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ULTRA HIGH FREQUENCY ANTENNA

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FIG. 1.

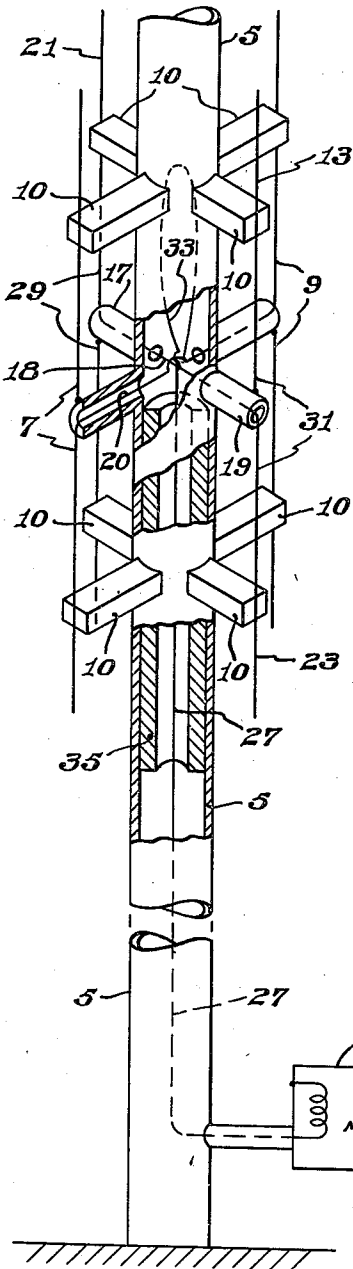


FIG. 2.

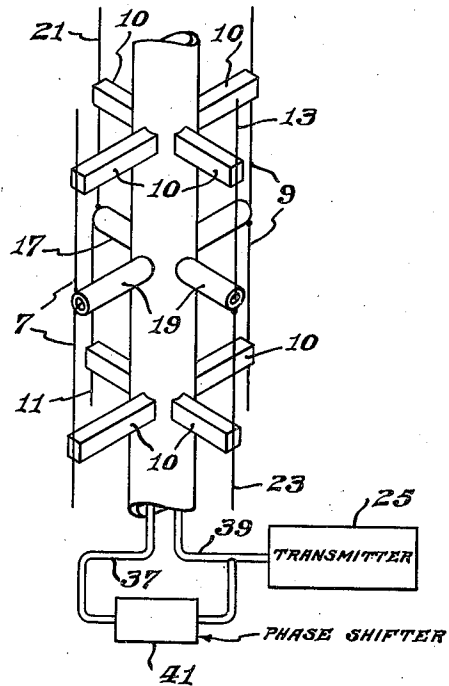
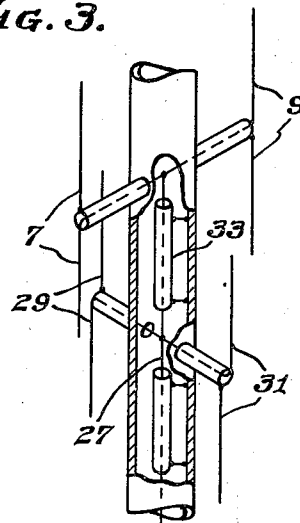


FIG. 3.



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ULTRA HIGH FREQUENCY ANTENNA

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2 Claims. (Cl. 250—33)

This invention relates to ultra high frequency antennas. Among the objects of the invention are the provision of a grounded-tower metallic support for an antenna system radiating vertically polarized waves, the provision of a structurally rigid antenna system which is free from reradiation due to currents induced in a supporting structure, and the provision of an antenna in which the supporting mast or pole is utilized as the outer conductor of a concentric transmission line feeding the radiating elements.

This invention will be better understood from the following description when considered in connection with the accompanying drawing, in which Figure 1 is a view, partly in section, of a preferred embodiment of this invention; Figure 2 is a partial view illustrating an alternative feeding arrangement; and Figure 3 is a partial view illustrating an alternative arrangement of the radiating elements.

One of the serious drawbacks to antenna systems generally is the difficulty of obtaining the completely balanced system which is necessary if radiation from elements of the structure which are not intended to function as parts of the radiating system is to be prevented. For example, to obtain sharply defined beacon courses, the actual radiation must conform in phase and polarization to the ideal condition. When currents are induced in a supporting structure, a field is radiated therefrom which may disturb or neutralize the desired field, thus destroying the radiation pattern which is to be provided. In addition, such induced currents represent power loss and therefore reduce the efficiency of the system.

The system illustrated in Fig. 1 of the accompanying drawing overcomes the difficulties which have been enumerated above. In the illustrated example, four vertical dipole radiators are symmetrically arranged about a supporting mast 5. The view is shown partly in cross-section to illustrate the connections within the mast. Each of the four dipole radiators 7, 9, 29 and 31 consist of two coaxial sections, one of which is connected at one end directly to the mast. Thus, sections 11 and 13 are mounted on and connected to tubular shields 17 and 19 which extend radially from the mast. The remaining sections 21 and 23 are insulated from the mast and are connected together by a lead which extends through the tubular shields 17 and 19. Stand-off insulators 10 are provided where necessary

to support the free ends of the various radiating sections.

The lengths of the various coaxial radiating sections of the dipole radiators are determined by the desired radiation resistance, and are approximately one-quarter wave length long. It is to be understood that this length includes the conductor which extends to the center of the supporting mast 5. Oppositely positioned pairs of dipole radiators are preferably arranged in vertical planes which are mutually perpendicular. A circular field pattern may be obtained by energizing adjacent antenna sections in phase quadrature, as is well known. To accomplish this, I have illustrated several methods which have proved satisfactory.

A transmission line is provided which couples a transmitter 25 to the antennas, although if the antenna is to be used for reception a receiver would be substituted for the transmitter. The transmission line comprises a conductor 27 which is led through the supporting mast 5. When a metallic mast is used, as in the present instance, it constitutes the outer conductor of the concentric line. The inner conductor is connected to the lead 18 joining antenna sections 21 and 23. An extension 33 of conductor 27, having a length which is approximately one-quarter of a wave length, is connected to a conductor 20 which joins the other pair of radiators 7, 9.

Referring again to Fig. 1, the quarter wave extension 33 of the inner conductor 27 referred to above is looped or folded within the mast in any suitable manner, and is preferably enclosed in a tubular shielding of such a diameter that the required impedance match between the two antennas and the transmission line is maintained. Similarly, in order to match the impedance of the parallel-connected antennas to that of the transmission line, the inner diameter of the mast 5 is made smaller over a region approximately a quarter wave length long by the insertion of a metallic tube or shield 35. By properly relating the diameters of the inner conductor 27 and the tube 35, the impedance is adjusted to the required value.

If the radiation pattern is to be circular, the distance between oppositely disposed dipole antennas is preferably made less than one-eighth wave length. However, if some deviation from a circular radiation pattern is not harmful, this distance may be increased.

It is evident that the arrangement shown in Fig. 1 does not readily lend itself to an application in which the oppositely disposed antennas

are successively energized to produce a pair of alternate figure-of-eight patterns. If such an arrangement is desired, the single transmission line feed may be replaced by a pair of transmission lines 37, 39 as shown in Fig. 2. A device 41 for shifting the phase of the currents in one line with respect to the currents in the other is included in one of the transmission lines.

Referring now to Fig. 3, an arrangement is illustrated in which the necessity for looping the quarter wave extension 33 of the inner conductor is avoided. By mounting one pair of dipole antennas 7, 9 approximately a quarter wave length above the other pair 29, 31 the proper phase relation is obtained. While I have illustrated an antenna system comprising two pairs of radiators, the system may be extended to provide a larger number by arranging a pair of dipole antennas on alternate sides of the mast at regular quarter wave intervals, or by providing duplicate systems corresponding to that shown in Fig. 2.

It is apparent that in each of the modifications shown, the supporting mast is in the radio frequency field of the antennas. However, since the antennas are fed in phase opposition, and are symmetrically disposed, and of equal dimensions, their effective fields along the length of the mast are cancelled out, so that no induced currents flow in the mast. Also, each pair of antennas is in the neutral zone, or region of zero radiation, of the other pair. For this reason, no mutual coupling exists between the two antennas and adjustments may be readily carried on independently.

By extending the supporting mast above the

antennas, as indicated in the drawing, the system is afforded protection against lightning discharges. Since the mast itself is directly grounded and constitutes a low impedance path, this arrangement greatly reduces the likelihood of lightning causing a failure of the system due to excessive currents through the transmitter or receiver coupling systems.

I claim as my invention:

1. An ultra high frequency antenna which includes a metallic mast and two pairs of radiators disposed in mutually perpendicular planes on opposite sides of said mast, said radiators having two coaxial sections parallel to said mast, one pair of said radiators being positioned a quarter wave length above the other, and a coaxial transmission line for energizing the coaxial sections of each radiator in phase opposition and including means for energizing one of said pairs in phase quadrature with respect to the other pair.

2. An ultra high frequency antenna which includes a metallic mast and two pairs of radiators disposed in mutually perpendicular planes on opposite sides of said mast, said radiators having two coaxial sections parallel to said mast, one pair of said radiators being positioned a quarter wave length from the other radiator in a direction parallel to said mast, a concentric transmission line of which said mast is the outer conductor, said line being connected to said radiators and including a quarter wave section between said radiators, whereby said radiators are energized in phase quadrature.

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