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SEARCH ROOM

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OMNIPOLARIZATION SURFACE WAVE ANTENNA

Filed May 28, 1962

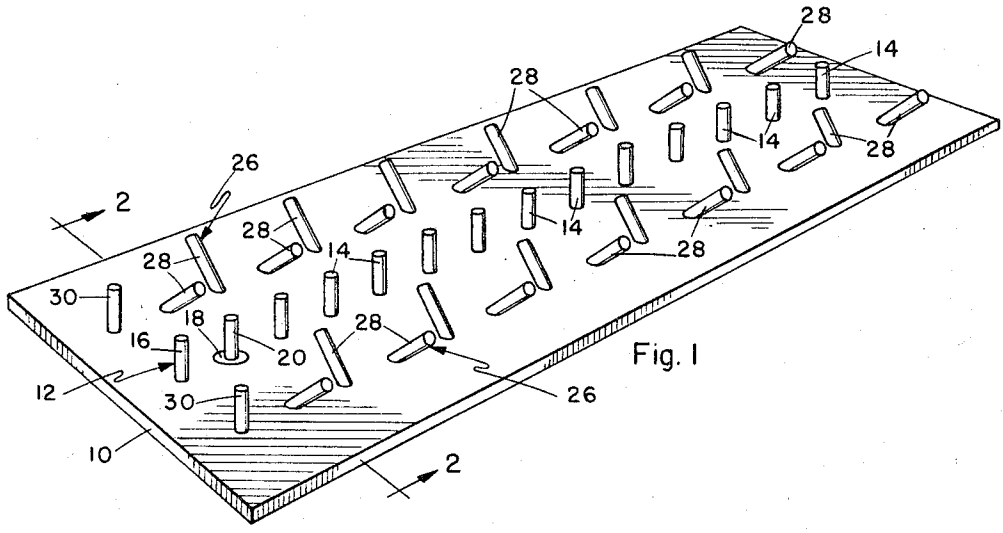


Fig. 1

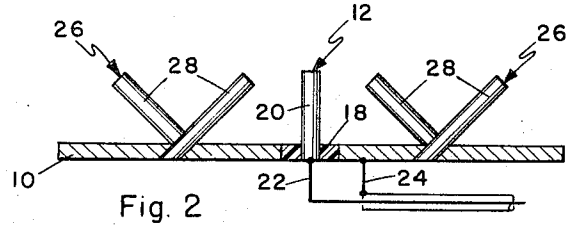


Fig. 2

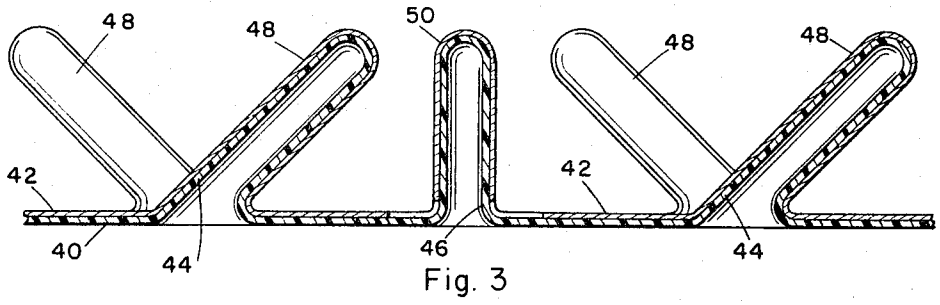


Fig. 3

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OMNIPOLARIZATION SURFACE WAVE ANTENNA

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The present invention relates generally to antennas and more particularly to an omnipolarization surface wave antenna.

The primary object of this invention is to provide a surface wave type antenna sensitive to radiation with linear or circular polarization.

Another object of this invention is to provide a surface wave antenna comprising a unitary structure in which the primary structural member serves as a ground plane and carries the entire antenna assembly.

Another object of this invention is to provide an antenna which is compact, light in weight and has a minimum number of components.

Finally, it is an object to provide a surface wave antenna of the aforementioned character which is simple and convenient to manufacture and is adaptable to a variety of uses.

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 the complete antenna;

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

FIGURE 3 is an enlarged sectional view of an alternative structure.

Referring now to FIGURES 1 and 2 of the drawings, the antenna is constructed entirely on a plate-like conductive ground plane **10**, which can be sheet metal, a metallic portion of some other structure, or even plastic material with a metallic coating. Longitudinally disposed along the center of ground plane **10** is a transmission line **12** comprising a linear array of spaced perpendicular monopoles **14**. The first monopole in the transmission line **12** serves as a reflector **16**, the second monopole being mounted in an insulated insert **18** in ground plane **10** and constituting a feed **20**, the remainder of monopoles **14** acting as directors. Appropriate connections **22** and **24** are made to the feed **18** and ground plane **10**, respectively, as in FIGURE 2.

Along each side of the transmission line **12** in spaced parallel relation thereto is a linear radiating array **26** comprising a plurality of substantially one quarter wavelength monopoles **28** spaced to form laterally aligned rows with the monopoles in the transmission line. The first monopoles in each radiating array **26**, on either side of reflector **16**, are perpendicular and serve as reflectors **30** for the respective arrays. The remainder of monopoles **28** in each array **26** are alternately inclined in opposite directions in perpendicular planes normal to the linear extent of the arrays, each laterally opposed pair of the two arrays being inclined in the same direction, so that one monopole **28** of each laterally opposed pair is inclined inwardly toward the respective monopole **14** while the other monopole **28** of that pair is inclined outwardly. All of the monopole elements except feed **20** can be directly secured to ground plane **10** in any suitable manner, forming an integral structure without loose or adjustable parts to become detached. The angle of inclination of monopoles **28** is preferably 45 degrees from the perpendicular for optimum omnipolarization sensitivity, but the angle can be varied to obtain specific radiation patterns.

The antennas can be considered as a central Yagi array for a transmission line, flanked by a pair of Yagi type radiating arrays, since each monopole, with its image on the other side of the ground plane, constitutes a half-wave resonant dipole.

With the monopoles **28** inclined in opposite directions, the radiating arrays **26** are excited by incident radiation of virtually any polarization and, in turn, excite the transmission line **12** from which feed **20** receives the signal. The radiation pattern can be varied somewhat by changing the number and spacing of the monopoles and bandwidth can be increased by increasing logarithmically the longitudinal spacing and length of the monopoles.

The antenna, being simple and light in weight, is particularly suitable for use in aircraft, missiles and space vehicles. Portions of the structural skin could be utilized as ground planes in such instances.

A particular example of the antenna suitable for use in or as a part of a space vehicle is illustrated in FIGURE 3, in which structural weight is reduced to an absolute minimum. In this configuration, the basic ground plane comprises a sheet of flexible plastic material **40** with a metallic conductive coating **42**, the monopoles being hollow fingers **44** and **46** formed integrally with the ground plane material. The metallic coating is continued over fingers **44** to provide radiating monopoles **48**, comparable to the monopoles **28** previously described. The feed **50** is insulated merely by leaving a gap between the metallic coating of the feed and the coating **42** on the ground plane. This structure can be folded compactly for delivery into space and erected by inflation or foam filling into a rigid antenna structure when required. Techniques for erection of such inflatable elements are well known and do not form a part of the present disclosure.

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 omnipolarization surface wave antenna, comprising:

a conductive ground plane;

a linear transmission line array of spaced conductive monopoles extending from said ground plane;

one of said monopoles being insulated from said ground plane and constituting a feed;

a linear array of spaced conductive radiating elements extending from said ground plane on each side of and substantially parallel to said transmission line array;

said radiating elements in each array being inclined alternately in opposite directions with the radiating elements in each laterally opposed pair being inclined in a common direction.

2. An omnipolarization surface wave antenna, comprising:

a conductive ground plane;

a linear transmission line array of spaced conductive monopoles extending perpendicularly from said ground plane;

one of said monopoles adjacent one end of the array being insulated from said ground plane and constituting a feed;

a linear array of spaced conductive radiating elements extending from said ground plane on each side of and substantially parallel to said transmission line array;

said radiating elements being in laterally opposed pairs with one of said monopoles therebetween;

the pairs of said radiating elements being alternately

inclined in opposite directions in perpendicular planes normal to the linear extent of the arrays.

3. An antenna according to claim 2 wherein said monopoles and said radiating elements are hollow and inflatable.

4. An antenna according to claim 2 wherein said radiating elements are inclined substantially at an angle of 45 degrees.

5. An omnipolarization surface wave antenna, comprising:

a conductive ground plane;

a linear transmission line array of spaced conductive monopoles extending perpendicularly from said ground plane;

one of said monopoles adjacent one end of the array being insulated from said ground plane and constituting a feed;

a linear array of spaced conductive radiating elements extending from said ground plane on each side of and substantially parallel to said transmission line array;

said radiating elements being in laterally opposed pairs with one of said monopoles therebetween;

the first of said radiating elements in each array at the end adjacent said feed being perpendicular and constituting reflectors;

the remaining pairs of said radiating elements being alternately inclined in opposite directions in perpendicular planes normal to the linear extent of the arrays.

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