No. 816,205. PATENTED MAR. 27, 1906.

A. ARTOM.

WIRELESS TELEGRAPH RECEIVING APPARATUS.

APPLICATION FILED SEPT. 7, 1905.

2 SHEETS—SHEET 1.

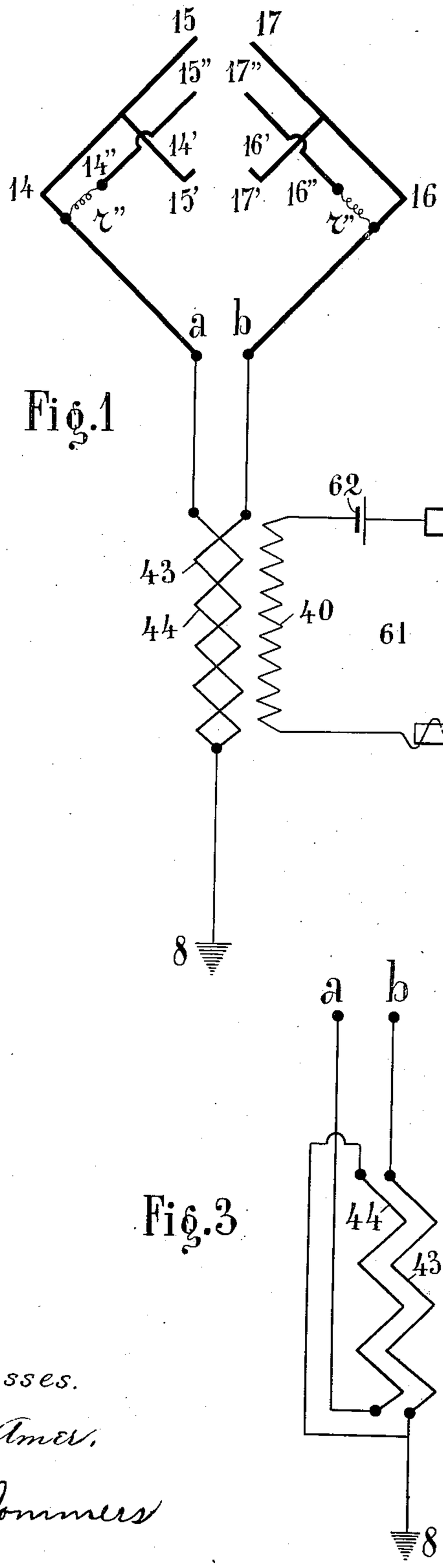

Fig. 1

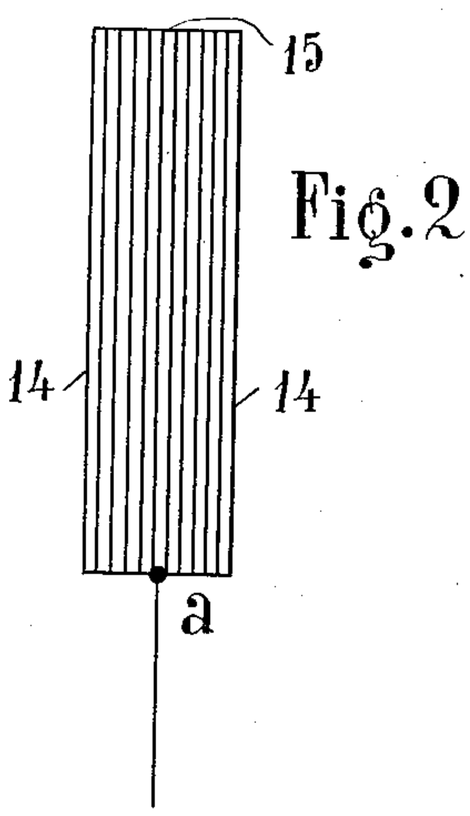

Fig. 2

Fig. 3

Witnesses.
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Fig. 4

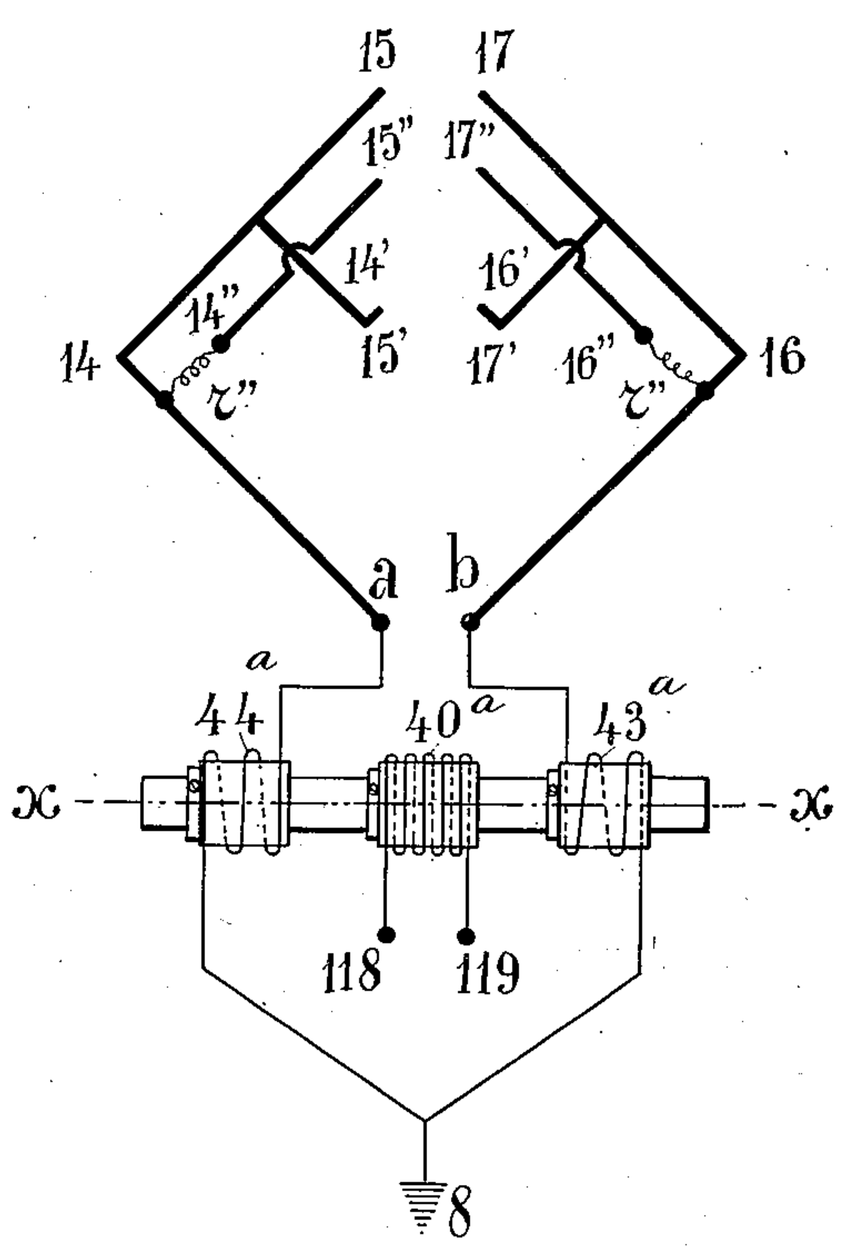


Fig. 5

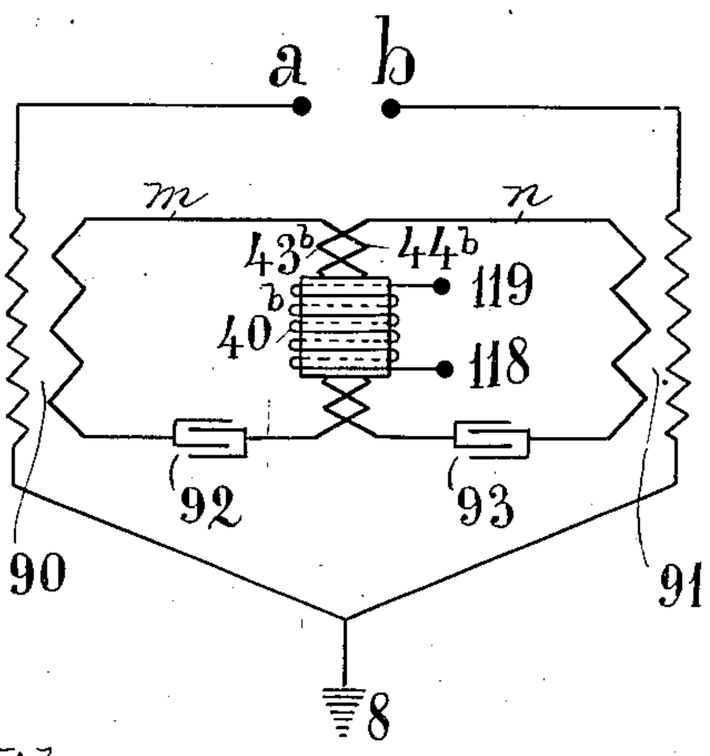
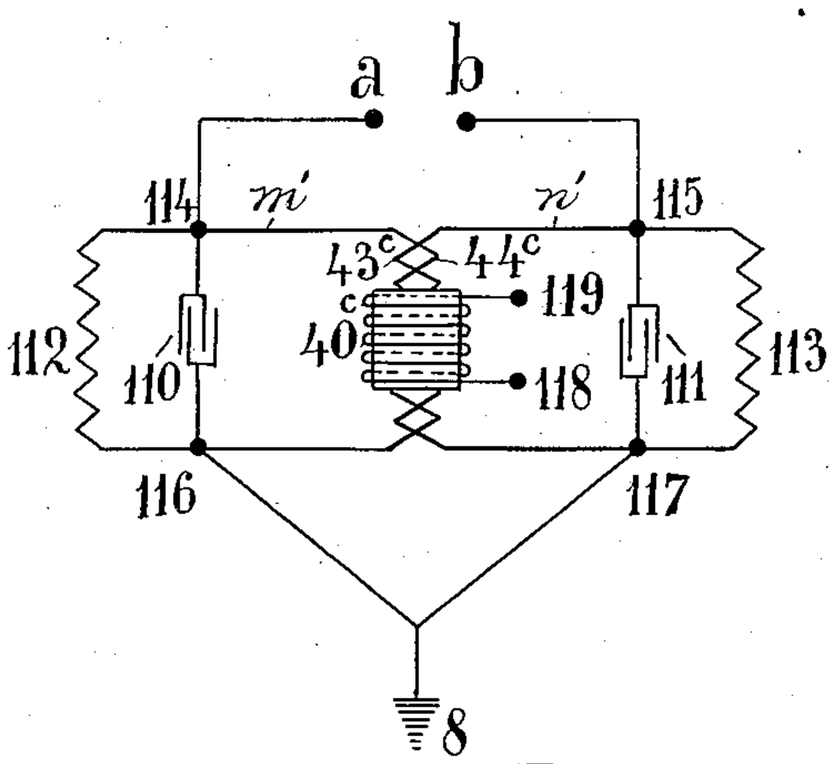


Fig. 6



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UNITED STATES PATENT OFFICE.

ALESSANDRO ARTOM, OF TURIN, ITALY.

WIRELESS-TELEGRAPH RECEIVING APPARATUS.

No. 816,205. Specification of Letters Patent. Patented March 27, 1906.

Application filed September 7, 1905. Serial No. 277,424.

To all whom it may concern:

Be it known that I, ALESSANDRO ARTOM, a subject of the King of Italy, residing at Turin, Italy, have invented certain new and useful Improvements in Wireless-Telegraph Receiving Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention relates to receiving mechanisms at the receiving-stations for wireless-telegraph apparatus and more particularly to such apparatus designed to receive messages transmitted by circularly or elliptically polarized electromagnetic waves, and has for its object the arrangement and construction of parts hereinafter fully described and claimed.

Referring to the drawings in which like parts are similarly designated—Figure 1 is a diagrammatic view of the mechanism at a receiving-station. Fig. 2 is a detail side view of one of the aerials angularly disposed to each other. Fig. 3 is a diagrammatic view of a modified form of transformer. Fig. 4 is a diagrammatic view of a modified form of receiving mechanism. Figs. 5 and 6 are similar views of further modifications.

Referring to Fig. 1, the aerial conductors *a*, 14, 15 and *b*, 16, 17, which are angularly disposed to one another, here shown as making an angle of ninety degrees, the several parts of each making angles of forty-five degrees with the horizontal have mounted on them secondary conductors 14′, 15′ and 16′, 17′ and similar secondary conductors *r*″, 14″, 15″ and *r*″, 16″, 17″, being generally of the construction described in my United States Patent dated July 11, 1905, No. 794,334, nevertheless any other suitable form and arrangement of aerials may be used. It is preferable, that whatever the form and arrangement of the aerials, that aerial conductors at the receiving and at the sending stations be as nearly parallel as may be and that both stations have the same form of aerial conductors and they should preferably have the form of conductive wire grids as illustrated in Fig. 2. There are, generally speaking, two masts at each station making an angle with one another or parts of each making an angle with one another, their lower ends being indicated at *a* and *b*. In Fig. 4 these ends are connected to two windings 44, 43 of a transformer, these windings being so arranged that when traversed by equal currents the algebraic sum of their inductive effect will be zero and in this figure these windings are in opposite directions, joined together at one of their ends and grounded at 8. These two windings or coils 43 and 44 form the primary of an induction-coil and are wound upon the same spool or support. Superposed on these primaries is a third winding 40 of a large number of turns forming the secondary winding of the induction-coil that forms part of a circuit 61, containing a suitable source of electricity as a battery 62, a coherer 63 and a relay, electromagnet or similar translating device 64. The translating device operates an armature *c* to close an independent circuit 81 normally open. This independent circuit contains a battery 82, an armature *c* so positioned as to be acted upon by the translating device or electromagnet 64 and drawn against the tension of its spring *d* to close the circuit. 83 is a receiving device of any suitable kind operated by the current from battery 82 and may be an ordinary Morse indicator or a recording instrument for telegraphic signals such as is now used in telegraphy.

When circularly or elliptically polarized electromagnet waves or waves differing in phase and amplitude are sent out from the sending-station and are collected or received by the aerials angularly disposed to each other at the receiving-station, the magnet-flux resulting from the double winding 43, 44 will not be zero and the secondary winding 40 will be traversed by electric oscillations that will influence the coherer 63 and operate the relay 64 under the influence of the current from battery 62. The relay 64 in turn closes the independent circuit and the instrument at 83 operated by the current from battery 82 will indicate or record the signals according to the particular style of instrument used.

In place of the coherer 63 and battery 62 any other device that will be influenced by electromagnetic waves may be used.

In Fig. 3 I have shown a modification of the transformer accomplishing the same result, when the windings 43 and 44 are in the same direction instead of in opposite directions as in Fig. 1, but the terminal of the respective masts are connected to one end of one winding and to the opposite end of the

other winding, so that the oscillations will pass through the windings in opposite directions, and the algebraic sum of the induction effect of equal currents passing through them will be zero. In this case their opposite ends are connected and grounded.

All electromagnetic influences on the aerials angularly disposed to each other at the receiving station are rendered inoperative unless due to circularly or elliptically polarized waves, that is, waves composed of oscillations differing in phase and amplitude. It therefore results that atmospheric electricity or any other kind of radio-telegraphic waves, that will produce like potentials at *a* and *b* will have no effect on the receiver, such as waves produced by Marconi apparatus.

The essential conditions that are to satisfy the two primary windings 43, 44, that is, such as will produce equal fluxes in opposite directions in the secondary winding 40 when the two points *a* and *b* have the same potential is easily satisfied by the constructions shown in Figs. 1 and 3, by suitably proportioning the number of turns of the primary windings 43, 44, but a very practical arrangement is that shown in Fig. 4, allowing a latitude of adjustment of primary and secondary coils, one to the other. This arrangement consists of aerials hereinbefore described each of which is connected to a separate spool or winding 43^a and 44^a, placed in axial alinement on the line *x x*. These windings are in a direction opposite to one another as shown or may be wound in the same direction as indicated in Fig. 3. The end of the windings are connected and grounded at 8. The secondary winding 40^a is also wound as separate bobbin and in axial alinement with the primaries 44^a and 43^a, the terminals 118 and 119 of the secondary winding being connected to a suitable Hertzian wave detector and circuit, for example, such as the circuits 61 and 81 shown in Fig. 1. With this form of construction it is always possible to adjust the bobbins 44^a and 43^a along their axis of alinement *x x* such that the algebraic sum of the fluxes produced by them in the secondary 40^a will be zero when the points *a* and *b* are at the same potential or what amounts to the same thing position the secondary winding 40^a relatively to the two primaries along the same axis *x x*.

In Fig. 5 the points *a* and *b* are respectively connected to one of the primary windings of a pair of transformers 90, 91, said primary windings being connected together and grounded at 8. The secondary windings of these transformers form parts of two circuits *m* and *n*. The circuit *m* contains the secondary winding of the transformer 90, the primary winding 44^b and capacity 92 in series and the circuit *n* contains the secondary winding of the transformer 91, the primary winding 43^b and the capacity 93 all in series. These two similar circuits carry induced currents and the primary windings 43^b and 44^b induce currents in the secondary winding 40^b whose terminals 118 and 119 are suitably connected to a detector-circuit of Hertzian waves and for example, such as shown in circuits 61 and 81 of Fig. 1. By suitably regulating the capacities in the two induced circuits *m* and *n*, and shown as condensers, perfect resonance between the two circuits, their respective circuits formed by the aerials angularly disposed to each other and the primary conductors of the transformers 90, 91 may be obtained.

Fig. 6 is another form slightly modified to effect the same purpose. The aerials angularly disposed to each other being connected as before to the points *a* and *b*. The primary windings 43^c and 44^c are connected in series with variable ohmic resistances 112 and 113 in the respective circuits *m'* and *n'*. Connected across the circuit *m'* between the points 114 and 116 and in derivation, is a variable capacity 110, while a similar capacity 111 is connected between the points 115 and 117. The conductors from the lower ends of the aerials angularly disposed to each other *a* and *b* are connected respectively to the points 114 and 115, while the points 116 and 117 are connected together and grounded at 8. The secondary winding 40^c has terminals 118 and 119 that are connected to detector-circuits or mechanism for receiving Hertzian waves. The practical use of this arrangement has also shown that by suitably varying the ohmic resistances 112 and 113, the circuits 110–44^c and 111–43^c formed by the primary coils and the capacities assume well-determined oscillatory periods, so that the receiving apparatus can be easily placed in perfect accord with the apparatus at the sending-station. The apparatus in Fig. 6 owing to the primary windings 43^c and 44^c acting in opposition to each other, will not be sensitive to atmospheric electricity or to waves transmitted by Marconi instruments, but only to circularly or elliptically polarized electromagnetic waves, since said polarized waves have an oscillating period and a difference of phase previously determined to accord with the receiving instrument.

It will be noted that in Figs. 1, 4, 5 and 6, I have shown the primary windings 43 and 44 wound in opposite directions, but the same result can be obtained by winding them in the same direction, said windings being disposed as shown and described with reference to Fig. 3, the main object being that their inductive effect on the secondary windings 40 shall be substantially zero when the aerials supply equipotential currents.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. A receiver for circularly or elliptically polarized electromagnetic waves, comprising aerials angularly disposed to each other, an electromagnetic wave-detector and means to operate and influence the detector, said means including a device to eliminate the action of waves not polarized circularly or elliptically on the detector, substantially as described.

2. In a receiver for elliptically or circularly polarized electromagnetic waves, aerials angularly disposed to each other, an electromagnetic wave-detector, means to eliminate the action of waves not polarized circularly or elliptically, said means in inductive relation to the detector, substantially as described.

3. In a receiver for elliptically or circularly polarized electromagnetic waves, the combination with grounded aerials angularly disposed to each other, of means to eliminate the action of waves not polarized circularly or elliptically, and a receiving instrument controlled by induced oscillation from said means, substantially as described.

4. In a receiving-station for circularly or elliptically polarized electromagnetic waves, the combination with grounded aerials angularly disposed to each other, of primary coils of a transformer between the ends of the aerials angularly disposed to each other and the ground, said coils arranged to be traversed by oscillations differing in direction, and a secondary coil in inductive relation thereto, said primary coil forming part of a circuit controlling a receiving instrument, substantially as described.

5. In a receiving-station for circularly or elliptically polarized electromagnetic waves, the combination with a pair of grounded aerials angularly disposed to each other, of a primary coil inserted between the ground and each aerial, said coils in axial alinement, a secondary coil in inductive relation to the primary coils, said primary coil forming part of a suitable circuit controlling a receiving instrument, substantially as described.

6. In a receiver for circularly or elliptically polarized electromagnetic waves, the combination with a pair of grounded aerials angularly disposed to each other, of a primary coil inserted between each aerial and the ground, and a secondary coil in inductive relation to the primary coils and all of the coils in axial alinement, said secondary coil forming part of a suitable electric circuit controlling a receiving instrument, substantially as described.

7. The combination with a pair of grounded aerials angularly disposed to each other, of a closed circuit in inductive relation to the grounded circuit of each aerial, each of said closed circuits containing a capacity and a primary coil, the two primary coils of the closed circuits arranged to carry oscillations in opposite directions, and a secondary coil in adjustable inductive relation to both primary coils and forming part of a suitable circuit controlling a receiving instrument, substantially as described.

8. The combination with two grounded aerials angularly disposed to each other, of a primary coil between each aerial and the ground, an ohmic resistance and a capacity in parallel with each coil, said coils arranged to carry oscillations in opposite directions, and a secondary coil in inductive relation to the primary coils and forming part of a suitable circuit controlling a receiving instrument, substantially as described.

9. The combination with two grounded aerials angularly disposed to each other, of a primary coil between each aerial of the ground, an ohmic resistance capable of being varied and a capacity also capable of being varied in parallel with each coil, said coils arranged to carry oscillations in opposite directions and a secondary coil in inductive relation to both primary coils and forming part of a suitable circuit controlling a receiving instrument, substantially as described.

10. The combination with a pair of aerials angularly disposed to each other, of a primary coil connected to each aerial and said primary coils connected together and grounded, said coils arranged to be traversed by oscillations in opposite directions, a closed circuit containing a source of electricity, a detector of electromagnetic waves, a translating device and a secondary coil, said secondary coil in inductive relation to both of the primary coils, an independent circuit closed by the translating device and a receiving instrument in said independent circuit, substantially as described.

11. The combination with a pair of aerials angularly disposed to each other, of a primary coil connected to each aerial and said primary coils wound in opposite directions and grounded, a closed circuit, a battery, a coherer, an electromagnet and a secondary coil all in series in said circuit, said secondary coil in inductive relation to both of the primary coils, a normally open circuit containing a receiving instrument, said circuit closed by the electromagnet, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

ALESSANDRO ARTOM.

Witnesses:

HUGO PYZONI,

FRANCISCO SIMONI.