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F. A. KOLSTER

RADIO RECEIVING SYSTEM

Filed June 2, 1924

FIG. 1.

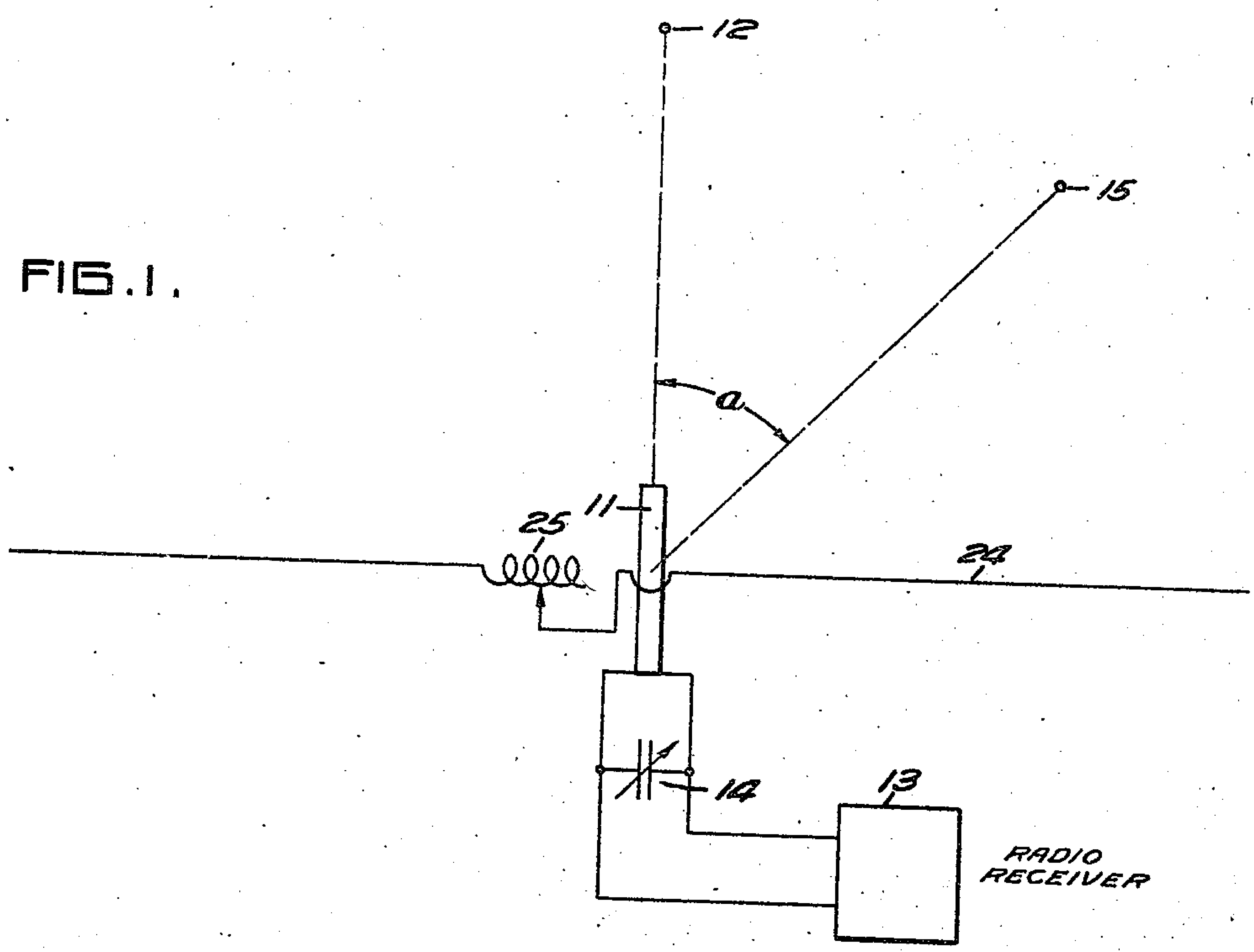
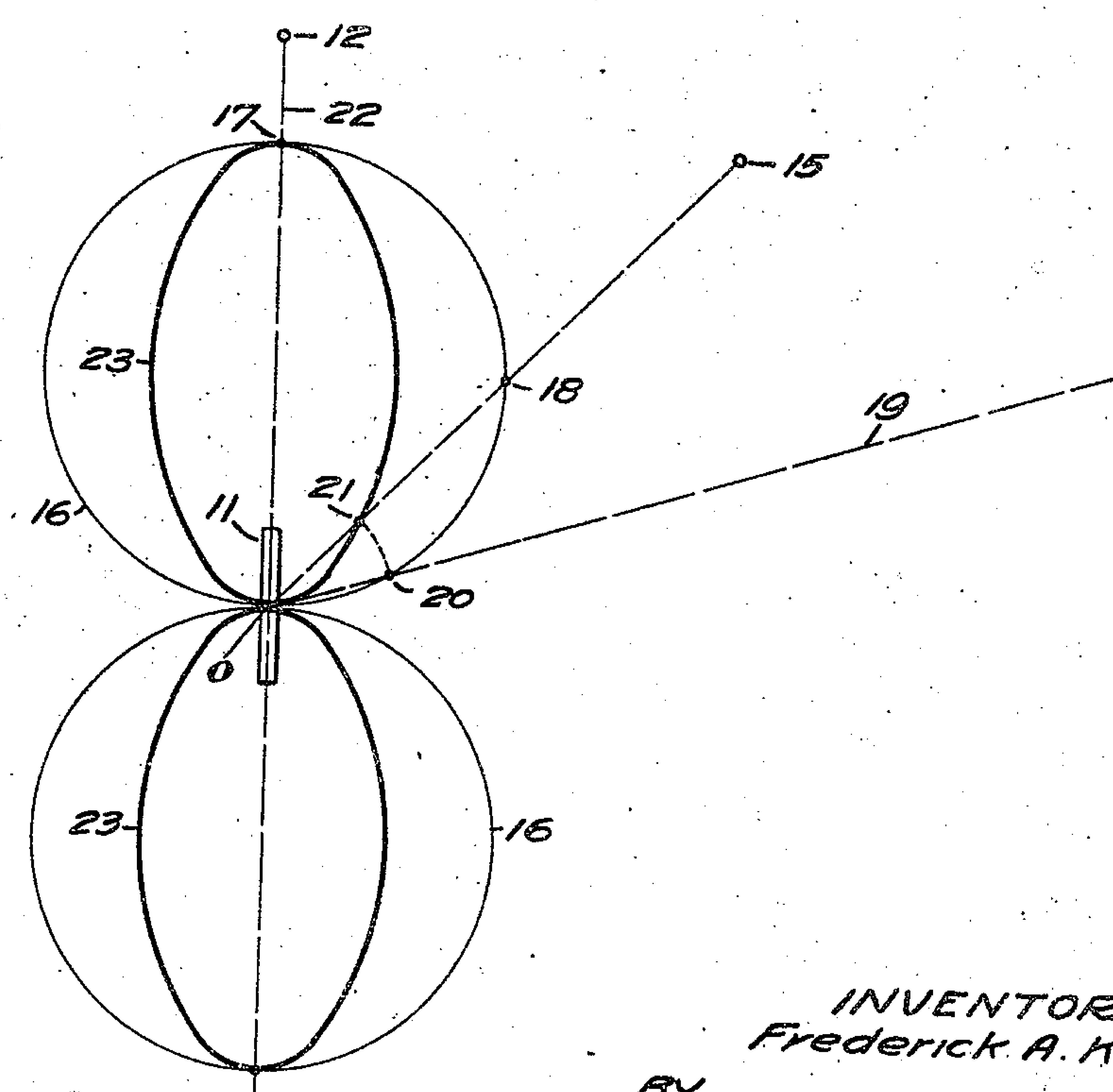


FIG. 2.



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RADIO RECEIVING SYSTEM.

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This invention relates to a system for receiving signals transmitted by radio, and more particularly to such a system arranged to receive messages only from one distant transmitting point. The handling of "traffic", or commercial messages, is now performed in many cases in this manner, the two communicating stations being kept constantly tuned to each other and operating only for the purpose of communicating with each other. Such an installation is commercially feasible in many localities where the traffic is sufficiently heavy. It is also evident that the reliability of the system of communication in maintaining favorable signaling conditions depends a great deal upon the degree of selectivity that the receiving station has, which determines its freedom from being hampered by interfering signals, statics or strays. It is one of the objects of my invention to increase substantially the selectivity of such a receiving system.

In order to assist in the accomplishment of this result, I use a coil or loop antenna for receiving the signals. As is now well understood, such an absorbing circuit exhibits directional receptive qualities; for example, it will receive the greatest amount of energy when the plane of the coil is in line with the direction from which radiations emanate, and it will receive the least amount of energy when the plane of the coil is normal or at right angles to this direction. By the plane of the coil is meant that plane which is passed through the coil perpendicular to the axis of the winding, and substantially through the geometric center of the axial length of the coil. Between these two extreme positions the response has been found to have intermediate values, gradually varying from minimum to maximum as the plane of the coil with respect to direction of the source is varied from normal position to coincident position. It is another object of my invention to alter this functional relation between the angular position of the coil plane, and the degree of response, whereby the coil is caused to respond to the radiations to a diminished extent than otherwise, except when the plane is in the maximum response position, which corresponds to the relative position of the coil and the source with which it is desired to communicate. Due to this arrangement, interfering stations out of line with the coil plane will not affect the coil to as great an extent as heretofore, and the danger of obscuring the desired signal by such interference is very materially lessened.

These advantageous results are produced by controlling to some extent, the direction of the wave front that radiates from an interfering source, so that such wave front strikes the coil plane more nearly in a normal direction, and therefore with a reduced effect on the receiving system. It is therefore another object of my invention to control the direction of movement of the wave front from an interfering source, to minimize interference.

My invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of the invention which I have selected for illustration in the drawings accompanying and forming part of the present application. Although I have shown in the drawings but one embodiment of my invention, I do not desire to be limited thereto, since the invention as expressed in the claims may be embodied in other forms also.

Referring to the drawings:

Figure 1 is a diagrammatic plan view of a receiving system embodying my invention; and

Fig. 2 is a diagram illustrating the effect of my invention to suppress interference.

In Fig. 1, I show a coil 11 with its plane fixed in the direction that causes its response to be a maximum to a transmitting station 12. In order to perceive the signals, any desired form of radio receiver 13 may be connected to the coil. In addition, a variable condenser 14 is shown, connected serially to coil 11, for tuning this circuit very sharply to the frequency of communication.

The point 15 represents one of any number of interfering sources, either transmitting stations, or focal points of "strays" or the like. It is well understood at the present time that the response of the coil to such a source is of a less degree than to station 12, since the plane of the coil 11 is displaced by a substantial angle *a* from the direction of source 15. The degree of response may in fact be plotted for such an installation, as shown by the figure 8 characteristic 16 of Fig. 2. In this figure, the response to radiation from station 12 may be represented by the line O—17, and is a maximum; while the response to radiation from any other source such as 15 is represented by the line O—18. These lines are drawn respectively in the directions of the corresponding sources, and when fully plotted for all directions, it will be found that the well-known figure 8 characteristic 16 is obtained.

A study of this characteristic reveals the fact that the response is a minimum in a direction perpendicular to the plane of coil 11, and rapidly increases as the direction approaches that of station 12. It is evident, therefore, that if it were possible to change the direction of the radiations before they reach coil 11 so as to bring them more nearly perpendicular to the plane of coil 11, the degree of response would be reduced. For example, if the radiations from point 15 were so changed in direction that apparently they proceed in a direction shown by the line 19, then the degree of response would be represented by the line O—20, which is much shorter than the line O—18. Plotting this new degree of response along line O—18, it will be represented by line O—21. My aim is to shift the apparent direction of all possible sources outside of the line 22 nearer the perpendicular position, so that the resultant characteristic is materially flattened, as illustrated by the heavy curve 23. In this way, the directional characteristic approaches more nearly the ideal straight line form, which would correspond to no response whatever of the coil to a station falling off of line 22.

I accomplish this desired result by providing a wave front distorter or guide, that leads the radiations more nearly perpendicularly toward the coil plane for stations falling off the line 12. This guide for the radiations takes the form of a long conductor 24, Fig. 1, that is placed at right angles to the plane of coil 11. This conductor should preferably extend equally on both sides of the coil, and be provided with some form of tuning device, such as the variable inductance 25. For radiations proceeding from the station 12, this conductor has no appreciable effect, since it is symmetrical with respect to the wave front, and cannot therefore change its direction. But for radiations proceeding from other points, such as from source 15, the conductor 24 serves to deflect the wave front more nearly toward its own line, producing the effect described in connection with Fig. 2. This effect is enhanced for any particular interference by tuning the conductor to the wave length of the interfering frequency. Since the arrangement has no effect on the radiations proceeding from source 12, this conductor could be tuned to an interfering frequency which is close, or even equal to that associated with source 12. Although the wire 24 is placed near the coil 11, and carries current due to energy absorbed from the interfering stations, such current has no harmful effect on the reception, due to the fact that the wire 24 is fixed in non-inductive relation to the coil 11. It is evident that the provision of such an arrangement to alter the wave front of interfering radiations has a marked effect in reducing interference while maintaining the degree of response to the desired radiations unimpaired.

I claim:

1. In a system for receiving electromagnetic radiations, a coil arranged to be responsive to a maximum degree to radiations propagated in the direction of its plane, and a conductor arranged adjacent the coil and extending substantially at right angles to its plane, said conductor being open ended and relatively long as compared to the coil.

2. In a system for receiving electromagnetic radiations, a coil arranged to be responsive to a maximum degree to radiations propagated in the direction of its plane, a conductor arranged adjacent the coil and extending substantially at right angles to its plane, said conductor being open ended and relatively long as compared to the coil and means for tuning said conductor.

3. In a system for receiving electromagnetic radiations, an absorbing circuit having nonuniform directional characteristics, and capable of movement to be affected most strongly by radiations from a desired direction, and means for altering the direction of the wave front of radiations from substantially all other directions, comprising a conductor arranged adjacent the circuit and at right angles to the desired direction, said conductor being open ended and relatively long as compared to the absorbing circuit.

4. In a system for receiving electromagnetic radiations, a loop antenna having directional characteristics, means for selectively tuning said antenna, a detector circuit electrically associated with said antenna, and means for altering the wave front of radio energy which is received from a direction other than perpendicular to the axis of said loop, said means comprising an elongated conductor relatively greater in length than the diameter of said loop and arranged at an angle to the plane of said loop.

5. A radio antenna comprising a closed loop having directional characteristics, means for selectively tuning said loop, a signalling circuit coupled to said loop, and means for accentuating the directional characteristics of the loop comprising a substantially linear open ended conductor of greater length than the diameter of said loop and arranged at an angle to the plane of the loop, and means inserted in said conductor for tuning the same.

In testimony whereof, I have hereunto set my hand.

FREDERICK A. KOLSTER.