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SHORT WAVE ANTENNA

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Fig. 1

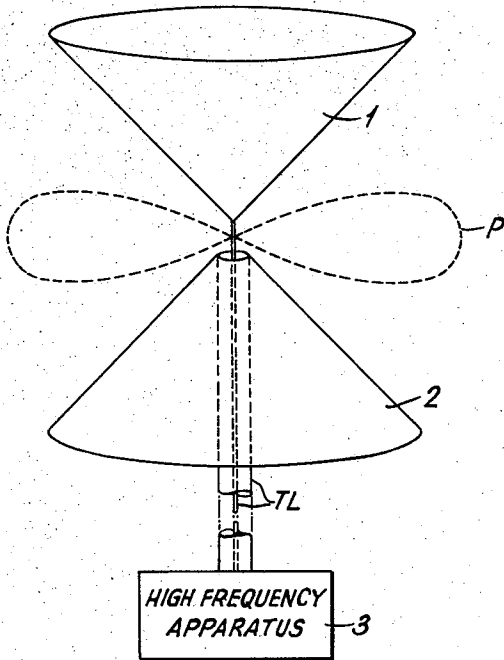


Fig. 2

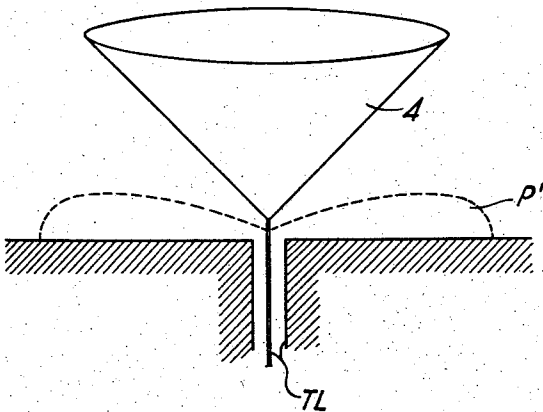
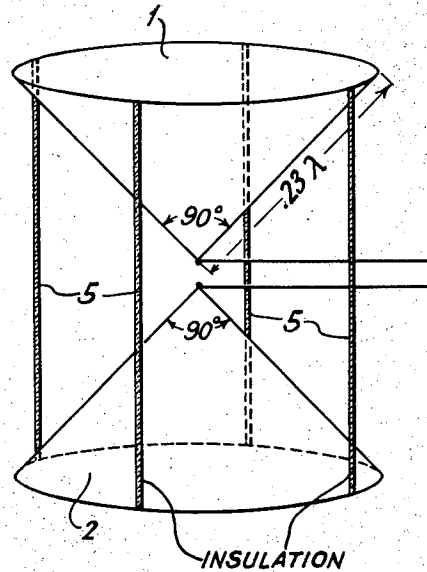


Fig. 3



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SHORT WAVE ANTENNA

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6 Claims. (Cl. 250—33)

The present invention relates to short wave antennas, and has for its primary object to provide a short wave antenna which will present negligible reactance at its terminals over a wide frequency range such as may be used in television transmission or reception.

Where a wide band of frequencies is used, such as in the transmission of television programs, it is desired that the antenna act, in an ideal case, as a pure resistance of constant magnitude over a wide range of frequencies, in order to prevent wave reflections (i. e., standing waves) along the feeder, inasmuch as reflections cause variations in the input impedance of the transmission line at the transmitter and increased losses in the transmission line. Such effects are especially deleterious when the length of the transmission line feeder to the antenna is relatively long with respect to the wavelength, such as five wavelengths and greater.

It has been observed that it is extremely difficult, if not impossible to attain the ideal case mentioned above, where an antenna will act as a pure resistance of constant magnitude over a wide range of frequencies. Consequently, in constructing an antenna for the purpose hereinabove described, it is essential to bear in mind that in most cases the introduction of a reactance component of an impedance (such as an antenna) loading a line, sets up considerably more reflection in the line than a moderate variation in the resistance component.

The present invention provides a highly desirable type of short wave antenna for use over a wide frequency range, which presents at its terminals an impedance appearing almost as a pure resistance, the phase angle of the impedance being very small. Putting it another way, the antenna of the invention introduces practically no reactive component with variation in frequency.

In brief, the antenna of the invention comprises one or more conducting surfaces of revolution in the form of cones, preferably energized at their apices. In accordance with one embodiment of the invention, there are employed two conducting cones symmetrically arranged along the same axis, apex adjacent to apex, in such manner as to give the appearance of an hour-glass. In accordance with another embodiment, the antenna comprises a single cone disposed above a reflecting surface or ground.

A more detailed description of the invention follows in conjunction with a drawing, wherein Figs. 1 and 2 illustrate two different embodiments

of the antennas constructed in accordance with the principles of the invention.

Referring to Fig. 1, there is shown an hour-glass type of antenna comprising two conducting surfaces of revolution in the form of hollow cones 1 and 2 symmetrically arranged about a vertical axis, the apices being placed adjacent each other. The cones are excited at their adjacent apices by means of a concentric transmission line TL which extends from a remotely located transmitter 3, usually five or more wavelengths away from the antenna, the inner conductor being connected to the apex of one of the cones, let us say the upper cone 1, as shown, while the outer conductor is connected to the other cone 2.

The energy radiation pattern obtained by the system of Fig. 1 is indicated in dotted lines by P, which it will be noted is similar to that of a half wave dipole. It will be observed that there is obtained maximum radiation at right angles to the axis of the cone; the pattern being circular at right angles to the drawing, and a figure 8 in the plane of the drawing.

Fig. 2 illustrates a modification of the antenna of Fig. 1 and employs a single hollow cone 4 disposed above a reflecting surface which may be the conducting roof of a building. This surface may be at ground potential. Similarly, as in Fig. 1, a concentric transmission line TL may be employed to energize the cone, the inner conductor connecting to the apex of the cone while the outer conductor is connected to the reflecting surface.

Fig. 3 illustrates an arrangement which was actually used in practice with the dimensions indicated on the drawing. The length of the cone indicated is the mean wavelength of the range of wavelengths over which the antenna is designed to operate. It will here be noted that the transmission line is a two-wire line, instead of the coaxial line shown in Fig. 1. The two cones 1 and 2 are maintained in position with respect to each other by four insulating rods 5, 5 fastened to the edges of the cones, as shown. With such an antenna, the impedance of the antenna was an almost pure resistance for a range of wavelengths varying from 1.36 meters up to 1.55 meters, the phase angle of the impedance in all cases being less than 4° or 5°. The impedance characteristic was determined from measurements made along the transmission line feeding the antenna. The resistance varied linearly from a value of 75 ohms at 1.55 meters to 104 ohms at 1.36 meters. It should be noted that although there was a moderate variation in re-

sistance, there was only negligible reactance over the range of frequencies employed.

Although the antenna of the system has been shown arranged vertically, it should be distinctly understood that the cones can be disposed at any angle to the vertical and that the transmission line may be any desired type and may be connected to the cones at points other than the apices for purposes of impedance matching. It will also be obvious that the antenna may be used both for transmission or reception. The cones may have other angles and may, in some cases, be solid.

What is claimed is:

1. In combination, a short wave antenna comprising two surfaces of revolution in the form of cones symmetrically located with respect to a common axis passing through their apices, said apices being adjacent one another, and high frequency apparatus connected to said apices the length and diameter of each of said surfaces of revolution being such that the impedance of said antenna is substantially pure resistance of substantially constant magnitude over a wide range of frequencies.

2. In combination, a short wave antenna comprising two surfaces of revolution in the form of cones symmetrically located with respect to a common axis passing through their apices, said apices being adjacent one another, a two conductor transmission line having the length relatively long with respect to the operating wave length directly connected to said cones, a translating apparatus connected to said transmission line, the length and diameter of each of said surfaces of revolution being such that the impedance of said antenna is substantially a pure resistance of constant magnitude over a wide range of frequencies.

3. The combination with a short wave antenna comprising a surface of revolution in the form of a cone, of translating apparatus, and a line connecting said translating apparatus to the apex of said cone, the length and diameter of said surface of revolution being such that the impedance of said antenna is substantially a pure resistance of substantially constant magnitude over a wide range of frequencies.

4. An antenna comprising two surfaces of revolution in the form of cones symmetrically located with respect to a common axis passing through their apices, the length of each surface of revolution as measured from its apex to the end being at least .23 wavelength at the operating frequency, each surface of revolution making an angle of 45° with said common axis, said surfaces of revolution presenting at their apices substantially a pure resistance over a wide range of frequencies.

5. A short wave antenna system comprising a surface of revolution in the form of a cone mounted vertically with its apex pointing downwards, and a horizontal reflecting surface mounted below the apex of said cone, said reflecting surface being at zero radio frequency potential, said cone being so constructed and so arranged with respect to said reflecting surface that the impedance of said antenna is substantially a pure resistance over a wide range of frequencies.

6. An antenna system as defined in claim 1, characterized in this that a coaxial transmission line connects said high frequency apparatus to the apices of said cones, said transmission line extending along the axis and through one of said cones, the outer conductor of said line being coupled to one apex, and the inner conductor of said line being connected to the other apex.

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