April 30, 1940. N. E. LINDENBLAD 2,199,375

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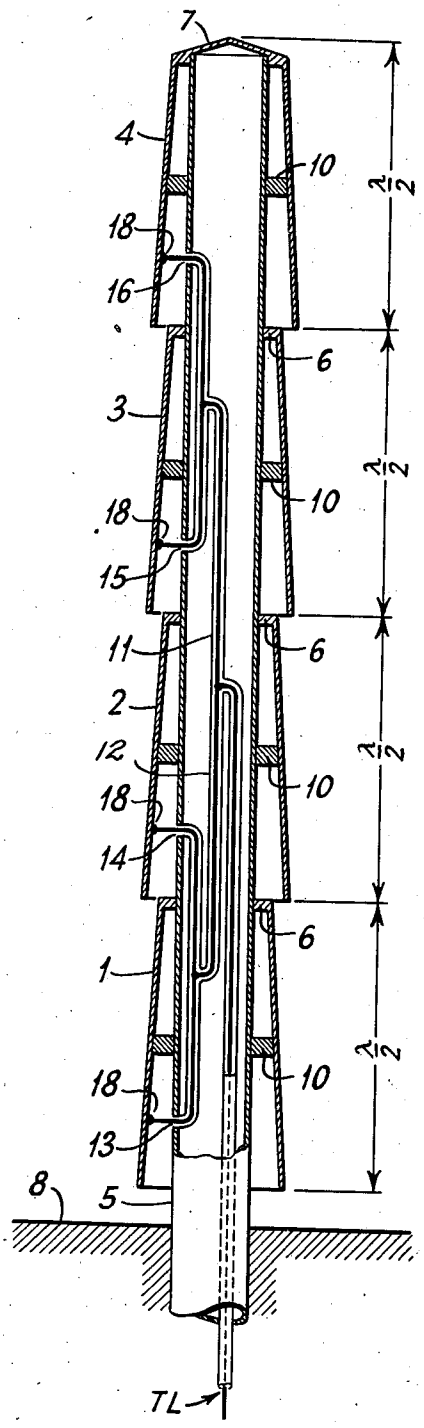

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10 Claims. (Cl. 250—33)

This invention relates to antennas and, more particularly, to short wave antennas.

A primary object of the present invention is to enable the transmission of vertically polarized short radio waves with vertical directivity and with uniform and maximum radiation in the horizontal plane.

A further object is to provide an antenna suitable for use on ultra high radio frequencies which has a broad frequency response curve.

Another object is to provide a mechanically simple antenna structure of pleasing appearance for use on the tops of high buildings and towers.

Still another object is to provide a mechanically simple antenna arrangement for use with ultra high radio frequencies which is effectively equivalent to a series of dipoles energized in the same phase with respect to one another.

These and other objects of the invention, which may appear from a reading of the specification, are achieved by providing an antenna in the form of series of overlapping tapered half wave length conductive tubes co-axially arranged about a common vertical axis. Each of the tapered conductive tubes acts as a half wave dipole antenna and all of the tubes are energized in parallel. The diameter of the tubes is chosen to give a desired width of frequency response curve and is based upon appreciation of the fact that the increase in width of the response curve can be had with an increase in diameter of the tubes. Also, since the elements are energized in parallel the frequency response curve of the complete antenna is as broad as that of each of its elements.

A better understanding of the invention may be had by referring to the following detailed description which is accompanied by a drawing.

In the drawing reference numerals 1, 2, 3 and 4 denote the tapered conductive tubes, each of which acts as a single half wave dipole antenna. The tubes are co-axially arranged about a common vertical supporting mast 5. Each of the tubes 1, 2 and 3 are connected at their upper ends by a conductive support 6 which may be in the form of a metallic washer or ring which entirely encloses the space between the top of the tube and the supporting mast 5. The topmost tube 4 is closed at its upper end by a roof 7 which is also formed of a conductive material. Each of the tubes are maintained radially in alignment about the supporting mast 5 by means of metallic rings 10 situated midway between the open and closed ends of the tubes. Metallic ring 10 also makes the inside electric length equal to approximately one quarter wave which results in maximum impedance between the upper and lower ends of adjacent radiators; also in a maximum impedance between the lower end of each radiator and supporting mast. The antenna structure is supported on top of a tall building or tower as indicated by reference numeral 8. The antenna is fed by transmission line TL, which is split into two branches 11 and 12. Each of these branches are again divided into two branches resulting in four branches, 13, 14, 15 and 16 at the antenna end of the transmission line. The outer sheath of each of the branches of the transmission line is metallically connected to the outer shell of the supporting mast 5 and the central conductors are attached as shown at 18 to the radiating dipole tubes. The point of attachment 18 is so adjusted that the effective impedance of each antenna element looking toward the antenna from the transmission line is N times the impedance of the transmission line TL where N is the number of radiating tubes. Each of the branches 11 and 12 are twice the impedance of the transmission line TL. Thus, if the impedance of each of the dipoles is in the order of 120 ohms the resultant impedance for the transmission line is in the order of 30 ohms. From this it may be seen that the antenna may be directly coupled to the conventional concentric cable transmission line without the use of any coupling transformers, or the like.

It will be understood, of course, that the invention is not limited to the precise arrangement shown in the figure since various modifications may be made without departing from the spirit and scope thereof. For example, the antenna may be horizontally arranged and extended symmetrically from a center so as to form a structure equivalent to two antennas end to end somewhat like an extended dipole antenna. In this modification the radiated wave is horizontally polarized. Also, four antennas as shown in the figure may be horizontally extended from a common center at angles of 90 degrees with each other to form a turnstile type of antenna, if it is desired to transmit horizontally polarized waves with uniform and maximum radiation in the horizontal plane.

I claim:

1. An antenna for enabling the radiation of short radio waves with substantially uniform radiation in a plane at right angles thereto comprising a plurality of co-axially arranged electrically conductive conical radiating sections each arranged with its apex adjacent the base of the next section and means for energizing all of said sections in the same phase relationship connected to each of said sections near their bases, the point of connection of said means to said sections being so determined that the impedance of each of said sections is equal to that of the means connected thereto.

2. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the

form of a truncated cone, a conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and means for energizing all of said sections in the same phase relationship connected to each of said sections near their bases, the point of connection of said means to said sections being so determined that the impedance of each of said sections is equal to that of the means connected thereto.

3. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the form of a truncated cone, a conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints and means for energizing all of said sections in the same phase relationship, connected to each of said sections near their lower ends, the point of connection of said means to said sections being so determined that the impedance of each of said sections is equal to that of the means connected thereto.

4. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the form of a hollow truncated cone, a hollow conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and means for energizing all of said sections in the same phase relationship, connected to each of said sections near their lower ends and passing through said hollow mast.

5. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the form of a hollow truncated cone, a hollow conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints, means for energizing all of said sections in the same phase relationship comprising a transmission line and a plurality of branch lines, each of said branch lines having an impedance equal to the impedance of said transmission line multiplied by the number of branches, said branch lines being so connected to said radiating sections that the effective impedance of said sections is equal to the impedance of said branch line.

6. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the form of a hollow truncated cone, a hollow conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints and means for energizing all of said sections in the same phase relationship comprising a concentric cable transmission line and a plurality of branch lines within said mast, each of said branch lines having an impedance equal to the impedance of said transmission line multiplied by the number of radiating sections, said branch lines being so connected to said radiating sections that the effective impedance of said section is equal to the impedance of the branch line connected thereto.

7. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged electrically conductive radiating sections, each of said sections being in the form of a hollow truncated cone, the length of each of said sections being a half the length of the operating wave, a conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints and means for energizing all of said sections in the same phase relationship, connected to each of said sections near their lower ends.

8. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged hollow electrically conductive radiating sections, a conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints and means for energizing all of said sections in the same phase relationship, connected to each of said sections near their lower ends.

9. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged hollow electrically conductive radiating sections, the length of each of said sections being a half the length of the operating wave, a hollow conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints, means for energizing all of said sections in the same phase relationship comprising a transmission line and a plurality of branch lines, each of said branch lines having an impedance equal to the impedance of said transmission line multiplied by the number of branches, said branch lines being so connected to said radiating sections that the effective impedance of said sections is equal to the impedance of said branch line.

10. A vertical transmitting antenna for enabling the radiation of short radio waves with vertical directivity and with substantially uniform radiation in a horizontal plane comprising a plurality of co-axially arranged hollow electrically conductive radiating sections, the length of each of said sections being a half the length of the operating wave, a hollow conductive supporting mast passing through said sections, said sections being electrically connected to said mast at their upper ends and at their midpoints and means for energizing all of said sections in the same phase relationship comprising a concentric cable transmission line and a plurality of branch lines within said mast, each of said branch lines having an impedance equal to the impedance of said transmission line multiplied by the number of radiating sections, said branch lines being so connected to said radiating sections that the effective impedance of said sections is equal to the impedance of said branch line.

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