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FLEXIBLE JOINT FOR WAVE GUIDES

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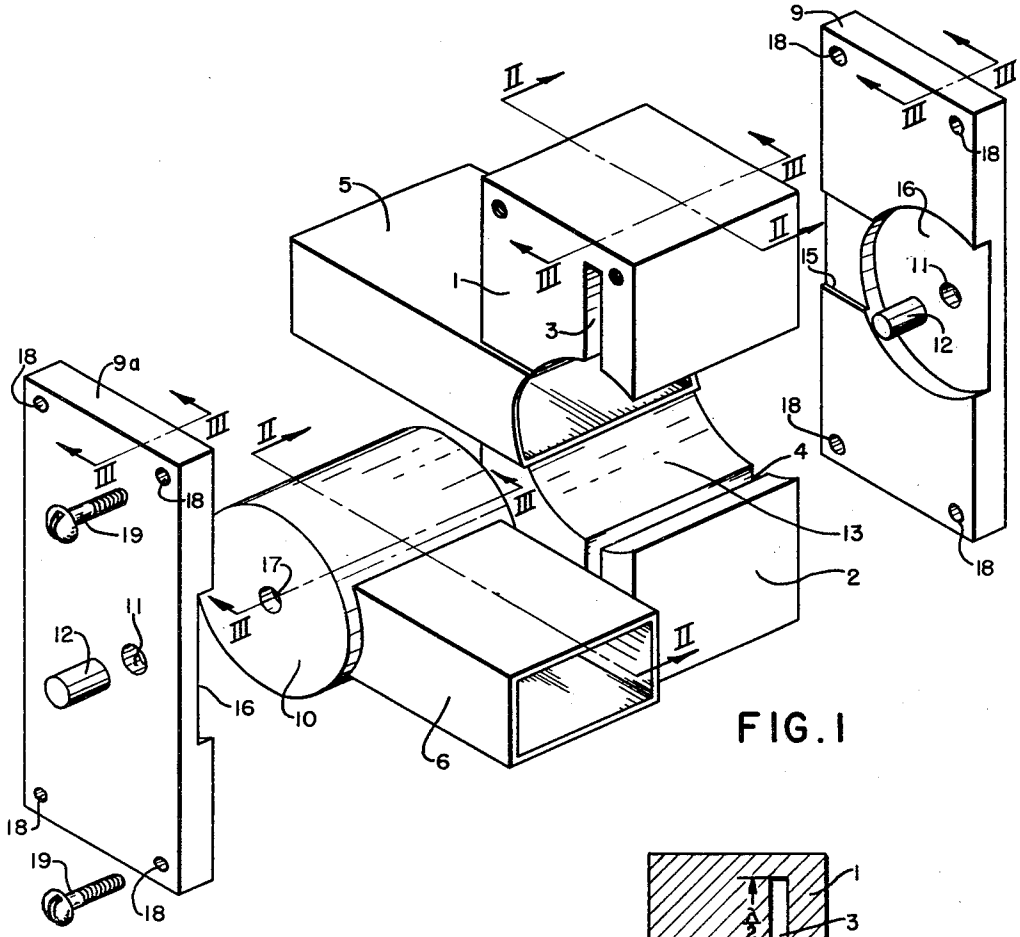

FIG. 1

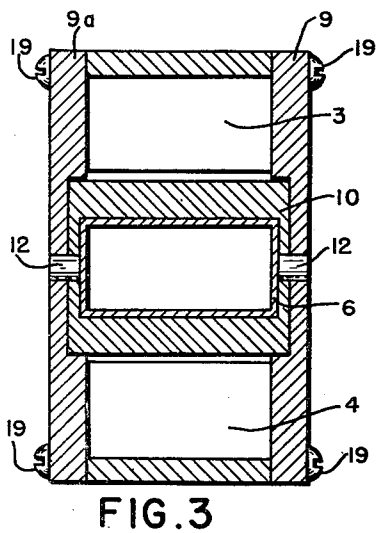

FIG. 3

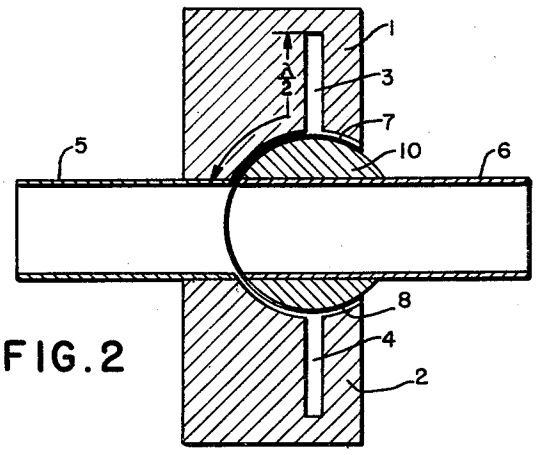

FIG. 2

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FLEXIBLE JOINT FOR WAVE GUIDES

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4 Claims. (Cl. 333—98)

This invention relates to a hinge joint for wave guides, and more particularly to a joint which permits the joined wave guides to wobble or nutate within fixed limits relative to one another.

In the construction of wave guides for transmitting electromagnetic energy, it is frequently desirable to provide a flexible joint so that various sections of the wave guide may be moved relative to each other. However, it has heretofore been found that considerable leakage of electromagnetic energy results from wave guide joints as heretofore constructed. This invention provides a flexible joint for joining wave guide sections in which loss of electromagnetic energy through the joint is reduced to a minimum.

One object of this invention is to provide a coupling means or joint for wave guides.

Another object of this invention is to provide a wave guide joint whereby abutting ends of the wave guide may be displaced angularly one from the other about an axis perpendicular to the plane of the electric vector in the wave guide.

Still another object of this invention is to provide a wave guide joint whereby abutting ends of the wave guide may be displaced angularly one from the other with a minimum loss and a minimum reflection from the joint.

A further object of this invention is to provide a wave guide coupling to give a hinge motion in the plane of the electric vector of the wave guide by use of a rectangular choke ditch.

A still further object of this invention is to provide a coupling means or joint which is simple in design, rugged mechanically, and efficient in the transfer of electromagnetic energy.

Other objects and features of the present invention will become apparent upon a careful consideration of the following detailed description when taken together with the accompanying figures.

Fig. 1 shows an exploded view of one embodiment of this invention;

Fig. 2 is a sectional view taken along the lines II—II of Fig. 1; and,

Fig. 3 is a sectional view taken along the lines III—III of Fig. 1.

Although the apparatus of this invention may be made in other forms it is herein illustrated as comprising two sections **5** and **6** of a wave guide in which wave guide section **5** is attached to a pair of modified rectangular blocks **1** and **2**, and wave guide section **6** is attached to a modified cylinder **10**. A pair of slots **3**, **4** extend entirely through modified rectangular blocks **1** and **2** in a direction transverse to the direction of propagation of electromagnetic energy within the wave guide. These are diametrically opposed longitudinal slots, which are effectively a quarter wave length of the electromagnetic energy being propagated in the wave guide. A circular segmented opening **13** is provided in the blocks, the segment being of such size that the distance along the surface of the segment from the inside of the abutting end of the wave guide wall attached to the block to the bottom of each slot is an effective one half wave length of the electromagnetic energy being propagated in the wave guide. The dimensions of the blocks in the direction of these openings is the same as the broad dimension of the wave guide interior. Cylinder **10** is a solid cylinder having an opening cut therethrough perpendicular to the axis of the cylinder, the opening being of such size that the end of wave guide section **6** can be precisely fitted therein. The end of wave

guide section **6** which is mounted on cylinder **10** extends through the cylinder and has the interior end thereof trimmed to the same radius as that of cylinder **10** to provide a smooth fit with the circumference of the cylinder. The radius of the cylinder is slightly less than the radius of the circular segmented opening of blocks **1** and **2**. Axial openings **17** to fit a pair of bearings **12** are located in each end of the cylinder. A pair of similar rectangular end plates **9** and **9***a* are provided as a means for retaining the complete joint in an operational relationship after the parts have been assembled. As shown in connection with Fig. 1, end plates **9** and **9***a* are each provided with a flat groove **15** to fit the narrow walls of wave guide segment **5**. In like manner, plates are each provided with a shallow circular segmented opening **16** to receive cylinder **10**. A plurality of drilled openings **18** serve to fix the end plates to blocks **1** and **2** upon insertion of suitable screws **19** therein. A pair of bearings **12** inserted in openings **11** of the end plates pivotally mount cylinder **10** to the plates.

In operation, wave guide section **6** and cylinder **10** act as the movable portion of the hinge joint, rotating within segmented opening **13** the stationary portion of the joint. The movable portion of the joint is rotatably mounted on bearings **12**, the ends of which are inserted in openings **11** in rectangular end plates **9** and **9***a* and openings **17** in cylinder **10**.

As is well known to those skilled in the art, slots **3** and **4** in combination with the openings between blocks **1** and **2** and cylinder **10**, being an effective half wave length of the average electromagnetic energy being transferred, will reflect a short circuit at the abutting inside edges of wave guide sections **5** and **6** thus preventing the loss of energy in the wave guide at the joint. It is to be understood that the electromagnetic energy being propagated in this system must be in the dominant or principal mode, i. e., the electric vector is perpendicular to the direction of propagation.

The invention described in the foregoing specification need not be limited to the details shown, which are considered to be illustrative of one form which the invention may take.

What is claimed is:

1. A mechanical connection for connecting a pair of abutting wave guide sections having electromagnetic energy propagated therethrough comprising a joint flexibly connecting the abutting ends of said wave guide sections, said joint including a pair of blocks enclosing one end of one of said wave guide sections and having a segmented opening therein, a cylindrical member having an opening therethrough for mounting one end of the other of said wave guide sections disposed within said segmented opening, a pair of side plates retaining said blocks in an assembled relationship, and a pair of diametrically opposed slots formed in said blocks, said slots extending across said blocks in a direction normal to the direction of propagation of said electromagnetic energy, the distance from the wall of said wave guide adjacent to each of said blocks along the segmented opening to the bottom of each slot being an effective half-wavelength of the electromagnetic energy being propagated in said wave guide sections.

2. A flexible joint for a wave guide transmission system comprising, a first section of rectangular wave guide, a pair of fixed conducting blocks secured respectively on opposite broad walls at one end of said first wave guide having inner surfaces forming with said one end of said first wave guide a segmented cylindrical opening having an axis parallel to the longer transverse axis of said first wave guide and passing through the longitudinal axis of said first wave guide, said cylindrical opening being disposed to provide a rectangular cutout in said blocks diametrically opposite said one end of said first wave guide, a second section of wave guide, a conducting cylindrical member rotatably journaled in said cylindrical opening, said second wave guide passing through said cutout and being fitted in a diametral opening through said cylindrical member and abutting said first wave guide, said blocks having a pair of diametrically opposed slots formed therein extending across said blocks and communicating with said cylindrical opening, the distance from

the broad wall of said first wave guide adjacent each of said blocks along said cylindrical opening to the bottom of its respective slot being a half wave length of the energy adapted to be transmitted by said system.

3. A flexible joint for connecting first and second sections of rectangular wave guide comprising, a pair of conducting blocks of width substantially equal to the width of said wave guide sections respectively secured to the opposite broad walls of one end of said first wave guide section, said blocks having a cylindrical opening therein communicating with said first wave guide section and having its axis disposed perpendicularly to the longitudinal axis of said first wave guide section, a conducting cylindrical member of length substantially equal to the width of said wave guide sections rotatably mounted in said cylindrical opening, said second wave guide section extending through a diametral opening in said cylindrical member and abutting said first wave guide section, conducting end plates closing the ends of said cylindrical opening and supporting said cylindrical member for rotation in said opening, said blocks each having a rectangular slot formed therein coextensive with the width of said blocks disposed parallel to the axis of said cylindrical opening and communicating therewith, the distance from the broad wall of said first wave guide section adjacent to each of said blocks along said cylindrical opening to the bottom of its respective slot being substantially equal to a half wave length of energy adapted to be transmitted by said wave guide sections.

4. A flexible joint for mechanically connecting first and second abutting sections of rectangular wave guide to permit displacement of the longitudinal axis of said first section from the longitudinal axis of said second section comprising, a pair of fixed blocks secured to the abutting end of said first wave guide section having formed therein a cylindrical opening having its axis disposed perpendicularly to the longitudinal axis of said first section of wave guide, a cylindrical member rotatably journaled in said cylindrical opening, said second section of wave guide passing through said cylindrical member and abutting said first wave guide section, and conducting side plates closing the ends of said cylindrical opening and maintaining said blocks and cylindrical member in assembled relation, said blocks having slots formed therein coextensive with said cylindrical member and communicating with said cylindrical opening and arranged to prevent leakage of electromagnetic energy from said wave guide sections through said joint.

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