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CIRCULAR POLARIZATION ANTENNA COMPOSED OF AN ELONGATED MICROSTRIP WITH A PLURALITY OF SPACE STAGGERED RADIATING ELEMENTS

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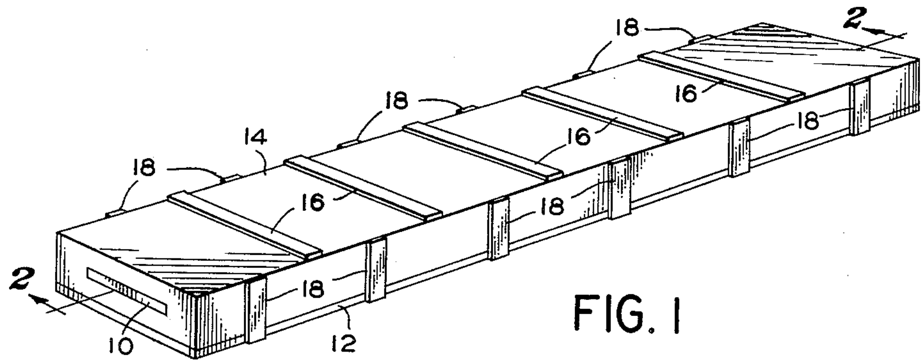

FIG. 1

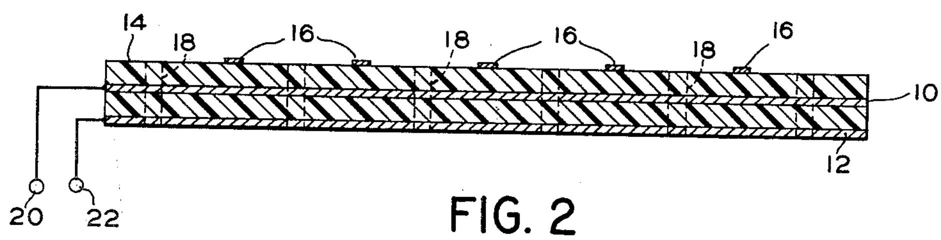

FIG. 2

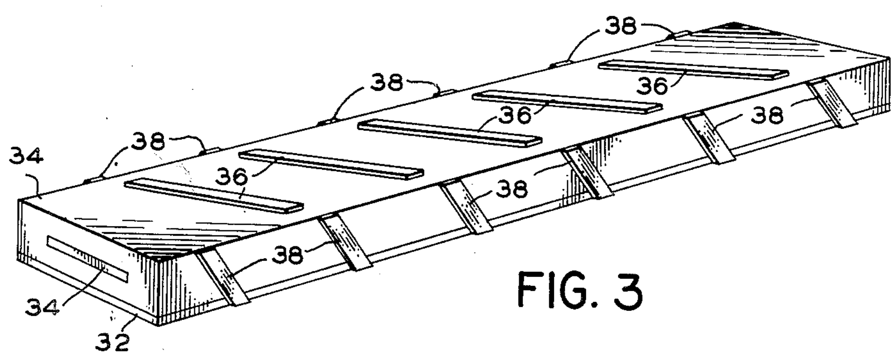

FIG. 3

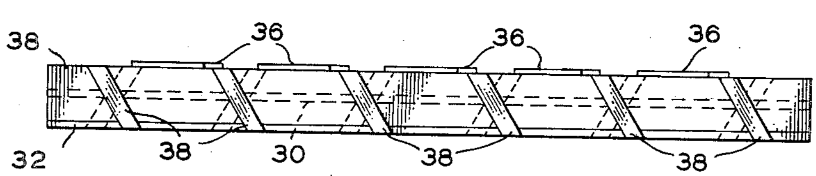

FIG. 4

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CIRCULAR POLARIZATION ANTENNA COMPOSED OF AN ELONGATED MICROSTRIP WITH A PLURALITY OF SPACE STAGGERED RADIATING ELEMENTS

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5 Claims. (Cl. 343—785)

The present invention relates generally to antennas and more particularly to a circular polarization microstrip antenna.

The primary object of this invention is to provide a microstrip antenna sensitive to circularly polarized radiation and which can easily be arranged to circular polarization in either direction or in one specific direction.

Another object of this invention is to provide a microstrip antenna which is very compact and is constructed as an integral unit with no parts to become detached or misaligned.

Finally, it is an object to provide a circular polarization microstrip antenna of the aforementioned character which is simple to manufacture in various sizes and for various frequency ranges.

With these and other objects definitely in view, this invention consists in the novel construction, combination and arrangement of elements and portions, as will be hereinafter fully described in the specification, particularly pointed out in the claims, and illustrated in the drawing which forms a material part of this disclosure, and in which:

FIGURE 1 is a perspective view of an antenna sensitive to circular polarization in either direction;

FIGURE 2 is a sectional view taken on line 2—2 of FIGURE 1;

FIGURE 3 is a perspective view of an antenna sensitive to circular polarization in one direction; and

FIGURE 4 is a side elevation view of the antenna of FIGURE 3.

Referring now to FIGURES 1 and 2 of the drawing, the antenna is basically a microstrip transmission line, comprising an elongated conductive microstrip 10 and an elongated conductive ground plane 12. The microstrip 10 is embedded, substantially centrally, in a block 14 of dielectric material and the ground plane 12 is bonded to the underside of said block. The dielectric block 14 is thus the primary structural member of the antenna and serves to hold the microstrip 10 and ground plane 12 in the proper spaced and parallel relation. Mounted on the top and sides of dielectric block 14 are a plurality of radiating elements, the upper elements 16 being longitudinally spaced and extending transversely across the block parallel to the plane of microstrip 10. Along both sides of block 14, the side elements 18 are perpendicular to the plane of microstrip 10 and longitudinally spaced between the upper elements 16, the lower ends of said side elements being connected to ground plane 12. The radiating elements 16 and 18 may be bonded to or embedded in the dielectric material and the width and spacing thereof is dependent on the required radiation pattern and frequency range.

With all of the radiating elements 16 and 18 perpendicular to the longitudinal axis of the microstrip 10, the antenna is sensitive to radiation having circular polarization in either direction and also to linear polarization. The incident radiation excites those of the radiating elements 16 and 18 which are substantially aligned with the electric vector and they, in turn, excite the microstrip 10. Electrical connections 20 and 22 are, of course, taken from microstrip 10 and ground plane 12, as in FIGURE 1. Regardless of the polarization of the incident radiation, the total amount of excitation and the resultant energy fed into the microstrip are substantially constant. Thus orientation of the antenna to a transmitter is not critical.

If the antenna is required to be sensitive to one particular circular polarization only, the configuration illustrated in FIGURES 3 and 4 may be used. In this antenna the basic structure is similar to that described above, with a microstrip 30 and ground plane 32 incorporated into a dielectric block 34. However, the upper radiating elements 36 and side radiating elements 38 are inclined to the longitudinal axis of microstrip 10. As illustrated the radiating elements 36 and 38 are at an angle of about 60 degrees to the microstrip axis and collectively form a rectangular helix with a screw sense for excitation by circularly polarized radiation with right hand or clockwise rotation. The angle of inclination of the radiating elements may vary and the inclination can be reversed to receive left hand or counter-clockwise polarization.

The radiation pattern of the antenna is endfire and can be controlled by variation in the size and spacing of the radiating elements and by the type of dielectric used, the directivity being a factor of antenna length in wavelengths and the number of radiating elements per unit wavelength. Phase velocity also varies with size and spacing of the radiating elements. For proper coupling the microstrip and radiator array should have the same phase velocity.

The antenna is particularly applicable, but not limited to space vehicles and satellites whose orientation may be problematic. Since signal strengths may be low over the long distances involved in space communications, antenna efficiency is critical and the non-directional characteristics of the antenna herein described are advantageous.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawing are to be considered as merely illustrative rather than limiting.

I claim:

1. An antenna, comprising:
an elongated, conductive microstrip;
an elongated, conductive ground plane spaced from and parallel to one face of said microstrip;
and a plurality of radiating elements spaced from and longitudinally spaced along the other face and both sides of said microstrip in staggered relation.

2. An antenna, comprising:
an elongated dielectric block;
an elongated, conductive microstrip embedded in said dielectric block;
an elongated conductive ground plane on said dielectric block spaced from and parallel to one face of said microstrip;
and a plurality of radiating elements on said dielectric block spaced from and spaced longitudinally along the other face and both sides of said microstrip in staggered relation.

3. An antenna, comprising:
an elongated dielectric block
an elongated, conductive microstrip embedded in said dielectric block;
an elongated conductive ground plane on said dielectric block spaced from and parallel to one face of said microstrip;
and a plurality of radiating elements on said dielectric block spaced from and spaced longitudinally along the other face and both sides of said microstrip;

the radiating elements along the sides being spaced equally between those along the said other face.

4. An antenna according to claim 3 wherein said radiating elements are perpendicular to the longitudinal axis of said microstrip.

5. An antenna according to claim 3 wherein said radiating elements are inclined relative to the longitudinal axis of said microstrip and collectively form a substantially rectangular helix.

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