

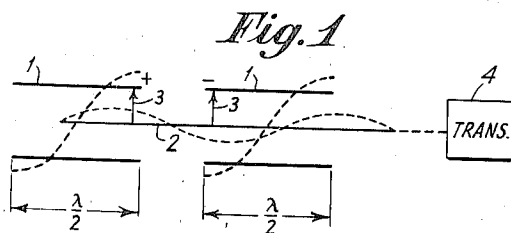
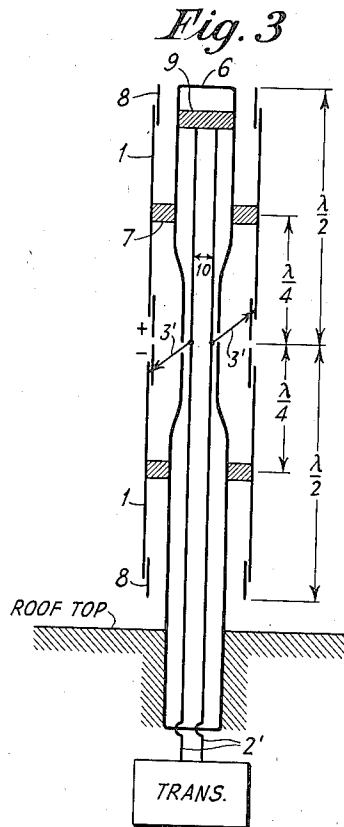
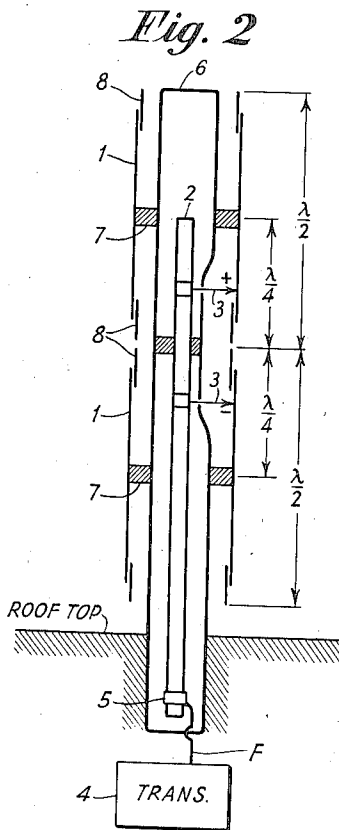
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This invention relates to antennas.

A primary object is to enable the transmission of 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 frequencies which has a broad frequency response curve whereby it will radiate the modulation sidebands of television, facsimile and other program services.

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

A further object is to provide a simple mechanical antenna arrangement for use with ultra high frequencies which gives the equivalent of 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 having a plurality of radiating doublets in the form of half wave length tubular sections arranged in series and energized in parallel such that the currents flowing through them are in the same direction, whereby cophasal energization is effected.

According to the preferred embodiment of the invention, energy is fed to the half wavelength radiating tubular antenna sections by means of a single transmission line located coaxially within the tubes and upon which standing waves are produced. Individual connections from the antenna sections to the transmission line are provided which are oppositely disposed with respect to a voltage nodal point on the line, whereby opposite instantaneous polarities are caused to exist on the radiating sections at the points of connection to the line. In this manner the tubular sections act as radiating doublets whose ends are always in opposite relative phase with respect to the adjacent end of the succeeding tube, due to the energy supply connections.

According to another embodiment, the radiating tubes are energized by means of a two-conductor transmission line also running within the tubes and from which connections extend to the tubes. In the latter case, adjacent ends of succeeding tubes are fed by individual connections to similarly located points on opposite sides of the line. Since opposite instantaneous polarities exist on opposite sides of a two wire line, it does not matter in this instance whether standing waves or travelling waves are used on the line

for energizing the radiating tubes, although it is preferred to employ travelling waves.

The diameter of the radiating tubes is chosen to give a desired width of frequency response curve and is based upon an appreciation of the fact that the increase in width of the curve can be had with an increase in diameter of the tube.

A feature of the invention is the adjustable sleeve at both ends of the radiating tubes for obtaining a desired half wavelength for a desired operating frequency.

Advantages of the invention are that the antenna (1) possesses moderately great vertical directivity but no horizontal directivity when erected vertically; (2) is simple to construct; (3) is rigid in construction; and (4) is easily adapted for use on the top of a high building.

A better understanding of the invention may be had by referring to the following description which is accompanied by a drawing, wherein:

Fig. 1 illustrates diagrammatically a simple circuit arrangement for energizing an antenna in accordance with the principles of the invention;

Fig. 2 illustrates a practical embodiment based on the circuit of Fig. 1, for use on the top of a building; and

Fig. 3 is a modification of the system of Fig. 2.

The antenna system of Figs. 1 and 2 comprises essentially a plurality of half wavelength doublets 1, 1 which are concentrically positioned with respect to an inner transmission line 2 which is supplied with energy from a transmitter 4, here shown conventionally in box form. Standing waves are produced on line 2 and individual connections 3, 3 extend from points on feeder 2 symmetrically located with respect to a voltage nodal point on the line to adjacent ends of the tubes 1, 1, as shown. The voltage distribution along line 2 is indicated in Fig. 1 by dotted lines in sinuous form from which it will be appreciated that adjacent ends of the concentric tubes 1, 1 are of opposite relative phase. The voltage distribution along doublets 1, 1 is also indicated by dotted lines, and consequently the doublets are energized cophasally and the currents flow in the same direction in both tubes. In practice, the transmitter is connected to the line 2, 2 in such manner that the surge impedance of the feeder (F) is matched. Fig. 2 illustrates, by way of example only, a variable tap 5 connected to one end of line 2 for effecting this result. Of course, other suitable impedance matching systems may be used. Line 2 is preferably in the form of a tube which is mounted within another tubular structure 6, the latter of which supports

the half wavelength sections 1, 1 on insulating rings 7, 7, as shown in Fig. 2. For properly adjusting the length of each radiating section 1, there is provided at each end of the section, or if desired at only one end, a telescoping sleeve 8 which is in contact with and movable with respect to its radiating section.

Fig. 3 shows an embodiment which differs from Fig. 2 in the provision of a two wire transmission line 2' to the opposite wires of which are connected individual connections 3', 3' for energizing the radiating dipoles 1, 1 in proper phase. Support 9 at the end of tube 6 maintains the individual wires of the two-wire line 2' in proper spacial relation with respect to the other elements of the system. The wires of two wire line 2', in practice, consist of tubular conductors. An adjustable connection 10 extending between the wires of the line 2' and movable along the length thereof determines the end of the line. Although it is preferred that travelling waves be used on line 2', it may be noted that this is not necessary since opposite instantaneous polarities are obtainable from opposite sides of any two-wire line whether standing or travelling waves are employed.

Although the antennas of Figs. 2 and 3 have been shown positioned vertically, it will be understood, of course, that they may be located horizontally or at any desired angle for obtaining uniform radiation in planes other than the horizontal plane. The invention is not limited to the precise arrangements shown in the figures, since various modifications may be made without departing from the spirit and scope thereof. For example, there may be used many more sleeves than the two shown in Figs. 2 and 3, provided proper polarities are obtained from the transmission line. Also the antennas of Figs. 1 and 2 may be extended symmetrically from a center so as to form a structure equivalent to two antennas end to end, somewhat like an extended dipole antenna. Various arrays of antennas may be used to obtain additional directivity.

What is claimed is:

1. An antenna comprising a plurality of serially mounted tubular radiating sections each having a length equal to half the length of the operating wave, a transmission line within said plurality of sections and running parallel to said sections, a source of high frequency energy coupled to said line, and a connection from each section to a point on said line intermediate the ends of said line such that the adjacent ends of adjacent sections are energized out of phase with respect to one another and the currents in all sections are in the same direction.

2. An antenna comprising two serially mounted tubular radiating sections each having a length equal to half the length of the operating wave, a single wire line within said sections and spaced therefrom, a source of high frequency energy coupled to said line for producing standing waves thereon, and connections from the adjacent ends of said sections to points on said line which are intermediate the ends of said line and symmetrically located with respect to a voltage node thereon, whereby said adjacent ends of said sections are energized out of phase with respect to one another.

3. An antenna comprising two serially mounted tubular radiating sections each having a length equal to half the length of the operating wave, a two wire line within and parallel to said sections and spaced therefrom, a source of high frequency

energy coupled to said line, and connections from said sections to opposite wires of said line for supplying said sections with currents which flow in the same relative direction.

4. An antenna comprising two serially mounted tubular radiating sections each having a length equal to half the length of the operating wave, a two wire line within said sections and spaced therefrom, a source of high frequency energy coupled to said line, a connection from one end of one of said sections to one wire of said line and a connection from the adjacent end of said other section to the other wire of said line at a point adjacent the point of connection of said first connection, whereby said adjacent ends of said sections are energized out of phase with respect to one another.

5. An antenna in accordance with claim 2, including means for varying the length of each of said sections.

6. An antenna in accordance with claim 4, including means for determining the effective length of said two wire line, and means for varying the lengths of said sections.

7. A vertical antenna for obtaining great vertical directivity with little or no horizontal directivity comprising a pair of serially mounted tubular radiating sections each having a length equal to half the length of the operating wave, a transmission line extending within both of and running parallel to said sections, a source of high frequency energy coupled to said line, a connection from each section to a point intermediate the ends of said line such that the adjacent ends of adjacent sections are energized out of phase with respect to one another, and the currents in all sections are in the same direction, a hollow tube surrounding said line and positioned within and coaxially with respect to said sections, and means for supporting said sections on said tube.

8. An antenna comprising two serially mounted tubular radiating elements each having a length equal to half the length of the operating wave, a transmission line extending within and throughout the length of one of said sections and for at least a substantial distance within said other section, a source of high frequency energy coupled to one end of said line, and a connection from each section to a point intermediate the ends of said line, said connections being so arranged that the adjacent ends of adjacent sections are energized out of phase with respect to one another and the currents in all sections are in the same direction.

9. An antenna comprising two serially mounted tubular radiating elements each having a length equal to half the length of the operating wave, a transmission line extending within and throughout the length of one of said sections and for at least a substantial distance within said other section, a source of high frequency energy coupled to said line at a point where the surge impedance of said line is matched, and a connection from each section to a point on said line intermediate the ends of said line such that the adjacent ends of adjacent sections are energized out of phase with respect to one another and the currents in all sections are in the same direction.

10. An antenna comprising a supporting tube, a pair of substantially half wavelength radiating elements surrounding and being mounted on said tube at different locations along the length thereof, a transmission line within said supporting tube, a source of high frequency energy coupled

to said line, and a connection from each element extending through an aperture in said tube to a point on said line intermediate the ends of said line, said connections being so arranged that
5 the adjacent ends of adjacent sections are energized out of phase with respect to one another and the currents in all sections are in the same direction.

11. An antenna in accordance with claim 10,
10 characterized in this that said line is a single rod which extends parallel to and is insulated from said tube.

12. A vertical antenna comprising a supporting tube whose lower end extends below and is
15 mounted on the roof of a building, a pair of half wavelength cylindrical radiating elements

mounted one above the other on said tube, a transmission line in the form of a metallic rod extending within and spaced from said supporting tube, a source of high frequency energy coupled to said rod below the roof line at a point
5 which matches the surge impedance of said rod, and connections from portions of said radiating elements to points on said rod intermediate the ends of said rod and symmetrically located with respect to a voltage nodal point of said rod. 10

13. An antenna in accordance with claim 12,
characterized in this that said radiating elements are adjustable in length by means of telescoping extensions at the ends thereof. 15

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