

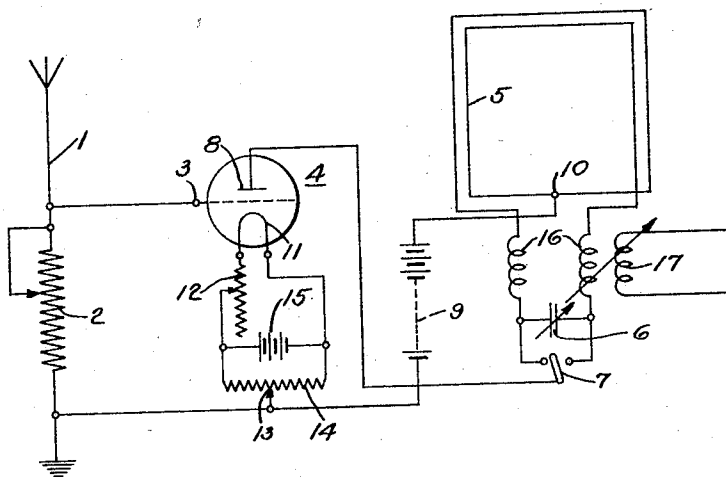
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RECEIVING CIRCUIT FOR WIRELESS SIGNALING

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WITNESSES:

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UNITED STATES PATENT OFFICE.

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RECEIVING CIRCUIT FOR WIRELESS SIGNALING.

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My invention relates to receiving circuits for wireless telegraphy and particularly to receiving circuits having means for selective reception.

5 One object of my invention is to produce a radio receiving system having means for substantially reducing interference.

Another object of my invention is to produce a radio receiving system having means 10 for substantially reducing static influences.

Another object of my invention is to produce a combination of an open aerial and a loop aerial.

Another object of my invention is to construct a combination of an aperiodic open 15 aerial combined with a loop antenna whereby signals received by one receptor are caused to neutralize undesired signals in the other receptor.

20 In the prior art of the construction of radio receiving apparatus, it has been common to use both open aerials and loop antennae, and attempts have been made to use them in combination, but all such structures have operated 25 under the handicap that forced oscillations or untuned impulses, have produced serious interference with signals which it was desired to receive.

My invention provides a combination of an 30 open aerial and a loop antenna whereby signals received by the one are caused to neutralize all of the undesired signals received by the other but only a portion of the desired signal.

35 According to my invention, signals are received upon an open aperiodic aerial and also upon a tunable loop aerial, and the respective electromotive forces, due to an undesired signal, are balanced out in the frame aerial 40 circuit. The vector difference of the respective electromotive forces due to the different signals of different direction or wave length or both is utilized for the compensation.

45 In carrying out my invention by a convenient arrangement, an aperiodic open aerial and a tunable loop aerial are combined with a three-electrode valve to form a reception circuit. The frame aerial forms part of the 50 tuned anode circuit of the valve. The signal voltages in the open aerial are impressed on the grid of the valve, the amplification factor of which can be adjusted to equalize the electromotive forces of an undesired signal in the respective antennae. The received signals are

rectified and amplified by the usual circuit 55 arrangement which can be coupled with the receiving circuit of my invention.

In order to maintain symmetry in the loop aerial the high tension battery, which is connected to the filament of the valve and earthed 60 at its negative end, is connected to the loop aerial at the electrically symmetrical midpoint thereof and a two-way switch is provided for connecting either of the loop aerial terminals to the anode of the valve. 65

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawing, wherein:

The single figure is a diagrammatic view of 70 circuits and apparatus embodying my invention.

Referring to the drawing, an open aerial 1 is in series with a high resistance 2, by means 75 of which it is made effectively aperiodic in so far as concerns wave lengths of the order it is desired to receive. The signal voltages across this high resistance 2 are impressed on the grid 3 of the valve 4. The loop aerial is shown at 5 with a corresponding tuning con- 80 denser 6 across the terminals thereof. A two-way switch 7 is provided for connecting either of these terminals to the anode 8 of the valve 4. The high tension battery 9 is connected to the electrically symmetrical mid- 85 point 10 of the loop aerial 5.

In order to secure accurate balance of the undesired impressed signal voltages it is 90 necessary as set forth above to alter the magnification factor of the valve. This may be done by variation of the current through the filament 11 of the valve 4 by means of the adjustable rheostat 12 or by variation of the 95 grid potential thereof by adjustment of the position of the tapping point 13 of the connection from the grid through the aerial resistance 2 on the high resistance potentiometer 14 which shunts the filament battery 15. The adjustment may also be made by 100 variation of the high resistance 2 in the open aerial circuit.

The tuning condenser 6 is connected to the loop aerial by means of symmetrically placed inductances 16 and from either of these a 105 variable coupling 17 may be arranged leading to the detector and the amplification circuits (not shown).

In order to receive a desired signal and

eliminate an undesired interfering signal, the loop aerial is tuned to the undesired signal. Such tuning may be initially effected with the switch 7 in its open position so that the open aerial is cut out of circuit. Preliminary tuning of the loop aerial having been obtained the switch 7 is closed on either of its contacts and the amplification factor of the valve is adjusted by any of the means described until the electromotive forces impressed indirectly in the loop aerial from the open aerial through the valve and the electromotive forces impressed directly in the loop aerial are equal.

Now it is obvious that these electromotive forces will assist or oppose one another according to which of the two contacts the switch 7 engages. Such assistance or opposition of the respective electromotive forces may obviously also be obtained by rotating the loop aerial through an angle of 180° . To eliminate the undesired signal, the respective electromotive forces are caused to be exactly balanced out in the loop aerial circuit by final adjustment of the constants of the system. The desired signal which is of different wave length or is arriving from a different direction will now be received since the respective electromotive forces due thereto will not be balanced out.

This will clearly be the case since, if the desired signals are of different wave length the loop aerial is not tuned thereto and the indirect electromotive forces from the open aerial will, therefore, be different from the electromotive forces directly impressed in the loop aerial. If, on the other hand, the desired signals arrive from a different direction the orientation of the loop aerial will be different with a corresponding difference in the electromotive forces directly impressed thereon. Such directly impressed electromotive forces will assist or oppose the electromotive forces derived from the open aerial according to whether the station transmitting the desired signals is angularly spaced more or less than 90° from the station transmitting the undesired signals.

The vectorial difference of the respective electromotive forces is in fact available. Strongest signals will be obtained when the two transmitting stations are in line with the receiving station and on opposite sides thereof. However, the desired signals can still be effectively received to the exclusion of the undesired signal even if the two stations are in line with the receiving station and on the same side thereof, if the wave lengths of the two signals are different. The difference need only be small. It will be appreciated that the directional effects of the improved receiving circuit are absolute, being obtainable in accordance with the well known heart-shaped polar diagram.

Thus by the means described, the usual

unidirectional reception can be obtained or interfering waves can be nullified. On moving the switch to its other operative position, or by rotating the loop through 180° , maximum strength of signals will be obtained, that is to say, the signals received by the open aerial will be strengthened by the addition of the voltage of those received by the loop aerial so that maximum signals will be obtained. It will be observed that only a single tuned circuit, namely that of the loop aerial is necessary, and that the signals received from the open aerial and the loop aerial are, with this arrangement, automatically brought substantially into phase while the voltage balances obtained are substantially true for all wave forms.

When desired, ordinary loop aerial reception can be obtained if the switch 7 is moved to its open position as above mentioned. By using a large open type aerial and by increasing the magnification factor of the valve, the arrangement can be made such that the effect of the loop aerial will be negligible for the desired signal and the ordinary open aerial reception obtained with the loop aerial forming part of the tuned anode circuit.

The open type aerial may in some instances be embodied in the loop aerial by using a split metallic former or frame for the conductors of the loop aerial, for example, or by conductors supported by the frame which would act as an open type aerial, or other methods may be used for utilizing the open type aerial effect of the loop aerial itself.

While I have shown only one embodiment of my invention, it is capable of various changes and modifications therefrom without departing from the spirit thereof and it is desired, therefore, that only such limitations shall be imposed thereon as are indicated in the prior art or in the appended claims.

I claim as my invention:

1. A selective receiving circuit for wireless telegraphy and telephony comprising an aperiodic open aerial, a tunable loop aerial and means for equalizing the electromotive forces derived from the open aerial due to a given signal with the corresponding electromotive force in the loop-aerial circuit and for applying said equalized open-aerial electromotive forces to the loop-aerial circuit to oppose and balance out the aforesaid loop-aerial electromotive forces, whereby the respective electromotive forces due to another signal of different direction or wave length or both are not balanced out and may be utilized.

2. Means for selectively receiving radio signals comprising an aperiodic antenna, an amplifying stage comprising a thermionic valve having an input circuit arranged to be energized from said antenna and an out-

put circuit comprising a tunable loop-antenna, means for coupling said output circuit to signal-indicating means, and means whereby potentials appearing across said output circuit by reason of signals received on said aperiodic antenna may be balanced against potentials developed in said output circuit by reason of the direct reception of signals on said loop.

10 3. A receiving circuit for wireless telegraphy and telephony which comprises a triode valve, an open earthed aerial in series with a high resistance, the two ends of which resistance are connected, respectively, to the
15 grid and to the cathode of said three-electrode valve, a loop aerial and an adjustable condenser connected across its terminals, the one or the other plate of said condenser being adapted to be connected to the anode of
20 the valve by means of a two-way switch, and a high-tension battery, the positive pole of which is connected to the electrically symmetrical mid-point of the loop aerial.

25 4. A directional receiving circuit for wireless telegraphy and telephony comprising an aperiodic open aerial, a tunable loop aerial and means for equalizing the electromotive forces derived from the open aerial, due to a given signal, with the corresponding electromotive forces in the loop aerial circuit,
30 and means for applying said equalized open-aerial electromotive forces to the loop-aerial

circuit so as to oppose and balance out the aforesaid loop-aerial electromotive forces, whereby the respective electromotive forces
35 due to another signal of different direction or wave length, or both, are not balanced out and can be utilized, and in which the loop aerial forms part of the tuned anode circuit of a three-electrode valve, to the grid circuit
40 of which the open aerial is connected, and in which the respective electromotive forces in the loop-aerial circuit are equalized by varying the amplification factor of the valve.

5. Means for selectively receiving radio
45 signals comprising an aperiodic antenna, an amplifying stage comprising a thermionic valve having an input circuit arranged to be energized from said antenna and an output circuit comprising a tunable loop-antenna,
50 means for coupling said output circuit to signal-indicating means, and means whereby potentials appearing across said output circuit by reason of signals received on said aperiodic antenna may be balanced against
55 potentials developed in said output circuit by reason of the direct reception of signals on said loop, said balancing means including a resistor connected across certain of the terminals of said valve and a connection there-
60 to from said aperiodic antenna.

In testimony whereof, I have hereunto subscribed my name this 9th day of May 1924.

NORMAN PULLEN HINTON.