

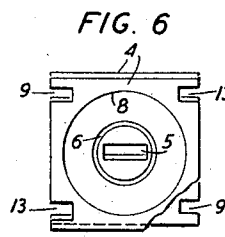
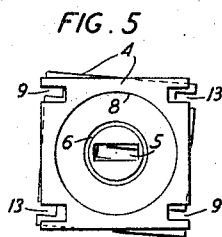
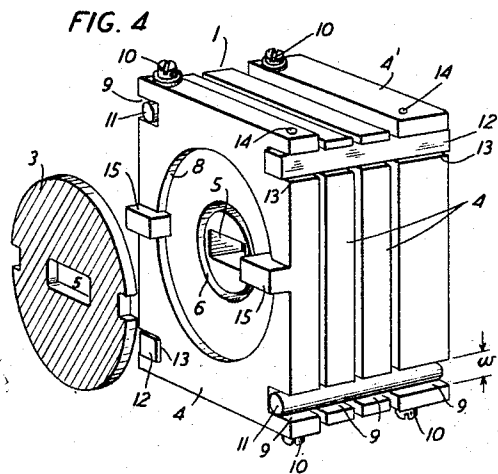
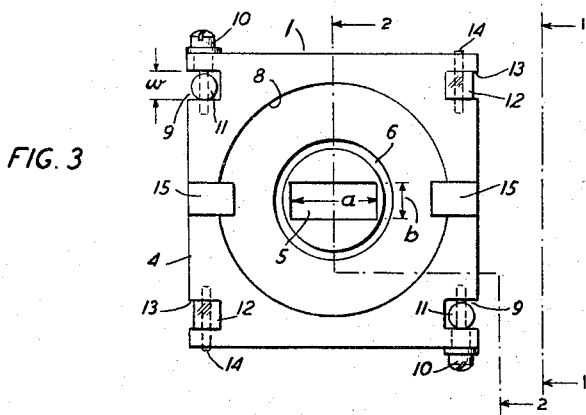
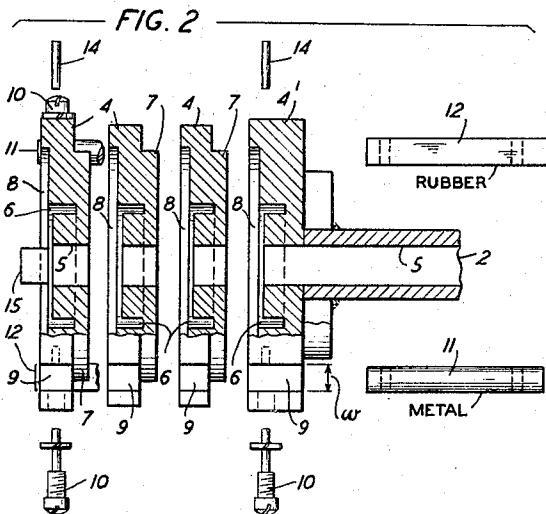
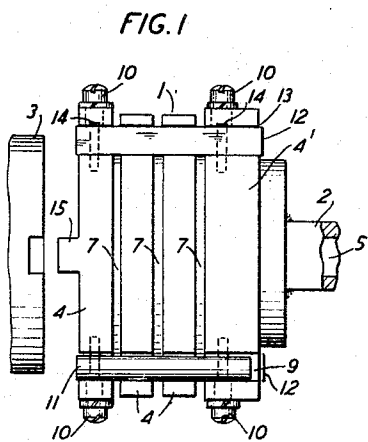
Sept. 12, 1950

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2,522,279

WAVE GUIDE COUPLING

Filed Dec. 3, 1946



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2,522,279

WAVE GUIDE COUPLING

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Application December 3, 1946, Serial No. 713,632

3 Claims. (Cl. 178-44)

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This invention relates to wave guides and more particularly to wave guide choke coupling devices.

An object of the invention is to couple misaligned wave guide parts without introducing appreciable loss and change in characteristic impedance.

Another object of the invention is to connect wave guide parts so as to allow limited flexing movement therebetween, and at the same time to maintain the loss of the connection comparable to a rigid wave guide and render the power leakage negligible.

A feature of the invention is a vertebra wave guide characterized by nested plates having aligned apertures for wave transmission therethrough, each plate having a choke groove around the aperture to prevent leakage loss of wave energy.

Another feature of the invention is a vertebra wave guide characterized by nested plates having aligned wave transmission apertures, said plates being held together for limited flexing movement.

Fig. 1 shows a side view of assembled wave guide coupler in accordance with the invention;

Fig. 2 is an exploded sectional view;

Fig. 3 is a front view of the coupler;

Fig. 4 is a perspective view of the coupler;

Figs. 5 and 6 show front views of a pair of choke vertebra elements in operative positions.

The figures of the drawing, as shown, are substantially drawn to scale.

Flexible wave guides formed of separate, spaced choke wafers or plates embedded in a rubber casing are known. Such devices are characterized by appreciable loss due to wave leakage through the casing permitted by the spacing between the choke wafers, and by more or less appreciable changes in the characteristic impedance introduced by the flexing of the guide.

In accordance with the invention, these objectionable features are overcome by providing a vertebra wave guide or coupling, wherein separate choke wafers or plates are nested and held together by rods and rubber strips in such a manner as to permit limited twist and shear of the plates with respect to the principal axis of the composite guide or coupler, without appreciable change in transmission characteristics.

Referring to Fig. 1 of the drawing, a wave guide choke coupling 1 of limited flexibility is shown connected between two rigid wave guide sections 2, 3 to allow for a slight amount of misalignment therebetween. The rigid wave guide

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section 2 may be a rectangular wave guide integrally connected to an end plate 4' of the coupler, while the wave guide 3 may be a section of rectangular guide having a terminal connecting disc joined to a magnetron oscillator or other microwave component. The plane of the connecting disc should be perpendicular to the axis of wave guide 2 to insure close contact between all adjacent plates of the coupler.

Referring to Figs. 2 and 3, the wave guide choke coupling 1 comprises a number of square metal plates 4, each having a choke groove 6, surrounding the rectangular wave transmission aperture 5.

The plates 4 are nested into close mechanical contact by a raised circular boss 7 fitting into a slightly larger counterbore 8 cut into an adjacent plate. An assembly of plates 4, so nested, is held together by two metal rods 11 and two longitudinal rubber strips 12, diagonally disposed as shown in Fig. 3. The rods 11 are held in slots 9 by pins 10 having a screw-threaded upper end, while strips 12 are held in slots 13 by retaining pins 14. The soft rubber strips 12 fit snugly and under tension in their corresponding slots.

The choke 6 on plates 4 is a circular groove approximately one-quarter of a wavelength deep at a suitable distance from the longitudinal axis of the rectangular guide 5. The thickness of the plate relative to the depth of groove is kept to a minimum consistent with desired mechanical strength whereby interplate discontinuities are spaced substantially a quarter wavelength apart to thereby mutually cancel undesirable reflections.

In operation, the coupling unit is connected between rigid wave guide sections 2, 3 between which a slight amount of misalignment prevails. The plates 4 are adapted to slide upon each other sufficiently to provide a limited relative shear and twist motion.

The amount of shear between a pair of adjacent, contacting plates 4, 4 is determined almost wholly by the relative diameters of boss 7 and counterbore 8, and will in practice be slightly modified by the existing twist. Similarly, the amount of twist will be determined by the relation of rod diameter 11 to slot width w , and will in practice be slightly modified by the existing shear. The function of the soft rubber strip 12 is to distribute the total displacement equally between the plates of the coupler.

Fig. 5 shows two nested plates 4 in operative relation, angularly displaced with respect to the longitudinal axis and to each other.

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Fig. 6 shows two such plates displaced linearly, parallel to the *b* side of the rectangular aperture 5. Various combinations of these exemplary displacements may be impressed on the plates 4 to give them a limited flexibility.

The amount of displacements should not be sufficient to cause any appreciable change in the characteristic impedance of the rectangular guide. Furthermore, the close nesting of the plates 4 into each other, operates to prevent any appreciable loss or leakage of wave energy to the outside past the plates 4.

When the guide section 3 is in place with female members fitted on lugs 15 of the coupler end plate, the entire coupler assembly may be held tightly by a modified U-shaped clamp (not shown) for insuring full contact between the plates.

Whereas for one practical form of coupler, four vertebra plates 4 were found sufficient, it should be understood that the number may be any desired. Wave guides of considerable length may be formed by nesting together a sufficiently large number of such plates. Such wave guides will possess limited flexibility, negligible leakage and the transmission characteristics of similar rigid wave guides.

What is claimed is:

1. In a structure for coupling together two misaligned wave guides comprising two end plates respectively joined to said guides, and a vertebra wave-guide coupling between said end plates comprising a series of contacting square rigid plates connected between said end plates, consecutive vertebra plates having open-ended slots in the corners thereof, each plate being provided with an aligned rectangular wave transmission aperture, an annular choke trap surrounding each aperture for preventing wave energy leakage, said plates being nested and each having a raised circular boss on one face thereof and a slightly larger counterbore on its opposing face, a pair of longitudinal metal rods seated in said slots for joining said plates together at a pair of diagonal corners, and a pair of longitudinal rubber strips snugly fitting into the other pair of diagonal corner slots, whereby the total relative angular displacement between said end plates is distributed equally between the plates of the vertebra coupler.

2. A vertebra wave guide for microwaves comprising a series of square rigid plates, each hav-

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ing an aligned rectangular wave transmission aperture, each plate having a circular groove approximately

$$\frac{\lambda}{4}$$

in depth and at a suitable radius from the longitudinal axis of said guide to prevent leakage of wave energy transverse thereto, nesting means between adjacent plates comprising a raised boss on one face of each plate and a slightly larger corresponding counterbore on its opposite face, rigid pins and flexible rubber strips connecting consecutive plates together at diagonally opposite corners thereof, whereby relative angular and linear displacements between the plates may be permitted without appreciable change in transmission through said guide.

3. A vertebra wave-guide coupling between misaligned rigid wave guides comprising an aligned series of square plates nested into each other, each plate having an aligned, rectangular wave transmission aperture therein, a boss on one face and a counterbore on the other face, open-ended slots at the corners of said plates, assembly pins loosely fitted in one pair of diagonally opposite slots, and rubber strips snugly fitted into the other pair of diagonal slots, whereby relative angular and linear displacements between the plates may be produced without appreciable change in the characteristic impedance of said guide.

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