Oct. 13, 1931. G. VON ARCO 1,827,054

COMMUNICATION BY ELECTROMAGNETIC WAVES

Filed Oct. 18, 1926

Fig. 1

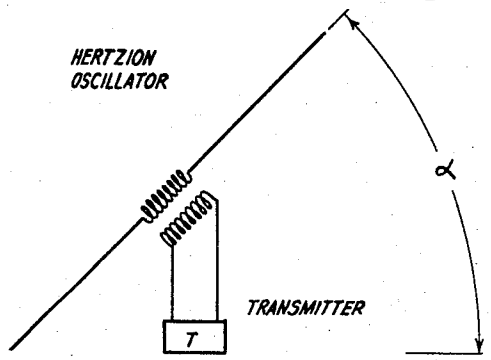


Fig. 2

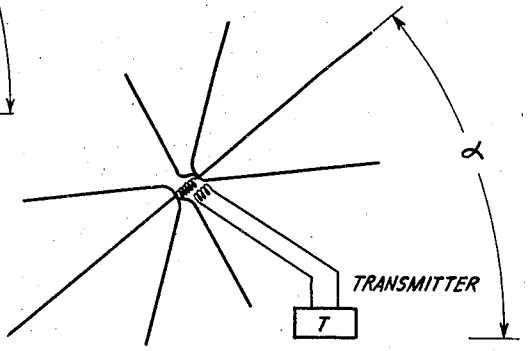


Fig. 3

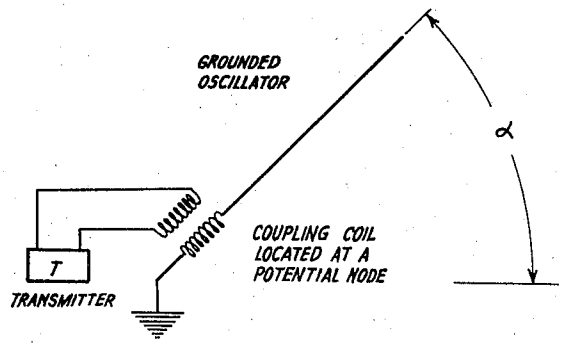
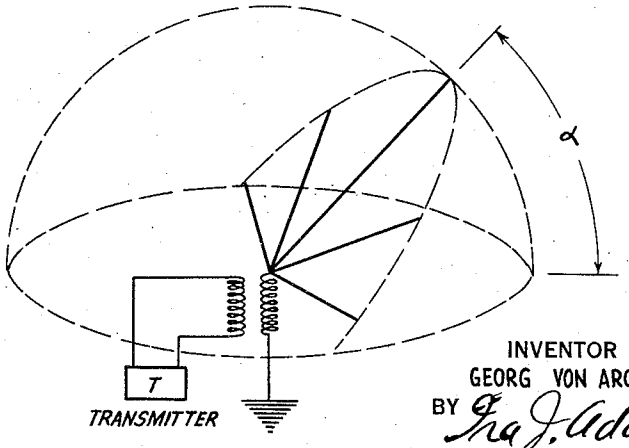


Fig. 4



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Patented Oct. 13, 1931 1,827,054

UNITED STATES PATENT OFFICE

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COMMUNICATION BY ELECTROMAGNETIC WAVES

Application filed October 18, 1926, Serial No. 142,453, and in Germany October 20, 1925.

This invention relates to the transmission and reception of electromagnetic waves, and the antennæ and other apparatus used therefor.

The antennæ which have heretofore been used in wireless intelligence transmission were always built in such a manner that the radiation issuing therefrom was not uniformly strong in all directions. In the ordinary vertical antenna which is excited at its fundamental wave, maximum radiation occurs in the equatorial plane, and no radiation occurs in the direction of the antenna itself. For the purposes of space radiation, i. e., radiation adapted to send relatively large volumes of energy into the higher strata of the atmosphere, the present invention consists in that the electromagnetic waves are radiated as far as feasible in a uniform way in several, or many, or all directions, so that the energy is propagated from the transmitter in a diffuse manner, while the receiver is so designed that it is capable of picking up waves as completely as possible even tho coming from different directions. The invention is especially, but not exclusively, applicable to long distance transmission at short wave lengths.

One antenna arrangement in which the basic idea of the invention may be carried into practice is an arrangement in which a series of linear oscillators is disposed with varying altitude and azimuthal angles. For instance, in the ultimate, the arrangement could have all of the individual antennæ or aerial elements extend in the directions of the radii of a sphere. There may be a relatively great number of rod shaped antennæ excited centrally, and disposed in different directions in such a fashion that half their length in radial direction starts from a center. One characteristic feature of such an antenna system is that in any one plane there is a row of antennæ disposed in star-fashion. In many cases, such an antenna arrangement in a single plane or in part of one, may be sufficient. This plane may be horizontal, or tilted, and the angle of inclination of the plane with reference to the horizontal, and the direction line of the normal to the intersection of the antenna plane and the horizontal plane are governed by the relation of the transmission and receiving points. Of course, the more general case is where a great number of such star-shaped or compass-like antenna systems intersecting in several planes are used.

The arrangement indicated has the advantage that the radiation from the transmitter does not propagate in one direction. The waves propagating from the transmitter to the receiver station consisting of oscillations polarized in various planes. As a consequence, fluctuations in intensity at the receiving station which depend upon the optical conditions of the atmospheric strata are diminished. At the receiving end it is a good plan to use a corresponding antenna system in which all of the antennæ are connected to a common receiver in order that the energy of the incoming oscillations from various directions may be supplied to the receiver.

The component antennæ at the transmission end may be excited simultaneously, or else a somewhat similar effect may be obtained by using a vibrating ray produced by excitation of the individual antennæ consecutively at very short intervals.

The specification is accompanied by illustrative drawings.

Figure 1 is a single ungrounded oscillator;

Figure 2 shows a group of such oscillators arranged star fashion in a single plane;

Figure 3 is a single grounded oscillator; and

Figure 4 shows a plurality of grounded oscillators.

The antenna system comprises a plurality of linear oscillators. The ungrounded and grounded types are illustrated by Figures 1 and 3 respectively.

Figure 2 shows how a plurality of oscillators such as have been indicated in Figure 1 may be arranged at various angles in a single plane, the angle of elevation of which is α. As was before explained, a plurality of such star shaped systems may be employed the planes of which have differing angles of elevation.

In Figure 4 a number of grounded linear

oscillators are indicated, these being located in a plane having an angle of elevation α. A number of such sets of oscillators may be used in planes having differing angles of elevation, and if these are arranged to intersect at the coupling coil the linear oscillators will in effect form the radii of a portion of a sphere, as is indicated by the dotted lines in Figure 4. Of course, if a similar arrangement is employed for the ungrounded oscillators indicated in Figures 1 and 2 the outline will more nearly approximate a complete sphere.

I claim:

1. An antenna system for transmitting electromagnetic waves comprising a number of antennæ positioned in the directions of the radii of a sphere, groups of the antennæ being connected together, a reactance at the intersection of the radii of the sphere for coupling the groups together, a transmitter, and means coupling the transmitter to the different component antennæ through said reactance at the intersection of the radii of the sphere.

2. An antenna system for transmitting electromagnetic waves comprising a number of antennæ positioned in the directions of the radii of a sphere, so that in each of a plurality of planes through the center of the sphere there are a plurality of linear oscillators arranged in the directions of the radii of a circle, a reactance connected to the antennæ at their intersection and means for supplying high frequency energy to the reactance.

GEORG v. ARCO.