Jan. 27, 1942. N. E. LINDENBLAD 2,271,300

DIRECTIVE ANTENNA

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Fig. 1

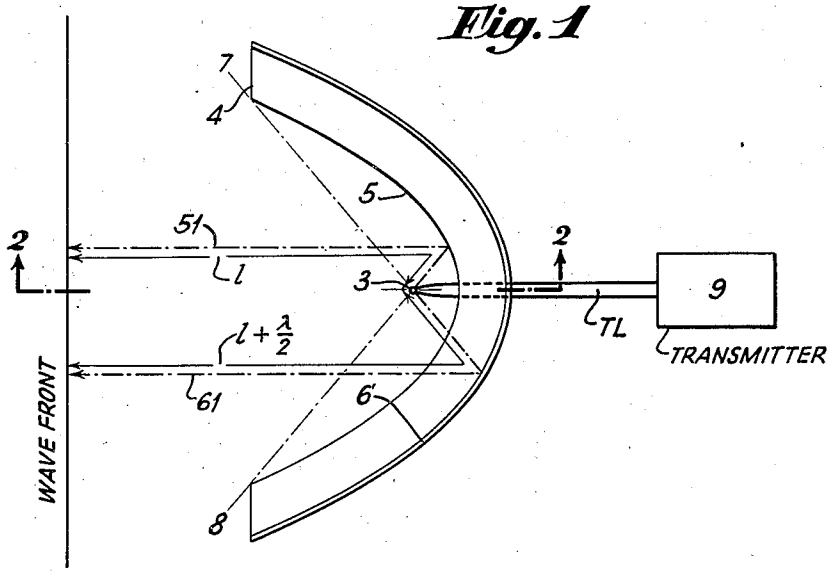
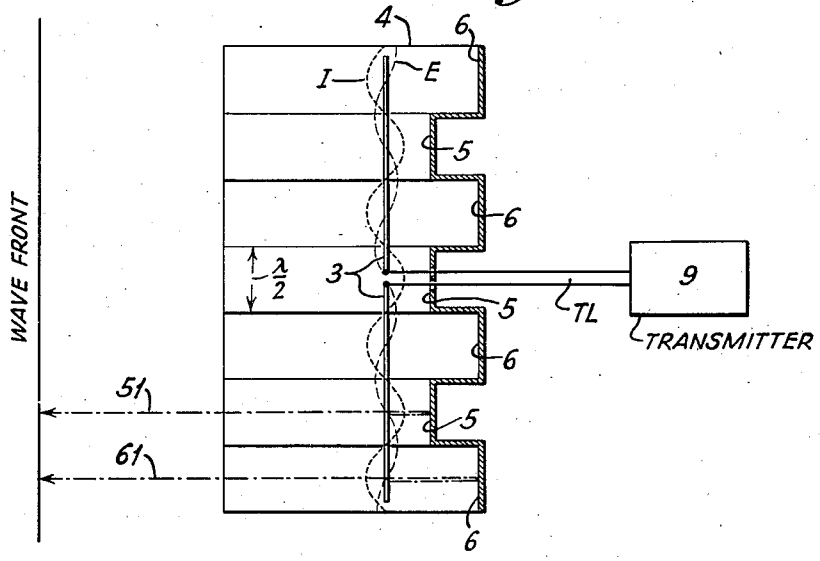


Fig. 2



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DIRECTIVE ANTENNA

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5 Claims. (Cl. 250—11)

The present invention relates to antennae and, more particularly, to directive antennae employing a reflecting surface at one side thereof in order to obtain a unidirectional characteristic.

An object of the present invention is the provision of a simplified directive antenna.

Another object is the construction of a directive antenna array which avoids the complications involved in connecting together a plurality of separate half wave radiators, such as are ordinarily employed in a directive array.

A further object of the present invention is the provision of a decorative antenna having a straight radiator of a length which is a multiple of the operating wavelength.

Still a further object of the present invention is the provision of a directive antenna array which does not require the use of phasing loop and non-radiating sections in the antenna structure.

A feature of the present invention is the provision of a long radiating wire at the focus of a cylindrical parabolic reflector with changing focal radius for every half wavelength distance along the wire so that the reflected radiation from the wire adds in an in-phase relationship in a plane wave front perpendicular to the direction of radiation.

Further objects and features of the present invention will appear from the following detailed description which is accompanied by a drawing in which Figure 1 illustrates an end view of an embodiment of the invention and Figure 2 illustrates a sectional view of the embodiment of Figure 1 taken along line 2, 2.

In Figure 1, reference numeral 3 indicates a radiating element which, as more clearly shown in Figure 2, is several wavelengths long. Radiator 3 is energized through transmission line TL in a conventional manner from transmitter 9. The effective current and voltage distribution is indicated by curves I and E. The radiating elements 3 is located at the focus of the parabolic reflector 4 in accordance with well known principles of optics so that the radiation from the radiator is confined within a comparatively narrow field beyond the open side of reflector 4. Parabolic reflector 4 is not of uniform focal radius throughout its length but is constituted by alternate portions 5 and 6 having radii which so differ that the difference between paths from the focus, via the alternate reflecting surface to a common plane wave front differ by half the length of the operating wave, or odd multiples thereof.

In Figure 2 the relationship between the varying focal radii of the reflector and the phase of the current I in the radiating wire 3 is more clearly shown. It will be noted that the increased distance between radiator 3 and reflecting surfaces 6 compared with the distance between radiator 3 and reflecting surfaces 5 compensates for the opposing phase relationship of the alternate half cycles of the current wave on radiator 3. This is also shown in Figure 1 wherein the lines 5l and 6l indicate two typical paths of wave travel and also shows that along the line of the wave front the radiating energy adds in an in-phase relationship.

A further advantage of the present form of construction results from the fact that a long wire energized as shown in Figure 2 but without the reflector would have its effective radiation along cones coaxial with the wire. The number of such cones or petticoats of radiation of various angles depends upon the length of the wire versus the wavelength. In general, however, there would be but little radiation perpendicular to the wire. Due to this effect, the direct radiation within the angle formed by lines 7—3 and 8—3 (Figure 1) is very small in central planes which are perpendicular or nearly so to the wire, leaving only the energy reflected from reflecting surfaces 5 and 6. The major portion of the radiation from the wire when introducing the reflecting surfaces takes place over the reflected path since the field vectors may add up at maximum strength over this path instead of cancelling or nearly cancelling one another as is the case without the reflector and since the radiation along the conical surfaces is made up of vectors of small amplitude although having additive phase. I, therefore, am enabled to obtain a much sharper directional characteristic from my improved antenna than has heretofore been obtainable, as far as I am aware.

While my present invention calls for a more complicated reflecting surface than has heretofore been used in the art, the freedom from the complications involved when mounting and connecting together an array of half wave radiators is very considerable and far more than compensates for the more complicated reflecting surface.

While I have particularly shown and described several modifications of my invention, it is to be particularly understood that my invention is not limited thereto but that modifications may be made within the scope of my invention.

I claim:

1. A directive antenna system comprising a parabolic reflector and a radiating member at the focus thereof, said member having a length equal to a whole multiple of one half the operating wavelength, said reflector having a radius which varies for every half wave increment along the length of said reflector so that the energy reflected from each of the incremental lengths of said reflector is additive along a common reference line.

2. A directive antenna system comprising a cylindrical parabolic reflector and a radiating member at the focus thereof, said member having an elongated length equal to a whole multiple of one half the operating wavelength, said reflector having a radius which varies for every half wave increment along the length of said reflector so that the energy reflected from each of the incremental lengths of said reflector is additive along a common reference line.

3. A directive antenna system comprising a straight radiating member having a length equal to a whole multiple of half the length of the operating wave and so energized that current loops of opposite instantaneous direction appear along said member and a reflector adjacent said member, the spacing between said member and said reflector varying along the length of said radiating member and being such that the radiant energy path lengths from said radiating member to a common reference line by way of said reflector from points on said member having current loops therein of one instantaneous direction differ by a half the length of the operating wave from the path length from points on said member having current loops therein of the other instantaneous direction whereby said energy is additive at said reference line.

4. A directive antenna system comprising a cylindrical parabolic reflector and a straight radiating member at the focus thereof, said radiating member having a length equal to a whole multiple of half the length of the operating wave and so energized that current loops of opposite instantaneous direction appear along said member, said cylindrical parabolic reflector being so constructed that the distance from said radiating member to said reflector varies along the length of said member in a manner such that the radiant energy path length from said radiating member to a common reference line by way of said reflector from points on said member having current loops therein of one instantaneous direction differ by a half the length of the operating wave from the path length from points on said member having current loops therein of the other instantaneous direction whereby said energy is additive at said reference line.

5. A directive antenna system comprising a parabolic reflector and a straight radiating member at the focus thereof, said radiating member having a length equal to a whole multiple of half the length of the operating wave and so energized that current loops of opposite instantaneous direction appear along said member, said parabolic reflector being so constructed that the distance from said radiating member to said reflector varies along the length of said member in a manner such that the radiant energy path length from said radiating member to a common reference line by way of said reflector from points on said member having current loops therein of one instantaneous direction differ by a half the length of the operating wave from the path length from points on said member having current loops therein of the other instantaneous direction whereby said energy is additive at said reference line.

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