June 21, 1949. J. T. BEECHLYN 2,473,777

VARIABLE CAVITY RESONATOR

Filed May 17, 1945

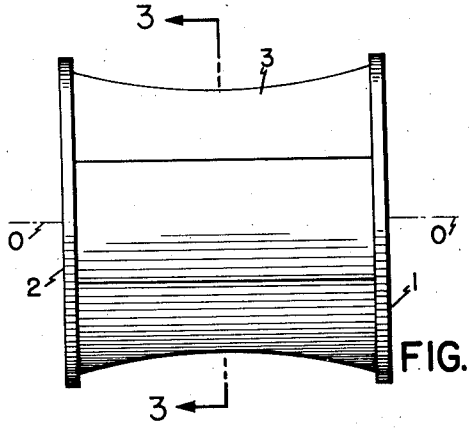


FIG. 1

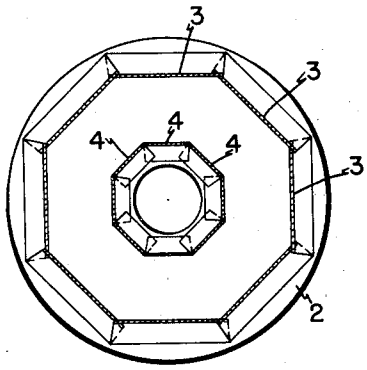


FIG. 3

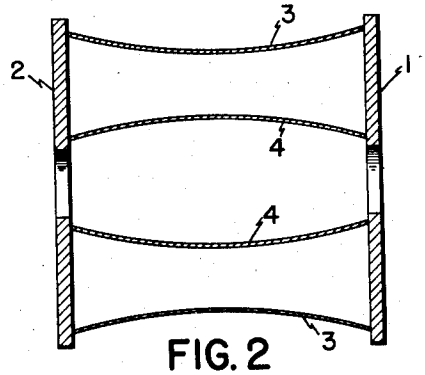


FIG. 2

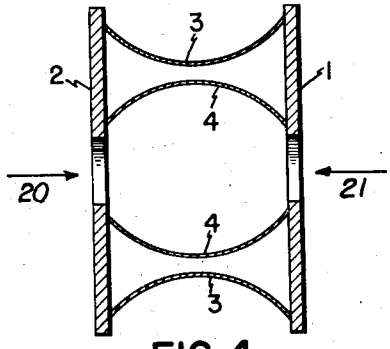


FIG. 4

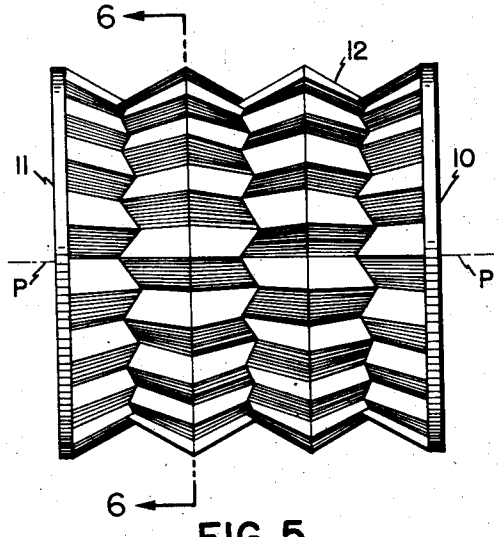


FIG. 5

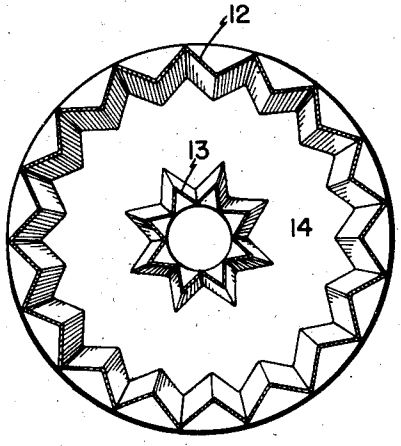


FIG. 6

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Patented June 21, 1949 2,473,777

UNITED STATES PATENT OFFICE

2,473,777

VARIABLE CAVITY RESONATOR

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Application May 17, 1945, Serial No. 594,211

3 Claims. (Cl. 178—44)

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The present invention relates to a cavity oscillator used in ultra high frequency radio circuits for producing oscillations and acting as a resonator for the oscillatory circuit.

In devices of this nature where very high electromagnetic oscillations are employed it is well known that the current confines itself to the external surfaces so that if there is a crack or cut in the surface, then the path of travel of the electricity is increased since it must flow around the cut into the interior of the material and back again to the surface.

The lack of good connections and polished surfaces establishing good electrical contact often cause increase in resistance and decrease in efficiency of cavity resonators. In addition to this, resistance in such circuits introduces greater damping and thus prevents free oscillations. Where a cavity resonator may be built to be used for a single frequency, no adjustment in the volume of the resonator need be made and under these conditions the resonator may be made to have a continuous metallic surface and many of the difficulties, due to adjustment of resonance, will be avoided. However, it is often necessary to make adjustments for frequencies in such cavity resonators not only in transmitting and receiving systems but also in test circuits which are used to determine or adjust for the resonance of a transmitter or a receiver and to bring such units into desired resonance.

The present invention aims to provide a cavity resonator of the type in which resonant adjustments may be made without changing the conductive contactual relation of the various parts of the resonator.

A further purpose of the present invention is to provide a cavity resonator in which broken contacts are avoided in the main resonant circuit of the cavity. In one form of the present invention this is fully accomplished while in a second form it is only partially accomplished.

The present invention will be more fully described in connection with the drawings annexed hereto showing embodiments thereof in which Fig. 1 shows a side elevation of one form of a cavity resonator; Fig. 2 shows a section through the cavity resonator of Fig. 1; Fig. 3 shows a sectional view of the resonator of Fig. 1 taken on the line 3—3; Fig. 4 shows a central section similar to that shown in Fig. 2 but with the resonator collapsed to a greater degree; Fig. 5 shows a modification of the resonator of Fig. 1; and Fig. 6 shows a section taken on the line 6—6 of Fig. 5.

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In the device shown in Figs. 1 to 4 there are provided end conductive plates 1 and 2 which are joined by means of thin flexible conductive plates 3, 3, etc., which at either end are permanently united with the end plates and form a regular polygonal figure symmetrical with a central axis 0, 0. In this polygonal figure the side edges of successive plates overlap each other successively in regular order and the plates also are bowed inwardly as shown more particularly in Fig. 1. Joined also to the end plates 1 and 2 is a similar set of flexible conductive plates 4, 4, 4, etc., arranged in a polygon symmetrically positioned about the axis 0, 0 and wholly within the outer set of plates 3, 3. These plates 4, 4 are flexible and conductive and are overlapped similarly as the plates 3, 3 but are bowed outwardly as indicated more clearly in sectional views of Figs. 2 and 4. The edges of the plates 4, 4 bear against the surface of the adjacent plates for their whole lengths.

The frequency of the resonator shown in Figs. 1 to 4 is adjusted by bringing the end walls 1 and 2 together or apart, thus both adjusting the length of the resonator and the cavity space within it. In these cases the resonating cavity comprises the annular space between the side walls 3 and 4 and the end walls 1 and 2. The frequency of the resonator is increased by bringing together the ends of the resonator, which action also bows inwardly the sections 3 and outwardly the sections 4. Fig. 4 shows the resonator decreased to practically its smallest amount, the end walls 1 and 2 having been moved closer together, as indicated by arrows 20, 21, directed toward each other, and in Fig. 2 the resonator is practically at its largest volume.

As the resonator volume is decreased, successive flexible sections 3 and 3 overlap on the side edges, the central parts overlapping to a greater degree than the parts at the edges which, of course, are fixed to the end plates. These overlapping side edges are in close contact one with the other on their whole surface length and while, therefore, conduction of electricity takes place through these joints, it is of a uniform nature and distributed uniformly over the whole length of the resonator.

Even these joints, however, are avoided in the modification illustrated in Figs. 5 and 6. Here the device may be of the Chinese lantern type or of any other general arrangement which may be extensible to provide an increase or decrease in the cavity volume whereby the tuning of the cavity may be varied. The device may take the

form of a Chinese lantern, a so-called coachman's boot or a device with accordion pleats.

Figs. 5 and 6 illustrate the application of this principle to a Chinese lantern type in which conductive end plates 10 and 11 are provided with conductive flexible walls 12 and 13, the wall 12 forming the outer shell of the resonator cavity 14 and the wall 13 forming the inner shell thereof. As indicated in Figs. 5 and 6 these walls are pleated in a longitudinal direction of the central axis P, P and are folded substantially in planes perpendicular to this axis with the folds alternately dovetailing one into the other. The volume of the cavity 14 may be increased or decreased by extending the end plates 10 and 11 apart from each other bringing them together. In this arrangement it should be noted, as previously mentioned, that there are no electrical discontinuities between different elements and that at all times full conduction is maintained over the whole conductive surface of the resonator.

In the present invention no particular emphasis has been placed upon the means of adjusting the resonator from an external source. This might be accomplished in any desired fashion, as, for instance, supporting the resonator on its end plates one of which may be slidable on a support or carriage and controlled by a screw back operated by a knot or a handle.

Having now described my invention I claim:

1. A resonator comprising a flexible outer conductor and a flexible inner conductor about a central axis having common end walls substantially parallel to one another, said conductors being formed by a plurality of flexible sections with the ends attached to said end walls, said sections forming a regular polygonal figure symmetrical with said axis.

2. A resonator comprising a flexible outer conductor and a flexible inner conductor about a central axis having common end walls substantially parallel to one another, said conductors being formed by a plurality of flexible sections with the ends attached to said end walls, the sections of said outer conductor being bowed inward and the sections of said inner conductor being bowed outward, said sections forming a regular polygonal figure symmetrical with said axis.

3. A resonator comprising a flexible outer conductor and a flexible inner conductor about a central axis having common end walls substantially parallel to one another, said conductors being formed in flexible sections with the ends attached to said end walls, each of said sections successively having one side edge overlapping the next adjacent section.

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