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P. C. HEWITT.

METHOD OF RADIATING ELECTROMAGNETIC WAVES.

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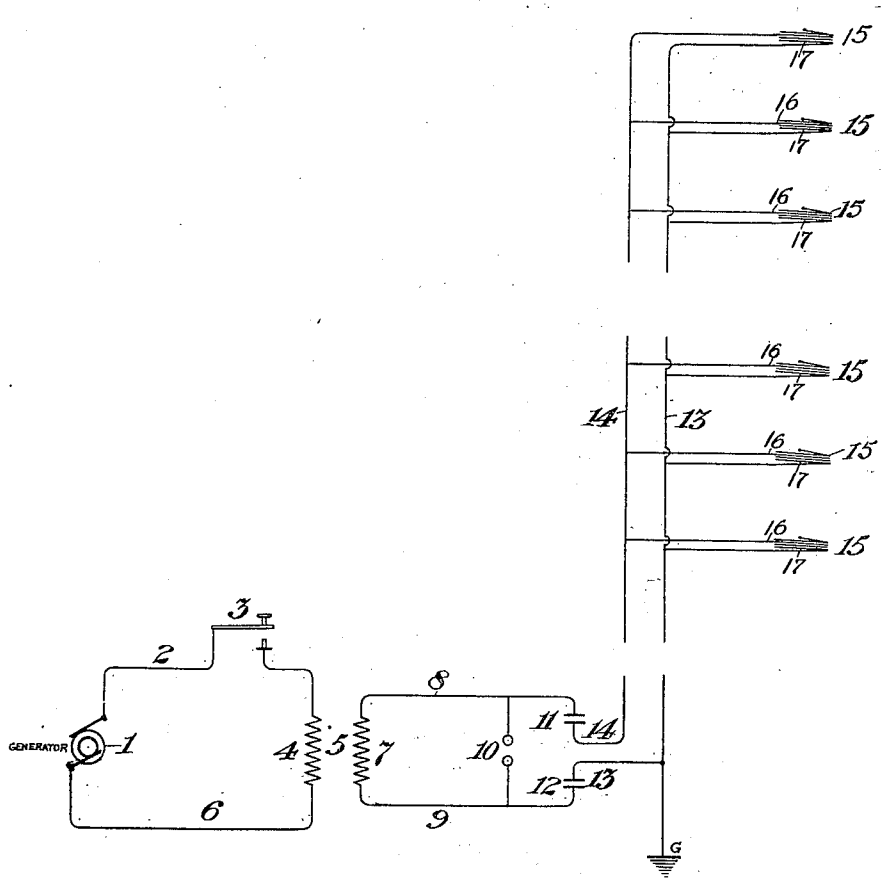

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METHOD OF RADIATING ELECTROMAGNETIC WAVES.

No. 856,150. Specification of Letters Patent. Patented June 4, 1907.

Application filed January 20, 1904. Renewed February 21, 1907. Serial No. 358,725.

To all whom it may concern:

Be it known that I, PETER COOPER HEWITT, a citizen of the United States, and a resident of New York, county of New York, State of New York, have invented certain new and useful Improvements in Methods of Radiating Electromagnetic Waves, of which the following is a specification.

My invention relates to certain improvements in the construction, organization and method of operation of wireless telegraphy and kindred apparatus. Heretofore it has been customary to employ as a radiating circuit some form of extended conductor usually projected into the air from which the energy is radiated in the form of electric waves, such extended conductor being repeatedly charged with high electrical potentials.

My invention relates particularly to a novel form of radiating circuit. While the exact theory of operation of the usual form of aerial radiator may not be absolutely determined, yet it seems probable that the waves of electric potentials to which the conductor is subjected, project into space waves which may be due to the magnetic field established in the neighborhood of the conductor by the electric currents in the conductor. The direction of such magnetic field induced by a vertical conductor would be in a horizontal plane, and the distribution of the resultant waves of stress would then be such as would result from such field primarily generated in a horizontal direction. More generally stated, any straight wire, whatever its direction, when energized by oscillatory currents of a time period equal to the natural time period of said wire, generates a field of force whose magnetic lines lie in planes perpendicular to said wire, the electrostatic lines lying at right angles to the magnetic lines, in planes substantially radial to the wire. The direction and length of such straight wire determine the direction and distribution in space of the electrostatic lines as longitudinal of the wire.

One of the purposes of my invention is to secure a field of force having primarily a direction such that the direction and space distribution of the magnetic and electrostatic lines of force with respect to the length of the generating conductor or radiator, are reversed so that the magnetic lines extend the entire length of the radiator and tend to lie in the radial planes passing through the axis of the radiator, while the electrostatic lines tend to lie in planes at right angles to the axis of the radiator. By my arrangement the magnetic and electrostatic lines, considered with respect to the longitudinal axis of the radiator, are substantially at right angles to those which would be generated by a straight wire located at and extending along such axis.

The general plan of my invention is to provide any suitable system of primary or exciting circuit with a radiating circuit comprising a series of two or more coils or solenoids having a common axis and preferably disposed in a vertical direction. These may be connected in multiple and so proportioned as to produce a resulting vertical line of magnetization adapted to radiate. By proportioning the length of the field created by the solenoids to the time of variation the true length best adapted for radiation may be obtained. In some cases it may be desired to arrange the series in some other direction than a vertical, but I usually prefer to have the solenoids so arranged that the axis of each is an extension of the axis of the others. I prefer to employ a considerable number of coils so that the electro-magnetic and electrostatic lines will be sufficiently distributed in space thereby insuring efficient radiation and propagation thereof.

By connecting the coils in the manner of auto-converters and each having a capacity and inductance equal to one-quarter of a wave length and having one end grounded they will maintain a more intense field and consequent effect.

In the accompanying drawings, I have illustrated diagrammatically a transmitting circuit equipped with an aerial radiating circuit involving the features of my invention.

Referring to the drawings, 1 represents a suitable source of electric currents with one pole of which is connected a conductor, 2, leading through any suitable transmitter, 3, to the primary coil, 4, of a transformer 5. The remaining terminal of the primary of the transformer is connected by a conductor, 6, with the other pole of the source. The sec-

ondary, 7, of the transformer has one end connected with a conductor, 8, and its other end connected with a conductor, 9. A suitable spark-gap, 10, is connected between the conductors 8 and 9. Condensers 11 and 12 are connected with the respective conductors 8 and 9, and between these condensers are connected conductors, 13 and 14, which are here shown as being led in a vertical direction, and between them are connected coils or solenoids, 15, arranged in multiple. The axes of these coils are here shown as vertical, the solenoids all being arranged in a vertical line. Currents traversing the vertical conductors will then be distributed through the several solenoids and cause a resultant magnetic field extending axially through the several solenoids, with the consequent aerial radiation. The several coils are so proportioned with reference to each other that they will severally receive their proper currents, and will vibrate substantially synchronously, in proper phase to produce the resultant rapidly varying magnetic field or flux.

The coils are here shown as each having one terminal connected with one of the vertical conductors 13, while the other vertical conductor 14, is connected with an intermediate point 16. When the connection is thus made at an intermediate point of the coil 15, instead of at the ends thereof, the part of the coil 17 below the connection 16 constitutes the primary of a step up auto-converter, while the entire winding 15 constitutes the secondary thereof. By thus connecting the coils in the manner of auto-converters having one end grounded as at G and having a capacity and inductance such as to give a time period of vibration corresponding to one-quarter of a wave length, they will maintain a more intense field and consequent effect, when excited substantially synchronously and in phase by energy from a suitable source, as, for instance, by discharge of the condensers 11, 12.

It is to be understood that while I have advanced a general theory of operation, my invention is not to be construed as necessarily depending upon the correctness of that theory.

In a divisional application Serial Number 196,841, filed March 7, 1904, claims are made upon the apparatus described herein.

I claim as my invention:—

1. The method of radiating energy by means of electromagnetic waves, which method consists in generating by separate circuits, a series of magnetic fluxes, in the same direction, along a common axis forming one field.

2. The method of radiating energy by means of electromagnetic waves, which method consists in generating by parallel circuits, a series of magnetic fluxes in the same direction, along a common axis forming one field.

3. The method of transmitting signal waves, which method consists in generating a series of vibratory electric currents, transmitting the same through a series of separate circuits, producing thereby synchronous fluxes in the same direction, along an axis common to all the circuits and radiating the energy thereof.

4. The method of transmitting signals by means of electromagnetic waves, which method consists in generating waves having their electromagnetic lines lying in radial planes having the linear axis of a longitudinally extending radiator, as their line of intersection.

5. The method of transmitting signals by means of electromagnetic waves, which method consists in generating waves having their electromagnetic lines lying in radial planes having the linear axis of a vertically extending radiator, as their line of intersection.

6. The method of transmitting energy by means of electromagnetic waves, which method consists in causing electric currents to traverse circular or spiral paths having a common axis and causing said currents to alternate in proper phase to produce synchronously alternating, similar, magnetic fields, substantially as and for the purpose described.

7. The method of transmitting energy by means of electromagnetic waves, which method consists in exciting free electrical oscillations in circular or spiral paths having a common axis and causing said oscillations to alternate in proper phase to produce synchronously alternating similar, magnetic fluxes in the same direction, substantially as and for the purpose described.

Signed at New York, in the county of New York, and State of New York, this 18th day of January, A. D. 1904.

PETER COOPER HEWITT.

Witnesses:
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