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CIRCUIT FOR DISTRIBUTING POWER BETWEEN TWO MUTUALLY ORTHOGONAL
POLARIZATION PATHS EMPLOYING A ROTATABLE ABSORBING STRIP

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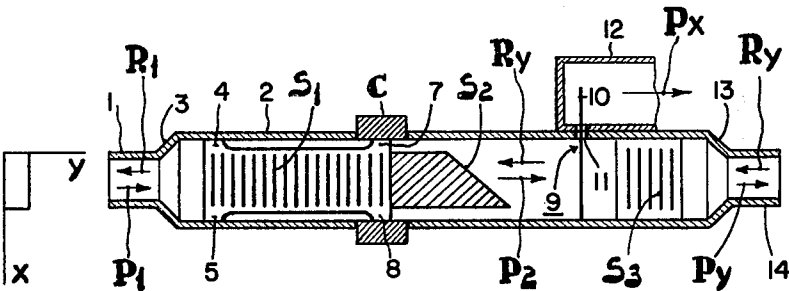


FIG. 1

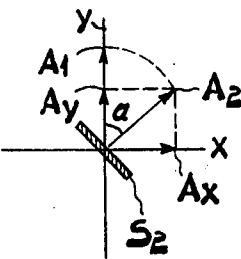


FIG. 2

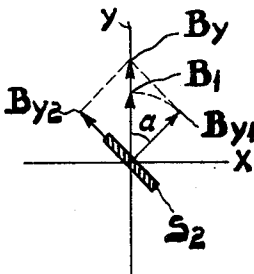


FIG. 3

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CIRCUIT FOR DISTRIBUTING POWER BETWEEN TWO MUTUALLY ORTHOGONAL POLARIZATION PATHS EMPLOYING A ROTATABLE ABSORBING STRIP

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The invention relates to a power dividing circuit for microwaves.

A power dividing circuit is known which comprises a first transmission path for electromagnetic waves having a certain direction of polarisation. This power divider further comprises a second transmission path for electromagnetic waves and a third transmission path for electromagnetic waves, the electromagnetic waves in the second and third transmission paths being polarised at right angles to one another. The first transmission path is connected to the second and third transmission paths through a common polarisation rotator. It is further known to use a twisted strip of conductive material as a polarisation rotator. The known power divider provided with the said known polarisation rotator has a limitation in that the second and third transmission paths are coupled with one another.

It is the object of the invention to eliminate this coupling.

According to the invention, at the end of the strip adjacent the second and third transmission paths and in alignment therewith a strip is provided made of a material for absorbing electromagnetic waves having a direction of polarisation parallel to the plane of this strip.

The invention will now be explained more fully with reference to the drawing.

FIG. 1 shows by way of example an embodiment of a power divider in accordance with the invention.

FIGS. 2 and 3 show vector diagrams illustrating the operation of the power distributor of FIG. 1.

In FIG. 1 a wave guide 1 of rectangular cross-section is connected to a wave guide 2 of circular cross-section through a matched transition piece 3. The wave guide 2 contains a strip S_1 of conductive material. This strip is secured to the inner surface of the wave guide 2 by means of projections 4 and 5. The points of attachment lie in a plane passing through the axis of wave guide 2, in the case shown in the plane of the drawing. At its other end the strip S_1 is secured to the inner surface of a cylinder C with the aid of projections 7 and 8. The inner surface of the cylinder C is linked up with the inner surface of the wave guide 2 without reflection. The cylinder C is adapted to be rotated about its axis which coincides with the axis of the wave guide 2. By turning the cylinder C relatively to the cylinder 2 the strip S_1 is twisted; as will be explained hereinafter, the maximum relative angular displacement of the cylinder C need not exceed 90° .

The strip S_1 and the cylinder C together constitute a variable polarisation rotator for electromagnetic waves.

A strip S_2 is aligned with the strip S_1 . This strip S_2 is made of a material, for example a metal deposited from vapour, for absorbing electromagnetic energy. In the position of the cylinder C shown in FIG. 1 both the strip S_1 and the strip S_2 lie in the plane of the drawing.

The wave guide 2 further contains a coupling member 9 for electromagnetic waves the direction of polarisation of which lies in the plane of the drawing at right angles to the axis of the wave guide 2. This coupling member comprises a conductive rod 10 which through an aperture 11 in the wave guide 2 extends into a wave guide 12 shown partly only.

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The rod 10 lies in a plane passing through the axis of the wave guide 2 at right angles to the axis. A strip S_3 of conductive material is arranged behind the rod 10 spaced away therefrom by one quarter wavelength. Both the rod 10 and the strip S_3 lie in the plane of the drawing. The part of the wave guide 2 behind the rod 10 now forms an infinite impedance for electromagnetic waves having a direction of polarisation lying in the plane of the drawing. Waves having this direction of polarisation are withdrawn substantially entirely from the wave guide 2 by the coupling member 9 and are passed to the wave guide 12 through the rod 10.

Transverse slits are provided both in the strip S_1 and in the strip S_3 . These strips prevent the occurrence of waves of other types. In particular no wave types can occur which are produced by longitudinal currents in the strips.

The wave guide 2 is coupled at its right-hand end through a matched transition piece 13 to a wave guide 14 of rectangular cross-section. The direction of polarisation of the electromagnetic waves in the wave guide 14 is at right angles to the plane of the drawing.

When the cylinder C is in the position shown, that is to say in the position in which both the strip S_1 and the strip S_2 lie in the plane of the drawing, an electromagnetic wave entering the wave guide 2 from the wave guide 1 will pass unimpeded from the right-hand end of the wave guide 2 to the wave guide 14. Thus, in the wave guide 12 no electromagnetic wave is produced.

The operation of the power distributor will now be explained with reference to FIG. 2 for the case in which the cylinder C is rotated from the position shown through a certain angle, for example an angle of α degrees, an electromagnetic wave being supplied from the wave guide 1 to the wave guide 2.

FIG. 2 shows co-ordinate axes. The y-axis corresponds to the direction at right angles to the plane of the drawing of FIG. 1, the x-axis corresponds with a direction in the plane of the drawing of FIG. 1 at right angles to the axis of the wave guide 2.

The vectors A_1 – A_y show diagrammatically the electric field strength of the electromagnetic waves propagating in the power distributor of FIG. 1 in the directions of arrows P_1 – P_y . The vector A_1 represents the electromagnetic wave supplied from the wave guide 1 to the wave guide 2. The direction of the vector A_1 corresponds with the direction of polarisation of this wave and the length of the vector A_1 is proportional to the amplitude of this wave.

FIG. 2 shows the vector A_2 rotated relatively to the y-axis through an angle α . This means that the electromagnetic wave in the direction of the arrow P_2 in FIG. 1 is polarised in a direction rotated through the same angle α relatively to the direction at right angles to the plane of the drawing.

The vector A_2 has a component A_x in the direction of the x-axis. The vector A_y represents the wave propagating from the wave guide 2 to the wave guide 14 and the vector A_x represents the wave supplied by the coupling member 9 from the wave guide 2 to the wave guide 12. The ratio between the lengths of the vectors A_y and A_x can be simply varied by increasing or reducing the angle α . Thus, by varying the position of the cylinder C the ratio between the amplitudes of the waves in the wave-guides 12 and 14 and hence the power supplied to either wave guide is varied.

The wave guide 14 of FIG. 1 generally is not terminated without reflection. Hence, in the wave guide 14 waves will also propagate in a direction opposite to the direction of the arrow P_y , as shown by arrow R_y .

Similarly to FIG. 2, in FIG. 3 the vectors B_y – B_1 diagrammatically represent the electric field strength of the electromagnetic waves propagating in the direction of the arrows R_y – R_1 in FIG. 1.

FIG. 3 shows that the vector B_y has a component B_{y1}

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at right angles to the strip S_2 shown in cross-section and a component B_{y2} tangential to the strip S_2 .

The electromagnetic wave represented by the vector B_{y1} propagates along the strip S_1 . Thus, the direction of polarisation of this wave rotates through an angle α . In the figure this wave is now represented by a vector B_1 rotated through an angle α relatively to the vector B_{y1} .

The electromagnetic wave represented by the vector B_{y2} is completely absorbed by the strip S_2 . However, if the strip S_2 is not present, this wave reflects at the end of the strip S_1 and the component of the reflected wave having a direction of polarisation according to the x-axis is guided by the coupling member 9 to the wave guide 12. In this event, the wave in the direction of an arrow P_x depends not only upon the wave in the direction of the arrow P_1 but also upon the wave in the direction of the arrow R_y . The provision of the strip S_2 in the manner shown prevents the latter wave from producing an electromagnetic wave in the wave guide 12.

The advantage of the power distributor described consists in that only the electromagnetic wave propagating in FIG. 1 from the left to the right supplies power to the wave guide 12. Thus, the power divider described actually is a directional coupler.

What is claimed is:

1. A microwave power dividing circuit comprising a source of electromagnetic waves of predetermined polarization, first and second microwave transmission path means for waves of mutually perpendicular polarization, and polarization rotating coupling means connected to couple waves from said source to said first and second transmission path means, said coupling means comprising a twistable strip of conductive material extending axially of said coupling means between said source and said first and second transmission means, means for twisting said strip for rotating the polarization of said waves, and a rotatable absorbing strip of material for absorbing electromagnetic energy, said absorbing strip being positioned between said twistable strip and said first and second transmission path means in a longitudinal plane with respect to said coupling means, said absorbing strip being in the same plane as the end of said twistable strip toward said first and second transmission path means.

2. A microwave power dividing circuit comprising a source of electromagnetic waves of predetermined polarization, first and second rectangular waveguide means hav-

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ing mutually perpendicular polarizations, and polarization rotating coupling means for coupling said waves to said first and second waveguide means, said coupling means comprising circular waveguide means, means applying said waves to one end of said circular waveguide means, means for coupling said first and second rectangular waveguide means to the other end of said circular waveguide means, a twistable strip of conductive material positioned within said circular waveguide means and extending axially therewith, means for twisting said twistable strip, and a rotatable strip of electromagnetic energy absorbing material within said circular waveguide means between said twistable strip and said other end, said energy absorbing strip being positioned in a plane extending through the axis of said circular waveguide means, said adjustable strip being in the same plane as the adjacent end of said twistable strip.

3. A microwave power dividing circuit comprising a source of electromagnetic waves of predetermined polarization, first and second rectangular waveguide means having mutually perpendicular polarizations, and polarization rotating coupling means for coupling said waves to said first and second waveguide means, said coupling means comprising circular waveguide means, means applying said waves to one end of said circular waveguide means, means for coupling said first and second rectangular waveguide means to the other end of said circular waveguide means, a twistable strip of conductive material positioned within said circular waveguide means and extending axially therewith, means for holding the end of said twistable strip toward said one end of said circular waveguide means, means for rotating the other end of said twistable strip for twisting said strip, a strip of electromagnetic energy absorbing material mounted on said other end of said twistable strip, said energy absorbing strip being positioned in a plane extending through the axis of said circular waveguide means and being in the same plane as said other end of said twistable strip.

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