No. 817,137. PATENTED APR. 3, 1906.

A. ARTOM.

APPARATUS FOR PRODUCING ELECTRIC WAVES.

APPLICATION FILED JULY 6, 1904.

*Fig. 1.*

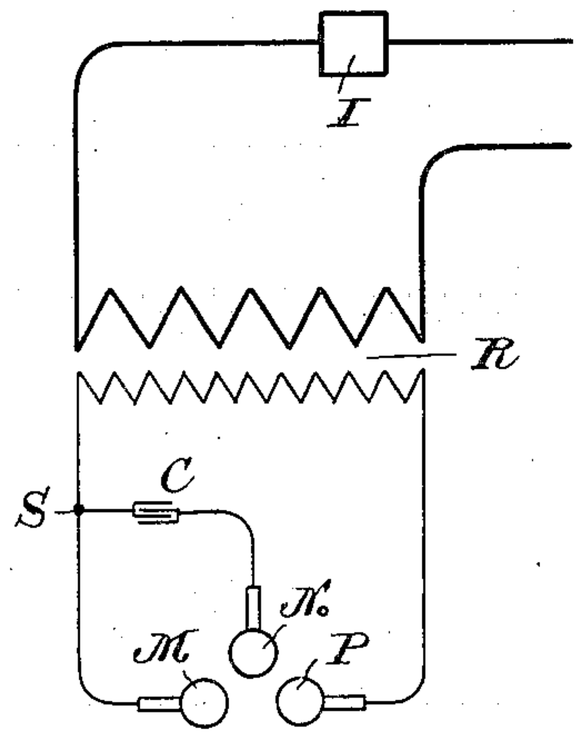



*Fig. 2.*

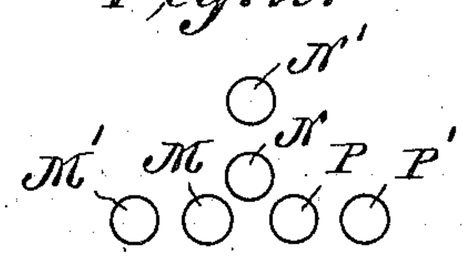
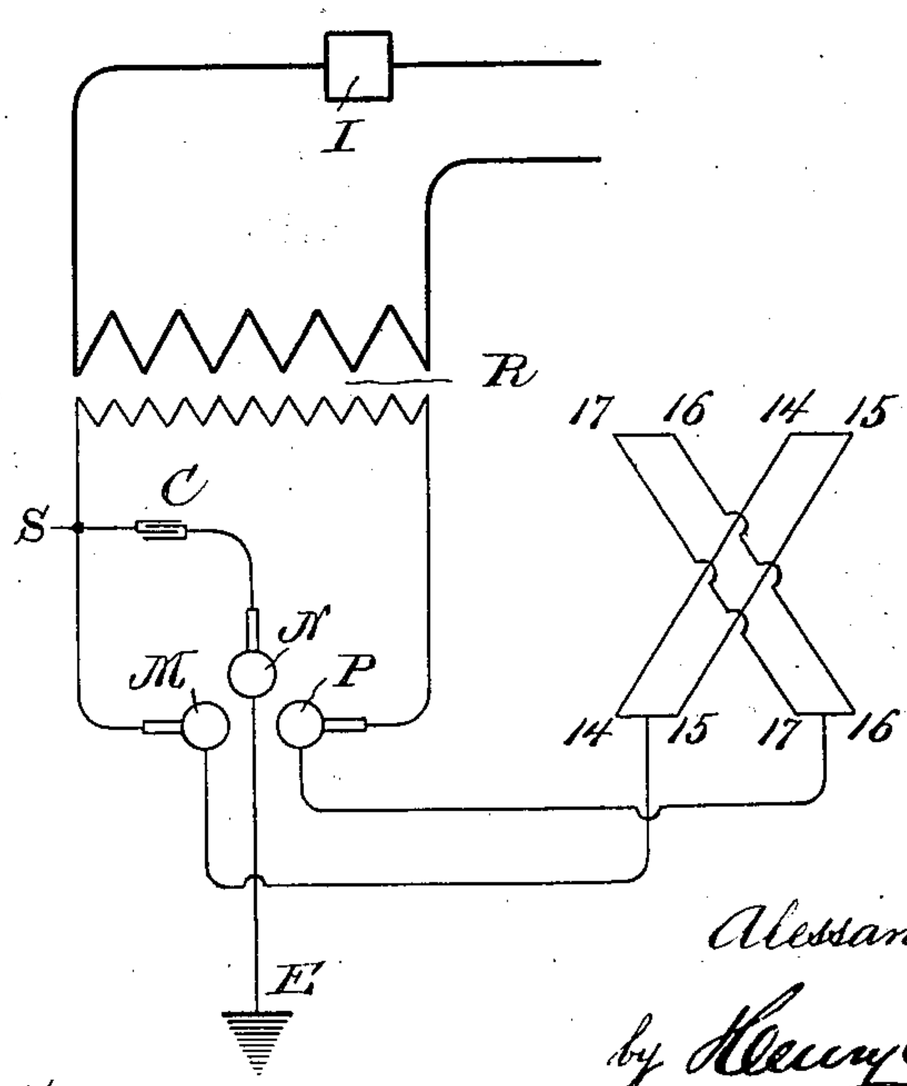



*Fig. 3.*




Witnesses.

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ALESSANDRO ARTOM, OF TURIN, ITALY.

## APPARATUS FOR PRODUCING ELECTRIC WAVES.

No. 817,137. Specification of Letters Patent. Patented April 3, 1906.

Original application filed January 3, 1903, Serial No. 137,692. Divided and this application filed July 6, 1904. Serial No. 215,510.

*To all whom it may concern:*

Be it known that I, ALESSANDRO ARTOM, industrial and electrical engineer, professor at the G. Ferraris School of the Royal Industrial Museum of Turin, a subject of the King of Italy, residing at Turin, in the Kingdom of Italy, (whose post-office address is 3 Via Venti Settembre,) have invented certain new and useful Improvements in Apparatus for Producing Electric Waves; 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 and figures of reference marked thereon, which form a part of this specification.

This invention relates to wireless telegraphy or more generally to the electrical transmission across space and particularly to apparatus therefor, being a division of my application Serial No. 137,692, filed January 3, 1903; Patent No. 770,668, September 20, 1904; whereby circularly and elliptically polarized electromagnetic waves are directly produced by two or more oscillatory discharges differing in phase and direction to produce a compact cone of electric rays.

In the accompanying drawings in which like parts are similarly designated—Figure 1 is a diagrammatic view illustrating a form of apparatus for the sending-station. Fig. 2 is a detail view. Fig. 3 is a second modification of the apparatus shown in Fig. 1.

In the form of apparatus shown in Fig. 1, the secondary terminals of an induction-coil R, the primary of which is fed with a continuous or alternate current and is provided with an interrupter I, are connected with two discharge-balls M, P or other suitable conductors. A third suitable discharge-conductor N is electrically connected through a suitable self-induction coil or preferably a suitable small condenser C to be suitably calculated, with one of the secondary terminals of the induction-coils. The three discharge-conductors are disposed at the vertices of a right isosceles triangle. A fourth suitable discharge-conductor can be fitted so as to form a parallelogram together with the others. This fourth conductor can be insulated or electrically connected with one of the other three. It can also be connected through another small condenser with the secondary terminal of the coil other than that with which the conductor N is connected; this arrangement allows the circuits to be more symmetrical and better fitted to syntonized apparatus. The discharge-conductors may also, in the present combination of circuits, be disposed on the same straight line. In this particular case of the general described disposition, waves with a difference of phase of a quarter-period are produced instead of circularly or elliptically polarized waves, by using the condenser C.

In Fig. 2, the discharge-conductors are shown arranged in pairs and there being a pair of conductors located at each vertex of a right triangle.

In Fig. 3, is shown the connection of the discharge-conductors with the aerial conductors whose object it is to reinforce the circular or elliptical polarization of the magneto-electric waves already produced by the discharge-conductors and to transmit said waves across space in order to produce signals at a greater distance than by not employing such aerial conductors and using only the discharge-conductors. I have illustrated in Fig. 3 four aerial conductors electrically coupled in pairs and the pairs disposed at right angles to each other. The aerial 14 15, is electrically connected with the discharge-conductor, M, and the aerial 16 17, is connected with the discharge-conductor, P, while the third discharge-conductor may be connected to earth at E. The aerial conductors are arranged in or about a vertical plane.

At every current impulse sent out by the induction-coil, several oscillatory discharges are produced and an oscillatory current is distributed in the secondary conductors. This current reaches the branch point S, Figs. 1, 3 and 5, part of it going to S, C, N, and part to S, M, producing discharges from N to P and from M to N, as indicated by the arrows, and since there is a capacity in the branch S, N, that causes an advancement in the phase, the current arrives at N advanced in phase. The oscillations that are transmitted between N, P and M, N being already displaced in phase meeting at an angle (in these cases a quarter of a period) will combine to form a radiation circularly or elliptically polarized that tends to assume a predetermined direction.

The substantial feature of my present invention is that elliptically or circularly polarized electromagnetic waves are directly produced and transmitted in a predetermined

direction, and the greater energy is transmitted in this direction. Rotary effects round this direction are easily observable upon little solids of revolution of dielectric materials or other suitable composition, as a rotating electrostatic and magnetic field is produced in said direction by my present arrangement. And it is possible to increase these mechanical effects by applying my present invention. In fact I can dispose one or several other similar systems of three or more discharge-conductors, M′, N′, P′, all round the same predetermined direction (Fig. 2), said discharge-conductors being connected in each system in the same manner as described for the first one. Each of these discharge-conductor systems may be fed by its own independent induction-coil; or the induction-coils of said several systems can be electrically connected with each other.

By the described improvements the aerial conductors of wireless telegraphy may be considerably diminished in height; and the construction of syntonized apparatus is rendered easier.

The present invention may be applied to wireless telegraphy and other electrical transmissions across space very usefully. The great advantage in using such electric waves lies in sending out the radiations from the transmitting-station in a compact cone in or about a single direction which is normal to the plane of the discharge-conductors and to the plane of the aerials, both of these planes being parallel to one another, instead of sending the same amount of energy subdivided in an infinite number of radiations simultaneously in all the radial directions of a sphere whose center is the transmitting-station, thereby effecting a great saving in energy. The cone of rays being directly produced without reflection or refraction and in the same direction as their generation, there is no loss of energy, thereby enabling the receiving-station to clearly and distinctly receive the signals, and every other station which is not in or about in a direct line between the two stations in question will either not be influenced at all, even if the waves have great force, or said stations will at most receive confused and unintelligible signals.

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

1. The combination with means to produce electrical current; of two discharge-terminals supplied with current therefrom and a third discharge-terminal arranged with respect to the other two at the vertex of a triangle, means to electrically connect said terminal in parallel with one of the other terminals and means to produce capacity in the electrical connection of the third terminal.

2. The combination with means for producing two oscillations out of phase; of discharge-terminals each of which is electrically connected to said means and supplied with current differing in phase from that in the other terminals, substantially as described.

3. The combination with means for producing three-phase current; of discharge-terminals arranged at the vertices of a triangle and means to supply the discharge-terminals at each vertex with current of different phase, substantially as described.

4. The combination with means to produce electrical current; of two discharge-terminals electrically connected thereto and a third discharge-terminal arranged at the vertex of a right isosceles triangle and electrically connected in parallel with one of the other terminals, and means to throw the current therein out of phase, substantially as described.

5. The combination with three discharge-terminals; of means to supply each with current differing in phase from that in the others, and aerial conductors connected thereto and disposed at right angles to each other, 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:

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GOTTARDO C. PIRONI. [L. S.]