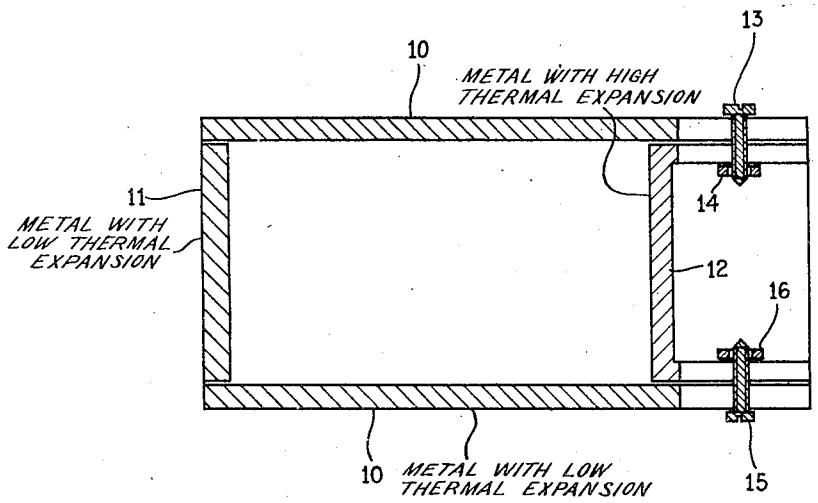
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ELECTRICAL RESONATOR

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ELECTRICAL RESONATOR

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The present invention relates to cavity resonators for use in wave guide systems of electrical communication, and is more particularly concerned with arrangements for controlling the frequency stability characteristics of such resonators.

Resonators of the above type have a very high "Q" factor and produce sharp resonance at a frequency dependent upon their dimensions. Accordingly temperature variation may have a considerable effect on their frequency stability and it is the object of the invention to provide means whereby the effect of temperature variation on such resonators is minimised.

According to one feature of the invention, a cavity resonator has one wall of material with a different coefficient of expansion from that of the material forming the remainder of the resonator, the member forming this wall being secured to the main body of the resonator in such manner that the movement of the wall member relative to the main body with changes of temperature will compensate to any desired degree for the changes in the volume of the resonator.

According to another feature of the invention, a cylindrical cavity resonator constructed of material having a small coefficient of expansion is provided with a piston of material having a greater coefficient of expansion the piston being secured to the resonator by means of an axial extension directed away from the cavity so that with increase of temperature the increase in the diameter and length of the cavity is compensated to any desired degree by the axial advance of the piston.

The invention will be better understood from the following description of one method of carrying it into effect, reference being had to the accompanying drawing which shows a sectional view of an elemental form of temperature-compensated cylindrical cavity resonator. This is assumed to be composed mainly of the alloy sold under the trade name "Invar" with compensation by means of a portion of copper.

The resonator is built up from an Invar cylinder 10 and is terminated at one end by an Invar piston 11 which is provided with a micrometer adjustment (not shown) for the purpose of giving a fine tuning of the resonant frequency of the cavity. The other end terminates in a copper piston 12 which can be secured in any given position with respect to the cylinder by means of the nuts and bolts 13, 14 and 15, 16 so as to give a coarse control of the resonant frequency. The interior surfaces of the cylinder 10 and

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piston 11 will preferably be silver- or copper-plated so as to provide a high electrical surface conductivity.

The main function of the copper piston 12 is for temperature compensation purposes and the two bolts 13 and 15 are therefore arranged to extend through longitudinal slots both in the cylinder 10 and in the piston 12 so that for any setting of the piston 12 with respect to the cylinder, it can be clamped in position over an appreciable range in order to leave more or less of the copper length on the inward side of the bolts free for controlling the effective cylinder dimensions in response to temperature variation.

With increase in temperature the small expansion of the Invar will produce a slight increase in both the length and diameter of the resonator, but at the same time the inwardly projecting part of the copper piston 12 will also expand to a greater extent owing to its higher coefficient of expansion. By suitable relation between the dimensions of the Invar cylinder and the free inwardly projecting portion of the copper piston, any increase in the dimensions of the resonator as effected by the Invar portion can be counter-balanced by the increase in the inwardly projecting length of the copper piston.

As regards the coupling of the resonator with a wave guide, if it is to be inserted in series with the guide, suitable entrance apertures may be provided in both the pistons 11 and 12, while if it is to be teed off the wave guide so as to give a parallel control effect, and entrance aperture need only be provided in piston 11 or piston 12. Alternatively, it may be thought preferable to provide entrance apertures in the wall of the cylinder.

To meet any special circumstances which might arise it is obvious that a degree of under- or over-compensation for temperature changes could be provided so that the resonant frequency would have a predetermined rising or falling characteristic with increase in temperature.

I claim:

1. In a wave guide system, a cavity resonator comprising a cylindrical tube closed at one end, said tube and end composed of material having a low coefficient of expansion, a cylindrical piston adapted to fit into the tube to form the other end of the resonator composed of material having a higher coefficient of expansion than the material of the tube and arranged to reduce the size of the cavity with an increase in temperature, means attaching the wall of the cylindrical piston to the wall of the tube at certain points,

means for altering the points of attachment of the cylindrical piston to the cylindrical tube while keeping the position of the piston with respect to the tube constant so as to obtain any desired ratio of piston expansion into the tube with length and diameter expansion of the tube for a given increase in temperature.

2. In a wave guide system, a cavity resonator comprising a cylindrical tube closed at one end, said tube and end composed of material having a low coefficient of expansion, a cylindrical piston adapted to fit into the tube to form the other end of the cavity resonator composed of material having a greater coefficient of expansion than the material of the tube, means for attaching the cylindrical wall of the piston at certain points within the tube so as to allow for adjusting the position of the piston relative to the tube to give coarse tuning of the resonator, said piston arranged to expand with an increase of temperature to reduce the size of the resonator, and means for altering the point of attachment of the piston to the tube while keeping the position of the piston with respect to the tube constant so as to obtain any desired ratio of piston expansion into the tube to length and diameter expansion of the tube for a given increase in temperature.

TREVOR HUGH TURNEY.

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