

June 9, 1953

S. H. M. DODINGTON

2,641,756

ANTENNA SYSTEM

Filed March 26, 1943

Fig. 1.

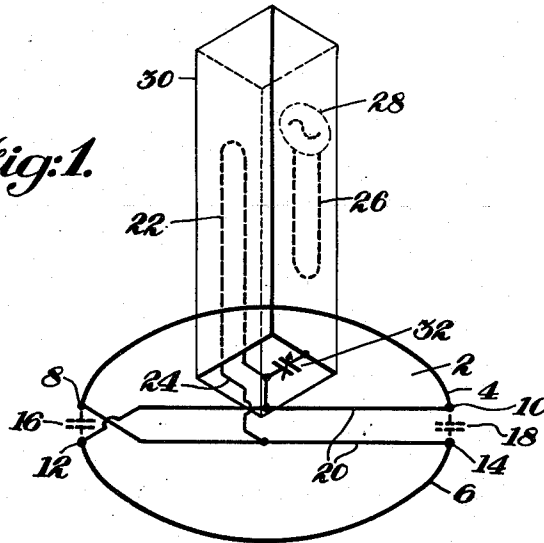
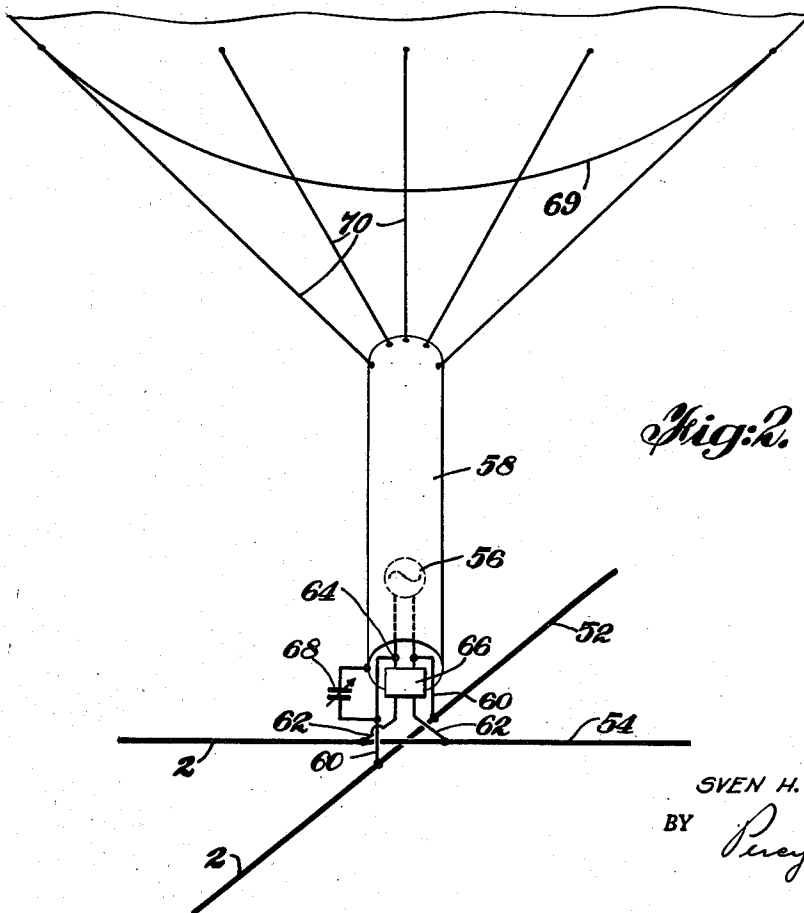


Fig. 2.



INVENTOR.
SVEN H. M. DODINGTON
BY *Percy P. Lantz*
ATTORNEY

UNITED STATES PATENT OFFICE

2,641,756

ANTENNA SYSTEM

Sven H. M. Dodington, Forest Hills, N. Y., assignor to Federal Telephone and Radio Corporation, Newark, N. J., a corporation of Delaware

Application March 26, 1943, Serial No. 480,604

3 Claims. (Cl. 343-100)

1

This invention relates to radio antennas and in particular to antennas suitable for use with impulse repeaters.

An object of the invention is to devise an antenna system suitable for intercepting electromagnetic waves regardless of the polarization of said waves.

Another object of the invention is to devise an antenna system which will radiate both horizontally and vertically polarized waves of substantially equal magnitude.

Another object of the invention is to devise an antenna system wherein one of the radiating elements encloses oscillation generating and/or receiving apparatus.

Still another object of the invention is to devise an antenna and oscillation generating system suitable for use with pulse repeater systems such as disclosed in my copending application entitled "Pulse Repeaters," filed March 26, 1943, and bearing Serial Number 480,603.

The above and other objects and features of my invention will become more apparent upon consideration of the following description to be read in connection with the accompanying drawings in which:

Fig. 1 illustrates in perspective an antenna system and self contained oscillator for simultaneously radiating both horizontally and vertically polarized waves, and

Fig. 2 represents in perspective a modification of the embodiment illustrated in Fig. 1 wherein the horizontal radiator comprises crossed dipole antennas.

Disclosed in my above mentioned copending application is a pulse repeater system primarily adapted to give false indications to an enemy who is attempting to ascertain the location of ships, aircraft, etc., by means of reflected radio waves. A more complete description of a system of this character is disclosed in a copending application of E. M. Deloraine and H. G. Busignies, Serial No. 436,846, filed March 30, 1942.

In systems of this type, the impulse repeater apparatus is suspended from a balloon during the period in which it is in operation. It is necessary that the equipment be self-contained and house all of the operating parts together with a suitable power supply. All adjustments are made prior to the time the balloon is to be released.

Referring now to Fig. 1 the reference character 2 represents an antenna for radiating horizontally polarized waves. The antenna is composed of two semi-circular members 4 and 6 disposed

2

in a common plane and with the extremities of the members positioned adjacent each other. For example, the extremities 8 and 10 of member 4 are positioned adjacent the extremities 12 and 14, respectively, of member 6.

The electrical length of the members 4 and 6 are substantially one-half wave length at the operating frequency. The physical length of these members is somewhat shorter than one-half wave length but the inherent capacitances between the extremities of the members operate to make the members 4 and 6 substantially resonant at the operating frequency. These inherent capacitances are represented by the characters 16 and 18.

The antenna 2 is energized from a crossed transmission line 20, the mid-point of which is connected to a coupling coil 22 over a short transmission line 24. The coil 22 is coupled to the oscillatory circuit 26 associated with the oscillation generator 28. The oscillator and associated oscillatory circuit may comprise any suitable construction and as disclosed in my above mentioned copending application the oscillation circuit 26 may take the form of a Lecher frame. While I have illustrated the use of inductive coupling, capacitive or other types of coupling could also be employed.

The generator and circuits are enclosed within a container 30. This container should have as small a cross-section as possible consistent with the apparatus which it encloses, and should preferably be substantially one-quarter wave length long. By coupling a portion of the output of the generator to the container 30, as illustrated by the variable coupling capacitor 32, the container itself functions as a radiator of electromagnetic waves. The polarization of these waves will be vertical or more properly have a polarization at right angles to the polarization of the waves radiated from the antenna 2.

The antenna system 2 acts substantially as a counterpoise for the container and together with the container should be adjusted to approximately one half wave length. With a given size of antenna system 2, this adjustment is made preferably by properly designing the container for the given frequency of operation. Although the system may be designed for one particular frequency, it will operate satisfactorily over a considerable band of frequencies due to the relatively large cross-sectional area of the container itself. The entire unit thus provides a repeater with two antennas, one antenna comprising container 30 operating with one polarization while

the other antenna 2 operates with a polarization at right angles thereto.

In Fig. 2 I have illustrated a modification of my invention wherein the horizontally radiating element 2 consists of a pair of crossed dipoles 52 and 54. These dipoles are energized from an oscillation generator 56 located within the container 58. Energy from the generator is transmitted to the dipoles over two pair of leads 60 and 62 from a point 64. This position 64 represents a suitable point in the oscillation circuit of the generators for supplying power to the antenna system. A suitable phase shifter represented by the block 66 is shown inserted in the leads 62 between the point 64 and the dipole 54. The phase shifter is designed to either advance or retard the phase of the current passing into the dipole 54 by 90° with respect to the phase of the current passing into the dipole 52. This means that the dipoles 52 and 54 are fed by currents in quadrature phase relation with the result that a rotating horizontally polarized wave is radiated from the dipoles. It is, of course, desirable to so space the leads 60 and 62 where they make contact with the dipoles 52 and 54 respectively, that a proper impedance match exists between the leads and the dipoles. This is common practice and forms no part of my invention.

In Fig. 2 I have illustrated the container 58 as substantially circular in cross-section. The actual cross-sectional shape of the container, however, is largely optional provided its length is substantially one-quarter wave at the operating frequency and its cross-section is relatively small. The manner in which the container 58 is energized from the generator 56 is illustrated as a variable capacitor coupling 68. It is desirable that this capacitance be made adjustable in order that the desired amount of energy may be passed to the radiating container 58. It is preferable that the energy radiated from the crossed dipoles 52 and 54 be substantially equal to that radiated by the container 58. This is also true in the case of Fig. 1 where it is desirable to have the energy radiated by the container 30 substantially equal to that radiated by the antenna system 2.

In Fig. 2 I have schematically illustrated the manner in which the antenna system of my invention may be attached to a balloon 69 by any suitable supporting means such as suspension cables 70.

While I have described above the principles of my invention in connection with specific apparatus and a particular modification thereof, I recognize that many variations and modifications thereof are possible without departing from the invention. For example, the horizontal antenna instead of the vertical antenna may be so constructed as to enclose the oscillating generator. It will be understood, therefore, that this description is made only by way of example and not as a limitation on the scope of my invention as set forth in the objects of my invention and the accompanying claims.

I claim:

1. In combination, a radiator adapted to radiate substantially horizontally polarized waves, an oscillation generator, said generator being connected to said radiator for energizing same, and a container enclosing said generator, said container being electrically connected to said radiator and together therewith being adapted to radiate vertically polarized waves.

2. The combination in accordance with claim 1 wherein said container is so shaped that its length is relatively long with respect to its width, said length being substantially equal to one fourth wave length.

3. In combination, a first antenna adapted to radiate waves having a given polarization, a second antenna adapted to radiate waves having a polarization which is at right angles to the waves radiated by said first antenna, an impulse repeater, one of said antennas being in the form of a hollow conductor, said repeater being positioned within said one of said antennas, and circuit connections whereby energy is interchanged between said antennas and said generator.

SVEN H. M. DODINGTON.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,930,505	Brown	Oct. 17, 1933
2,093,432	Gordon	Sept. 21, 1937
2,169,358	Hollmann	Aug. 15, 1939
2,180,855	Wundt et al.	Nov. 21, 1939
2,234,333	Brown et al.	Mar. 11, 1941
2,267,889	Aubert	Dec. 30, 1941