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ABSTRACT OF THE DISCLOSURE

An arrangement for directionally coupling microwave energy between two parallel, rectangular waveguide sections sharing a common wall on a side of each waveguide. An elongated perforation through the common wall is normal to longitudinal axes of the waveguides. The perforation has an enlarged central portion, with a post extending from one of the waveguide non-common wide sides through the enlarged portion and into the other waveguide. Energy is coupled in one longitudinal direction in the waveguide in which the post is mounted from the other waveguide.

BACKGROUND OF THE INVENTION

This invention is in the field of high-frequency directional energy couplers, in particular a coupler for use between two microwave guides.

Many types of high-frequency directional waveguide couplers are known. A specific example of such a known coupler is that shown by S. Senesir in U.S. Patent No. 2,641,648, issued June 9, 1953. This patent describes various types of known couplers, such as the Bethe hole coupler, wherein both electric and magnetic coupling takes place through a single hole in a common wall between two waveguides. The Senesir invention is an arrangement using separate couplers for electric and magnetic fields, with the couplers being in a common wall between two waveguides. The electric coupling is accomplished by a probe, and the magnetic coupling, by a slot. The probe is supported by an insulator in the common wall.

SUMMARY OF THE INVENTION

This invention is a directional coupler between two parallel rectangular waveguides having a common broad wall with a transverse slot in the common wall. The slot has an enlarged center portion, through which a post extends. One end of the post is fixed to a non-common broad wall on one of the waveguides, and extends into the other waveguide. This arrangement makes for a simpler physical construction than the above patent arrangement, and will be more rugged, since no insulator is used. Also, no dielectric losses from an insulator exist. The invention realizes a broad bandwidth and a high directivity, compared to the known couplers.

An object of this invention is to provide a novel contradirectional waveguide coupler.

Another object is to provide a contradirectional coupler which is smaller, cheaper and more rugged than known couplers.

Yet another object is to provide a waveguide coupler using a perforation-post combination.

These, and other objects which may be obvious to one skilled in the art may be realized from the invention as described herein.

BRIEF DESCRIPTION OF THE DRAWING

The single drawing figure shows a pictorial view of the inventive coupler, with a section cut away.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention may be best understood by reference to the drawing, which shows two parallel rectangular waveguides generally designated 1 and 2. These waveguides have a common broad wall 3, and respective non-common broad walls 4 and 5. The cut-away portion reveals a perforation generally designated 6 in wall 3. Perforation 6 is composed of a slot portion 6a and a central enlarged portion 6b. A post 7 is perpendicularly attached to wall 4, and penetrates perforation 6 through enlarged portion 6b. Post 7 extends into waveguide 2, but does not touch broad wall 5. Both post 7 and perforation 6 are centered on respective centerlines of walls 4 and 3, and perforation 6 is perpendicular to the centerline of wall 3. Arrow 8 in waveguide 2 shows the direction of the main transmission path of energy. Arrow 9 in waveguide 1 shows the direction of the coupled energy, with arrow 10 showing the direction of waste energy from the coupler. The diameter of post 7 is selected to optimize the directivity and impedance match of the coupler.

The length of post 7 and the length of slot 6a provides two well controlled variables that determine the exact design desired. Enlarged portion 6b may also be varied for specific conditions. Post 7 may be threaded in a tapped hole in wall 4, to allow ready adjustment of its penetration into perforation 6. Post 7 provides electric coupling for energy from waveguide 2 into waveguide 1, and slot 6 provides magnetic coupling. The waste power in direction 10 is optimized at a minimum value and may be absorbed by a matched waveguide load (not shown). The perforation-post combination does introduce some fringing of the electric and magnetic coupling, but proper selection of parameters minimizes the effects, and a contradirectional coupler is produced that features high directivity with a good voltage standing wave ratio (VSWR), relatively flat coupling (over the design frequency band), and consistent phase characteristics.

An example of the particular coupler in accordance with the invention is as follows. For a 10% bandwidth (±5%) about 5.55 GHz, with at least 15 db directivity over the band, the following coupler dimensions may be used (all dimensions in inches).

Inside height of waveguide 1=.086
Inside height of waveguide 2=.574
Inside width of waveguides 1 and 2=.1372
Thickness of common wall 3=.032
Length of post 7 extending into waveguide=.125
Diameter of post 7=.172
Length of slot 6a=.0319
Width of slot 6a=.0313
Diameter of enlarged portion 6b=.250

These dimensions allow a maximum VSWR of 1.12 in the band from 5.2 to 5.6 GHz. The directivities and couplings at various frequencies are given below (in db).

<table>
<thead>
<tr>
<th>Frequency (GHz)</th>
<th>Coupling</th>
<th>Directivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.3</td>
<td>20.7</td>
<td>19.0</td>
</tr>
<tr>
<td>5.53</td>
<td>20.5</td>
<td>24.3</td>
</tr>
<tr>
<td>5.56</td>
<td>20.0</td>
<td>24.3</td>
</tr>
<tr>
<td>5.68</td>
<td>19.4</td>
<td>20.4</td>
</tr>
</tbody>
</table>

The desired result is obviously obtained. The above dimensions are intended not to be limiting in any way, but are for particular frequencies and particular waveguides. Many other combinations of post length, post diameter, slot length, etc., may be used.
We claim:

1. A microwave coupler comprising a first section of rectangular waveguide parallel to a second section of rectangular waveguide, with a common broad wall therebetween; said wall having a transverse slot with a central enlarged portion; a post fixed to a non-common broad wall of said first section of waveguide, and extending through said enlarged portion of said slot.

2. The coupler of claim 1 wherein said slot is generally rectangular in shape.

3. The coupler of claim 1 wherein said post is of a circular cross-section.

4. The coupler of claim 3 wherein said enlarged portion is round.