R. A. FESSENDEN.

TRANSMISSION AND RECEIPT OF ELECTRICAL ENERGY.

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979,144. **Patented Dec. 20, 1910.**

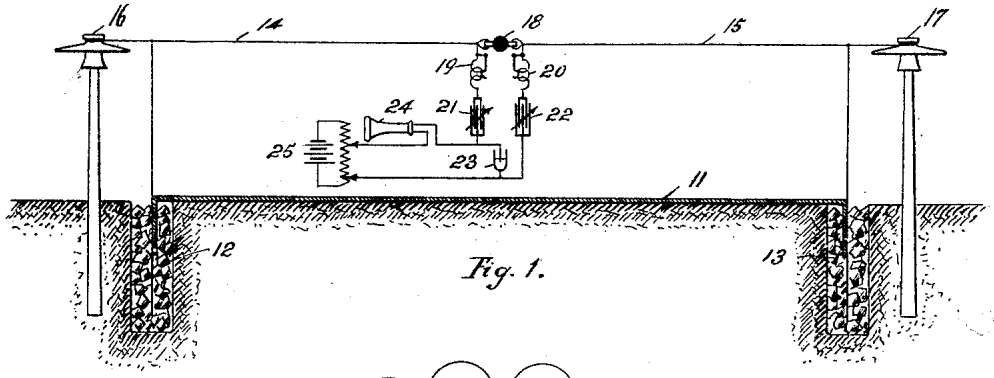

Fig. 1.

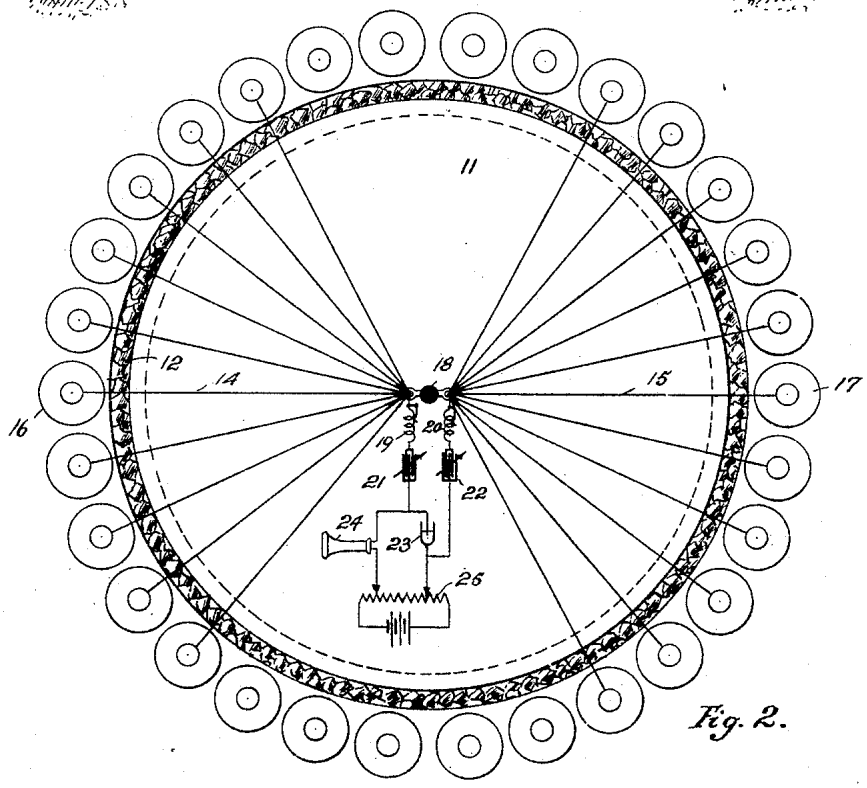

Fig. 2.

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TRANSMISSION AND RECEIPT OF ELECTRICAL ENERGY.

979,144. Specification of Letters Patent. **Patented Dec. 20, 1910.**

Application filed October 31, 1907. Serial No. 400,131.

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, a citizen of the United States, residing at Brant Rock, in the county of Plymouth, State of Massachusetts, have invented certain new and useful Improvements in Apparatus for the Transmission and Receipt of Electrical Energy, of which the following is a specification.

My invention relates to means for transmitting and receiving electrical energy and more particularly to wireless signaling. Its primary object is to provide improved means for the transmission and receipt of energy without the use of wires joining the transmitting and receiving stations, and more particularly an improved type of apparatus for collecting and transmitting electromagnetic waves.

In the accompanying drawings forming a part of this specification Figure 1 shows a cross sectional and diagrammatic view of apparatus for carrying out my invention and Fig. 2 shows a plan view of the same.

In the practice of my invention, instead of using a vertical antenna operated by the electrostatic component of the waves or a looped antenna operating by the electromagnetic component of the waves I use horizontal wires stretched at no great distance from the ground and approximately parallel thereto, thereby using the surface current flow of the electromagnetic waves.

In the prior practice, when the waves were sent or received by means of a higher and a lower capacity (earth) connected by a vertical conductor in which the receiver or sender was inserted, the electrostatic component of the waves was utilized. There have also been suggested methods of transmitting by means of coils whose inductive action was used, but no electromagnetic waves were employed by this method, or, if they could be produced with horizontal coils, by means of the condenser discharges, the effect could be only insignificant and the signals could not be sent or received in a given direction. In other cases, where two vertical antennæ have been placed apart by half a wave length, and some times perhaps connected by horizontal bridges to close the circuits, these closed circuits or planes of the antennæ have been at right angles to the direction of propagation of the waves, and the vertical parts of the antennæ were equal to a quarter wave length.

Apparatus comprising a loop or coil lying in the direction of propagation of the waves, and the use of a horizontal aerial, in a broad sense is known, but in the present case the applicant uses the component of the wave flowing through the earth surface, which is diverted through the receiving and sending instruments. This method has a number of advantages, in that it does not require the erection of tall towers and is free from atmospheric disturbances and is selective as to direction.

In Figs. 1 and 2, 11 is a large sheet, preferably made by riveting together sheets of thin soft iron of high magnetic permeability. These sheets may be supported on beams or may be laid directly on the ground as shown. The diameter of the sheet is preferably approximately a half wave length of the electromagnetic waves to be received or transmitted. The edges of the sheet are grounded all around by artificial grounds 12, 13. To the edges of the sheet are attached conductors 14, 15 supported by insulators 16 and 17 and separated from each other by the strain insulator 18. These conductors are connected, through the variable inductances 19, 20 and the variable condensers 21, 22 to the receiver 23. 24 is a telephone receiver and 25 a potentiometer. For transmitting any suitable form of transmitter is substituted in place of the receiver 23. The object of using the sheet 11 is to prevent the waves from traveling through the earth instead of traveling through the conductors 14, and 15. If the sheet 11 is omitted the apparatus will still operate but much less efficiently than when the sheet 11 is present. The object of having the sheet 11 of iron is so that the sheet may present a large inductance to the travel of the highly oscillatory surface currents and that thereby more of the energy may be forced through the conductors 14, 15.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:

1. In a system for the transmission of energy by electromagnetic waves, a receiver

and means for diverting and utilizing in said receiver the energy of the surface currents produced by electromagnetic waves.

2. In a system for the electrical transmission of energy by electromagnetic waves means operative to produce a signal through the action of the surface currents produced by electromagnetic waves, and magnetic material arranged for diverting the surface currents from the ground through the means for utilizing the currents.

3. In a system for the transmission of energy by electromagnetic waves, a horizontal conductor, a receiver operatively connected thereto and a sheet of material having comparatively high magnetic permeability placed substantially parallel with the conductor to divert earth currents through the receiver.

4. In apparatus for signaling by electromagnetic waves, the combination of a looped conductor and an indicating instrument in circuit, and a body of magnetic material arranged to divert surface currents through said conductor and receiver, substantially as described.

5. In a system for the transmission of energy by electromagnetic waves, a horizontal conductor, a signaling instrument operatively connected thereto and a sheet of material having comparatively high magnetic permeability placed substantially parallel with the conductor to divert earth currents through the receiver.

6. In apparatus for the transmission of energy by electromagnetic waves, the combination with an approximately horizontal conductor and a signaling instrument connected thereto, of a sheet of magnetic material lying substantially parallel to the conductor and connected to the ends thereof.

7. In apparatus for the transmission of energy by electromagnetic waves, the combination with an approximately horizontal conductor and a signaling instrument connected thereto, of a sheet of magnetic material lying substantially parallel to the conductor and connected to the ends thereof, said sheet being of a diameter equal to approximately a half wave length of the waves to be transmitted or received.

8. In apparatus for signaling by electromagnetic waves, the combination with a series of radially arranged substantially horizontal antennæ, and a signaling instrument operatively connected thereto, of a sheet of magnetic material placed below the antennæ and substantially parallel thereto.

9. In apparatus for signaling by electromagnetic waves, the combination with a series of radially arranged substantially horizontal antennæ, and a signaling instrument operatively connected thereto, of a sheet of magnetic material placed below the antennæ and substantially parallel thereto and connected to the grounded ends of said antennæ.

In testimony whereof I have hereunder signed my name in the presence of the subscribed witnesses.

REGINALD A. FESSENDEN.

Witnesses:

JESSIE E. BENT,

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