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ANTENNA ARRANGEMENT

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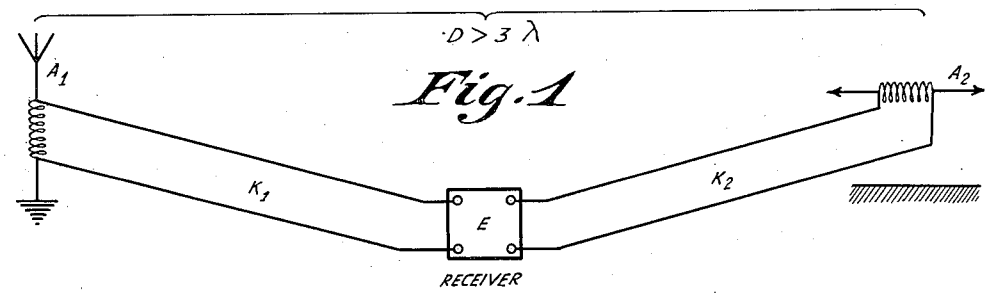


Fig. 1

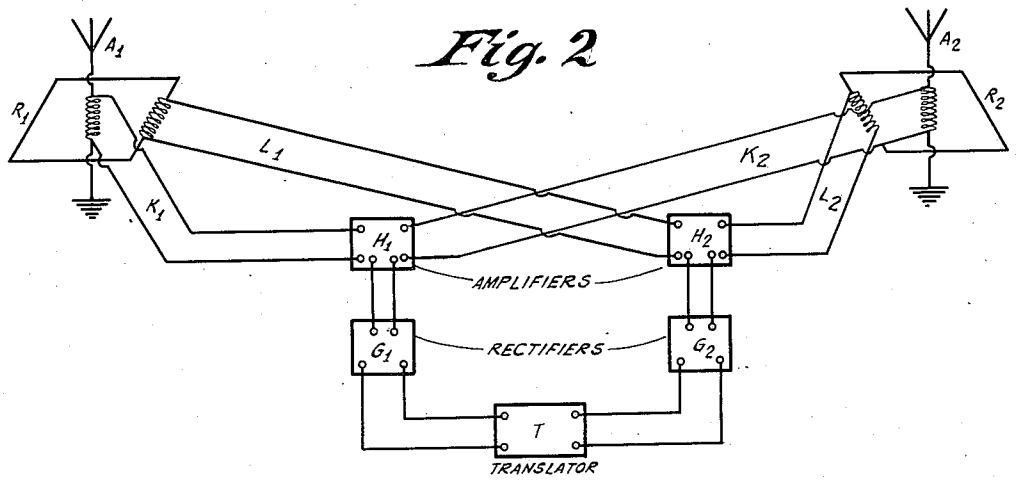


Fig. 2

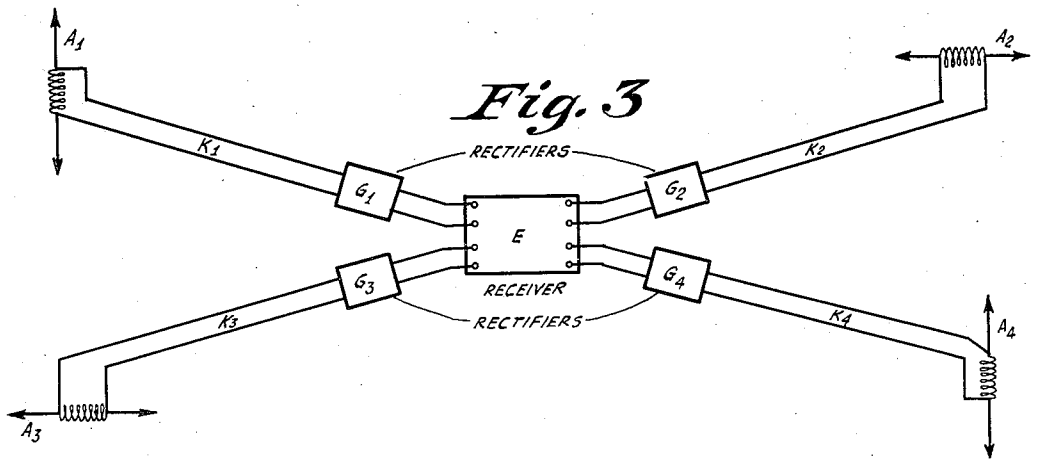


Fig. 3

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ANTENNA ARRANGEMENT

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1 Claim. (Cl. 250—11)

The present invention discloses a novel antenna arrangement and receiver arrangement adapted to obviate fading in the reception of wireless signals to a large extent. To eliminate this difficulty, which is especially observed in working with short waves, it has previously been suggested to mount several antenna systems separated from one another, and to combine the incoming currents of the different aerials in a joint receiver apparatus.

Now, the present invention is based upon a new understanding of the fundamental fact that fading is primarily caused by two different factors, i. e., (1) interference phenomena and (2) changes in the state of polarization of the incoming waves. Observations have shown that alterations in polarization manifest themselves in similar manner even at relatively great distances, while extinction of the signal due to interference is localized. Hence, the separation of the different antenna systems and the combination or integration of the collected energies is, at best, adapted to eliminate only interference phenomena.

The arrangement of two antennas positioned at right angles to each other at the same place is adapted to overcome alterations in the state of polarization and their resultant disturbances, but not the interference phenomena already discussed.

Now, the present invention consists in an antenna arrangement of a kind adapted to effectually eliminate both kinds of disturbance. According to the invention, at least two antennas or antenna systems are geographically spaced or separated from each other, but these antennas, however, are directed or positioned at right angles to each other, as respects polarization. The oscillations of both antenna systems are fed to a common or joint receiver apparatus. The combination of the oscillations may be effected at radio frequency or alternating frequency or after rectification. The spatial separation of the antenna systems precludes simultaneous extinction owing to interference, while the orientation, preferably at right angles, prevents fading due to fluctuations in the state of polarization. For best operation it has been found that the intervening distance should be at least equal to three wave-lengths. In many cases the use of two antenna systems of the said sort will suffice. However, also a greater number of such separate antenna systems may be employed. The constituent antenna systems may be disposed either along a straight line, preferably at right angles to the direction of the incoming signals for a definite station, or else at the corners of a triangle or some other geometrical figure.

My invention is described more in detail in the following specification, which is accompanied by drawing in which Figure 1 is a schematic representation of my invention in simple form; Figure 2 is a modification providing polarization diversity at each of the receiving points; and Figure 3 is an arrangement employing more than two points of collection.

Fig. 1 illustrates the basic principle of the invention in schematic form. Two antennas A1 and A2 are at a distance D from each other which preferably is larger than 3λ. The waves picked up by the antennas are fed to a common receiver E through lead-in wires K1 and K2, respectively. It will be understood that the antennas A1 and A2 need not necessarily consist of a single wire, indeed, more complex antenna structures may be used, say, directional antennas representing a number of dipoles. The only essential point is that their planes of polarization should be orientated at right angles to each other, as is shown in the accompanying drawing.

Insofar as the connection with the receiver is concerned, it is evident that all such ways and means as are well-known from the prior art of radio receiving may be utilized, such as amplifiers and phase regulators. The question whether the combination of the waves is to be accomplished after separate rectification, or in the radio frequency state, prior to rectification, or in alternating frequency form, may be decided according to the particular conditions of each case.

A scheme in which a combination of the antenna energies in radio frequency form as well as a combination after rectification are effected is illustrated in Fig. 2. This figure shows two antenna systems each comprising an elevated antenna and a horizontal antenna. At each place there is mounted a high antenna A1, A2, respectively, and a horizontal antenna R1, R2, respectively, which may be of the frame or loop type. The waves picked up by the two high antennas are combined in a joint circuit H1, and the waves picked up by the frame antennas are united in a common circuit H2, H1 and H2 being, for instance, oscillation circuits, or input circuits of radio frequency amplifiers, such as the audion tube or the like, they being connected with the respective antennas by the leads K1, K2, and L1, L2, respectively. Now, these combined radio frequency currents, in turn, are fed to respective rectifiers G1 and G2, and are then caused to act upon a joint indicator device

T. Alternatively, all four of the radio frequency currents may be rectified and then combined after rectification, and other modes of combination will suggest themselves.

The important thing about this modification is that it provides space diversity, regardless of the relative polarization of the received energy at the several points of collection, inasmuch as polarization diversity is provided for at each of the points of collection.

Fig. 3 illustrates the case in diagrammatic form in which four spatially separated antenna systems are employed, A1, A2, A3, A4, which are united with a receiver E by way of the lead-in transmission lines K1, K2, K3, and K4, respectively. The construction of the different antennas or antenna systems and of the receiver apparatus is governed by the wave-length to be received and the direction of the station to be received. If desired, rectifiers G1, G2, G3, G4 may be employed before combining the collected energies in the joint receiver E.

As is obvious from the figure, the antennas A1 and A4 are positioned vertically, while the antennas A2 and A3 are positioned horizontally, assuming the desired signal to be approaching in the direction of the arrow shown in the figure. In effect, space diversity is provided more or less independently of relative polarization, much as in Figure 2, yet even better space diversity may result because of possible changes in signal intensity between antennas A1 and A3, and antennas A3 and A4.

In each case the receiver E includes a translating means, such as a tape recorder or picture receiver, responsive to the combined energy.

I claim:

A diversity receiving system comprising a vertical antenna and a horizontal antenna having their planes of polarization oriented at right angles with respect to each other, another pair of antennas similarly arranged as said first pair and separated from said first pair by a distance greater than three lengths of the communication wave, means to combine the signal energies collected from said two vertical antennas, separate means to combine the signal energies collected from said two horizontal antennae, and means to translate the combined energy obtained from said first two means whereby there is obtained both space and polarization diversity.

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