outside wall;
a portion of the wall of at least two resonators being in common;
there being a plurality of holes in said common wall; and
the distance between said holes being equal to a half wavelength of the frequency of the said resonators.

2. The invention of claim 1 in which said resonators comprise an outside wall and a concentric internal post.