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RADIO RECEIVING ANTENNA

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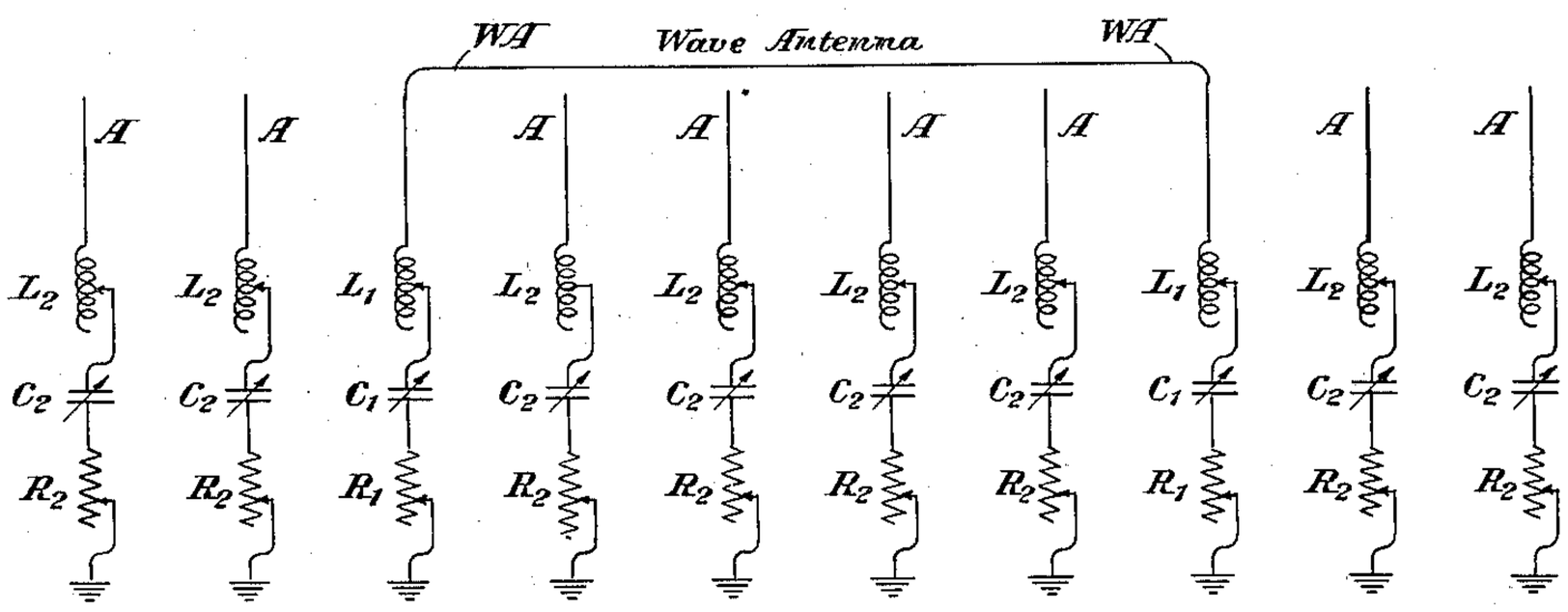

Fig. 1

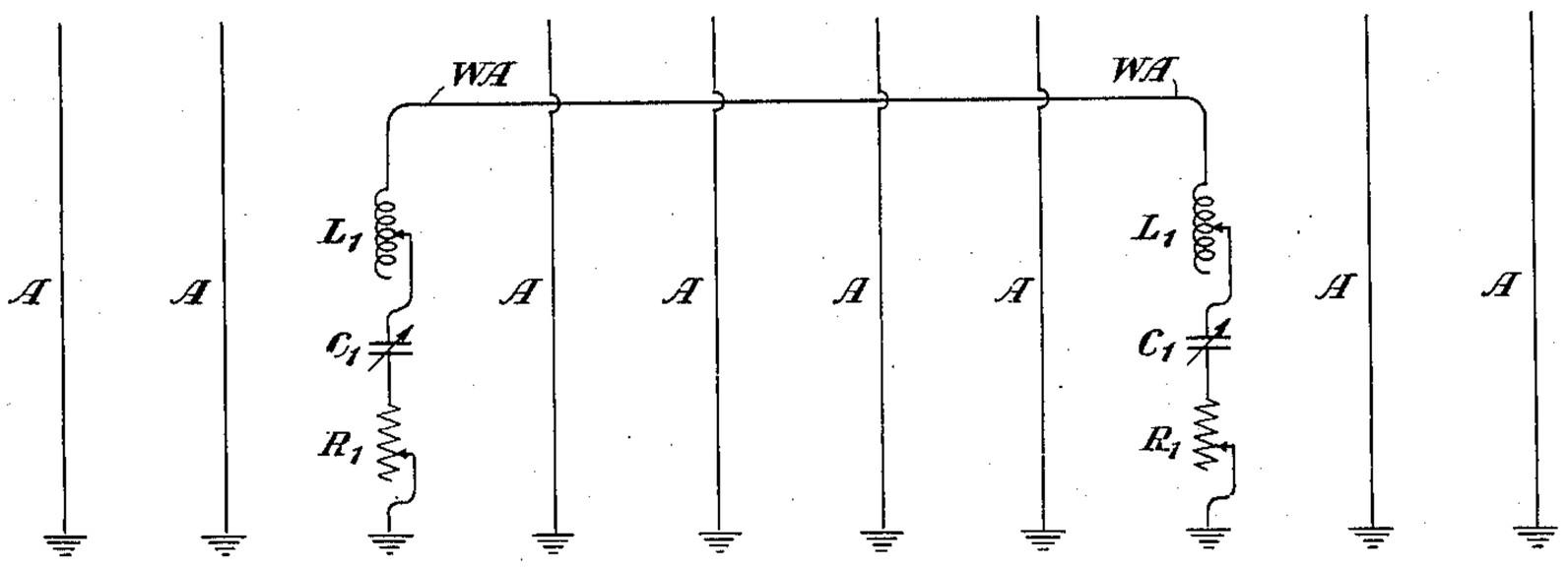

Fig. 2

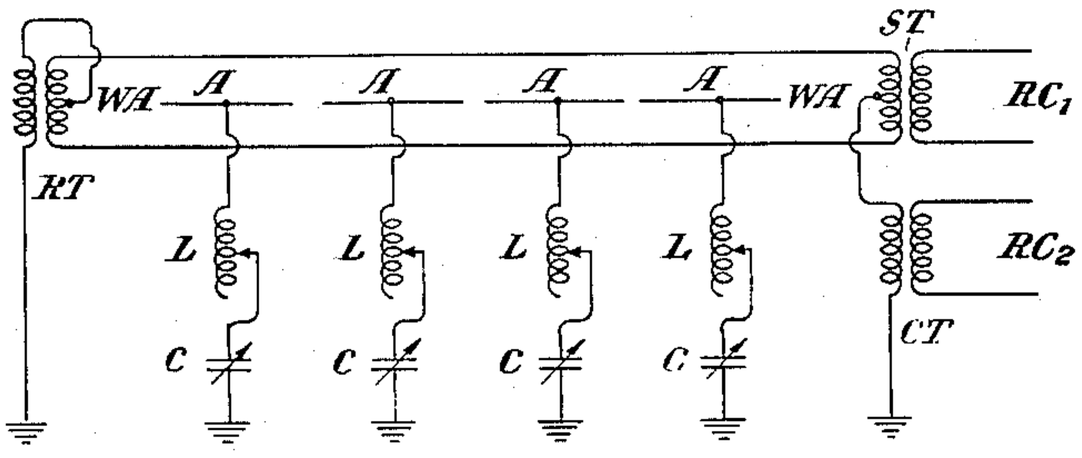

Fig. 3

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RADIO RECEIVING ANTENNA

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12 Claims. (Cl. 250—33)

This invention relates to radio receiving antennæ and particularly to a multiplex antennæ system having for its purpose the efficient reception of long distance radio communication.

One form of antenna which has been found to be highly successful in practice for the directional reception of signals, is known as the "wave antenna". This invention will be disclosed with particular reference to its use in connection with a wave antenna or an array of wave antennæ, although it will be apparent that it may also be applicable to other forms of antenna arrays.

As a result of measurements to determine the effective heights of various wave antennæ, there has been found some indication that the effective height is different for those antennæ which traverse thickly wooded areas. The present invention provides suitable absorbing structures placed near the antenna and intended to develop in a controllable way special characteristics in the antenna, some of which may be of the same kind as are developed naturally by the proximity of trees.

It is an object of this invention to provide a radio receiving antenna system which will include, in addition to a wave antenna, a plurality of antennæ equally spaced along the wave antenna or capable of absorbing energy of an incident beam. It is another object to provide such a system in which the plurality of antennæ equally spaced along the wave antenna are capable of absorbing very efficiently the vertical component of energy in that incident beam.

And it is a further object of this invention to provide a radio receiving antenna system which will include, in addition to one or more wave antennæ, an array comprising conductors each grounded at one end, all of which are perpendicular to the wave antennæ and insulated therefrom.

While this invention will be pointed out with particularity in the appended claims, the invention itself, both as to its further objects and features, will be better understood from the detailed description hereinafter following, when read in connection with the accompanying drawing, in which Figure 1 represents a wave antenna along which and beyond which there are a plurality of antennæ each having adjustable elements of inductance, capacitance, and resistance; Fig. 2 represents another arrangement in which the antennæ along and beyond the wave antenna comprise simple conductors each of which may have inherently appreciable magnitudes of inductance, capacitance, and resistance; while Fig. 3 shows two wires which may comprise the wave antenna with which may be associated a plurality of flat-top type antennæ.

Referring to Fig. 1 of the drawing, there is shown a simple form of wave antenna WA at each end of which there are adjustable elements of inductance L_1, adjustable elements of capacitance C_1, and adjustable elements of resistance R_1, as shown. Adjustments may be made in these elements so that the wave antenna WA may be terminated by its characteristic impedance. Along the line of the wave antenna WA or adjacent thereto, there may be a plurality of vertical antennæ each of which is designated in the drawing by the reference character A. Each of these antennæ may be connected to ground through variable elements of inductance, capacitance, and resistance, designated in the drawing as L_2, C_2 and R_2, respectively. It will be understood that each of these antennæ may be adjusted in the magnitudes of inductance and capacitance in order to be in resonance with the incident wave or beam. It will also be understood that elements which tend to produce resonance with the incident wave or beam are not absolutely essential, for each conductor alone exhibits a certain amount of inductance as well as capacitance (and resistance due to its connection to ground) and that it is this inductance which may be aided by inductance connected serially thereto. The vertical antennæ shown and described in connection with Fig. 1 of the drawing do not represent the only form of antennæ which may be employed to carry out this invention, for other antenna forms such as the horizontal flat-type, umbrella-type, fan-type, etc., may equally well be employed within the spirit and scope of this invention.

Fig. 2 of the drawing shows another embodiment of the invention, in which the wave antenna WA is shown terminated at each end in inductance, capacitance, and resistance, all of which may be varied in their magnitudes so that the wave antenna may be terminated in its characteristic impedance. A plurality of simple conductors may be located alongside of or adjacent to the wave antenna WA, each of these antennæ being designated in the drawing by the reference character A. It will be obvious that each of these antennæ inherently has a certain amount of inductance, capacitance, and resistance.

In Figs. 1 and 2 of the drawing, the array shown and described in connection with the wave antenna extends not only throughout the length of the antenna but considerably beyond it. In one embodiment of the invention experimented with, the wave antenna was approximately 25 feet high and each of the antennæ was held by means of a pole, so as to be approximately 28 feet high. Each antenna of the array was grounded at one end and insulated from the wave antenna at the other end. Standard radio responsive apparatus may be coupled to each wave antenna so as to receive and detect incident radio signals.

Fig. 3 of the drawing shows the wave antenna WA to consist of two parallel wires. As is often

the case, the receiving apparatus may be located under the eastern terminal of the wave antenna. Then it becomes necessary to terminate the wave antenna at the western terminal in a reflection transformer RT, so that the antenna conductors not only pick up the waves but may also be employed as a transmission line to transmit the signals back to the eastern terminal. The midpoint of the secondary winding of the reflection transformer RT is connected through the primary winding of that transformer to ground. At the eastern terminal of the wave antenna, another transformer ST is located, the midpoint of the primary winding of which is connected to ground through the primary winding of another transformer CT, which is so constructed that with its attached circuits it serves to properly terminate the wave antenna. Undesired signals, which may build up in the conductors of the wave antenna, may flow from west to east and through the halves of the primary winding ST oppositely to ground. The effect of these undesired signals will not be produced in the secondary winding of the transformer ST and in the circuit RC_1 connected thereto. These undesired signals will, however, have their effects on the secondary winding of transformer CT and will be present in the circuit RC_2 connected thereto.

A plurality of flat-type antennæ are located between the terminals of the wave antenna, each of these antennæ being designated by the reference character A. Each antenna is connected to ground through adjustable elements of inductance and capacity.

While this invention has been shown and described in certain particular embodiments, merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a wave antenna for receiving space waves and a plurality of parallel conductors located substantially in alignment with the wave antenna and comprising an antenna array, said conductors being located at substantially equal distances apart along the length of the wave antenna, each conductor being grounded at one end and insulated from the wave antenna.

2. The combination of a wave antenna for receiving radio waves and a plurality of vertical grounded conductors which are spaced from each other at definite intervals and extend substantially in alignment, along, and beyond the length of said wave antenna.

3. The combination of a wave antenna which receives space waves, said wave antenna being terminated at each end in its characteristic impedance, and a plurality of conductors located substantially in alignment with the wave antenna and along its length, each conductor being grounded and extending vertically above the wave antenna.

4. In a radio receiving system, the combination of a wave antenna for receiving space waves, said wave antenna extending on a line bearing in the direction of a distant transmitting station, and an antenna array comprisig a plurality of substantially parallel conductors extending substantially in alignment along the wave antenna, the lower extremities of the various conductors being independently grounded, each conductor being physically separated from the other conductors of said array and from said wave antenna.

5. The method of receiving space energy with a wave antenna which consists in intercepting energy at separate and mutually independent points equidistant from each other and located along the length of the wave antenna and receiving the space energy which impinges upon the wave antenna.

6. The combination of a wave antenna which receives space waves, and a plurality of independently grounded electrical structures located substantially in alignment with the wave antenna and adjacent to said wave antenna and spaced from each other along its length, said structures being so positioned with respect to said wave antenna that they produce a modification of its characteristics.

7. The method of improving the receptive characteristic of a wave antenna upon which radio waves directly impinge, which consists in intercepting electrically some of the received energy at a plurality of isolated points, said points being equidistant from each other and located along the length of the wave antenna.

8. The method of improving the receptive characteristic of a wave antenna upon which radio waves directly impinge and are transmitted thereby to a receiving apparatus, which consists in intercepting electrically some of the radio waves at a plurality of independent points which are equally spaced from each other along the line of the wave antenna and beyond its terminals.

9. The method of improving the receptive properties of a wave antenna upon which radio waves directly impinge and are transmitted thereby to a receiving apparatus, which consists in intercepting the vertical component of said radio waves along the line of the wave antenna at a plurality of points equally spaced from each other, and dissipating the energy of the vertical component so intercepted, whereby the horizontal component of said radio waves will be efficiently transmitted by said wave antenna.

10. The method of improving the electrical characteristics of a wave antenna which consists in absorbing in the neighborhood of the wave antenna and along its length the vertical component of received energy having the same frequency as that impressed upon the wave antenna so that the horizontal component of the energy will alone be received by the wave antenna.

11. The method of improving the electrical characteristics of a wave antenna which consists in absorbing at mutually independent points along the length of wave antenna the vertical component of received energy having the same frequency as is impressed on the wave antenna so that the wave antenna will receive the horizontal component of the energy to the exclusion of the vertical component of that energy.

12. The combination of a wave antenna which is terminated at each end in its characteristic impedance, a plurality of conductors positioned substantially in alignment with the wave antenna and along its length, the conductors extending vertically in space, one end of each conductor being grounded, and means for resonating each of the conductors at the frequency of the energy received by the wave antenna.

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