No. 818,363.

PATENTED APR. 17, 1906.

C. D. EHRET.

ART OF SIGNALING THROUGH SPACE.

APPLICATION FILED AUG. 25, 1905.

FIG. 1.

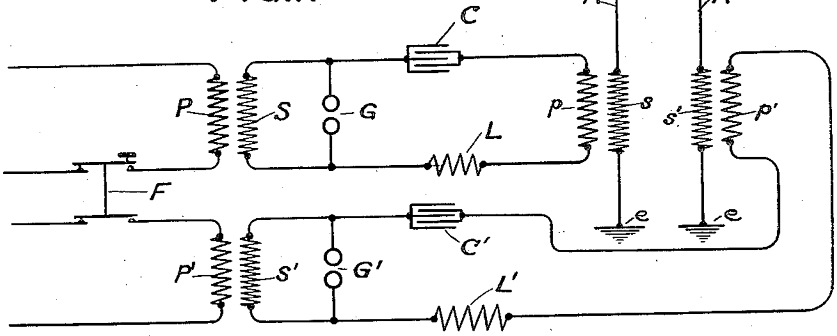


FIG. 2.

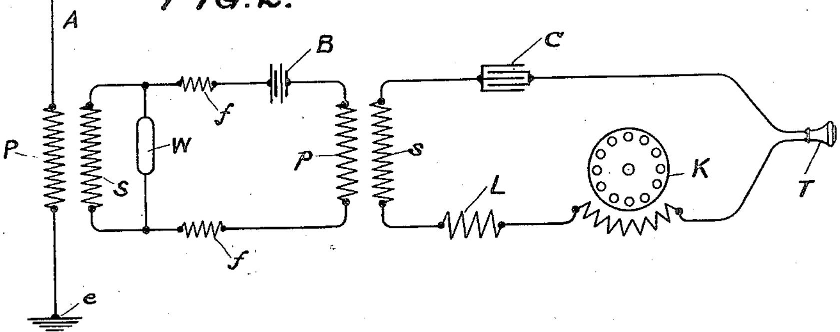
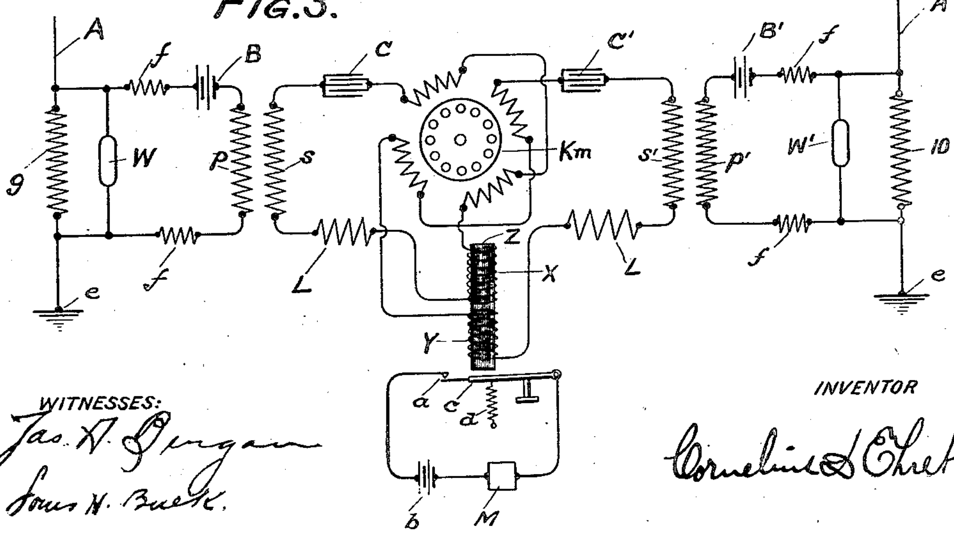


FIG. 3.



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ART OF SIGNALING THROUGH SPACE.

No. 818,363. **Specification of Letters Patent.** **Patented April 17, 1906.**

Original application filed July 27, 1903, Serial No. 167,129. Divided and this application filed August 25, 1905. Serial No. 275,760.

To all whom it may concern:

Be it known that I, CORNELIUS D. EHRET, a citizen of the United States, residing at Ardmore, in the county of Montgomery and State of Pennsylvania, have invented new and useful Improvements in the Art of Signaling Through Space, of which the following is a specification.

My invention relates to electrical signaling, more especially that system in which electroradiant energy representing the signal or message is transmitted through the natural media.

My invention consists in a method of transforming electroradiant energy into the energy of electric currents, such electric currents causing or controlling the production of an electric current of the fluctuating or alternating type and having a frequency corresponding to the frequency of the transmitted wave-trains and boosting or reinforcing the alternating current so produced to more effectively control or actuate a receiver or other translating device.

Reference is to be had to the accompanying drawings, in which—

Figure 1 is a diagrammatic view of the circuits of a transmitting apparatus for impressing upon the natural media two series of wave-trains, the trains of each series being displaced in time with respect to each other and the frequency or periodicity of the electromagnetic waves forming the trains at one series being different from the periodicity or frequency of the electromagnetic waves forming the trains of the other series. Fig. 2 is a diagrammatic view of the circuit arrangements at a receiving-station wherein the received electroradiant energy causes or controls the production of a fluctuating or alternating current, such alternating or fluctuating current being reinforced or boosted. Fig. 3 is a diagrammatic view of receiving-circuits in which dephased wave-trains cause or control the production of fluctuating or alternating currents, such currents being reinforced or boosted.

Referring to Fig. 1, P and P′ are primary coils of two separate transformers, such primary windings being included in the circuit of a source of two-phased currents—that is, the current passing through the winding P is dephased ninety degrees with respect to the current passing through the winding P′. The key F is a compound one so arranged as to simultaneously open or close the circuits of the primaries P and P′. S is the secondary winding of the transformer whose primary is P, and S′ is the secondary of the transformer whose primary is P′. Both of these transformers are preferably step-up transformers, the voltages of the secondaries being preferably equal. G is a spark-gap in shunt to the secondary S, and this spark-gap, along with the condenser C, transformer-primary *p*, and inductance L, forms an oscillating circuit of very short period or very high frequency, as well understood in this art. A is an aerial or radiating conductor between which and the earth-plate *e* is connected the transformer-secondary *s* of the transformer whose primary is *p*. G′ is a spark-gap in shunt to the secondary S′ and forms, along with condenser C′, transformer-primary *p*′, and inductance L′, an oscillating circuit of very high frequency. A′ is a second aerial conductor between which and the earth-plate *e* is the transformer-secondary *s*′, coöperating with the primary *p*′. The frequency of the oscillations in the circuit C, *p*, L, and G depends, among other things, as is well understood, upon the product of the capacity and inductance of such circuit. Similarly, the frequency of the oscillating circuit C′, *p*′, L′, and G′ depends upon the product of the capacity and inductance of such circuit. The capacity and inductance, or rather their product, of the circuit C *p* L G is taken different from that of the circuit C′, *p*′, L′, and G′, so that the frequency of the electromagnetic waves radiated from the conductor A is different from the frequency of the electromagnetic waves radiated from the conductor A′. Since the current supplied by the secondaries S and S′ are in quadrature, the oscillations for each train of waves generated in the circuit C *p* L G begin at a time earlier (or later) than the commencement of a wave-train generated by the circuit C′, *p*′, L′, and G′, such difference in time amounting to a quarter of a period of the current supplied to the transformer-primaries P and P′. In other words, the wave-trains emanating from the conductor A are dephased with respect to the wave-trains emanating from the conductor A′, and, further, the frequency of electromagnetic waves radiated from A is different from the frequency of the electromagnetic waves radiated from A′. Suppose the two-phased currents supplied to P P′ to have a frequency of one hundred and eighty cycles per second. Then the wave-trains emanating from A will be dephased from the wave-trains emanating from A′ by an amount corresponding with a quarter period or one seven-hundred-and-twentieth of a second. Furthermore, the electromagnetic waves radiated from A may be at the rate of one million per second, while those radiated from A′ may be at the rate of seven hundred and fifty thousand per second. I prefer to have the condensers C and C′ of very nearly the same capacity, the inductances of the two circuits being chosen differently in order to secure the different frequencies, so that both condensers will be charged to their maximum potential in equal periods of time, so that the spark at the gap G will precede (or succeed) the spark at G′ by exactly a quarter of a period of the current supplied to P and P′. The spark-gaps G and G′ are preferably similar in every respect, so that both will break down under similar circumstances.

From the foregoing description it is seen, therefore, that by depressing the operator's key F a plurality of series of wave-trains are transmitted, the wave-trains of the different series being dephased with respect to each other and the electromagnetic waves of each series having a frequency different from the frequency of the electromagnetic waves of any other series.

Referring to Fig. 2, A is an aerial conductor by which is received electroradiant energy. P is the primary winding of a transformer and is connected between A and the earth-plate *e*. Across the secondary S is connected the self-restoring wave-responsive device W, which controls the local circuit including the choke-coils *f f*, battery B, and primary winding *p* of a transformer. By this arrangement for every wave-train impinging upon A a current impulse passes through the primary *p*. In the circuit of the secondary *s* there is then a series of impulses or groups of impulses whose rate of succession depends upon the rate of succession of the wave-trains transmitted. To make such secondary circuit selective of wave-trains succeeding each other at a certain rate only, the condenser C and the inductance L are employed to so attune such circuit. T represents a telephone-receiver, recording instrument, or any other translating device. In cases where the current in the circuit of the secondary *s* is extremely faint, due to excessive distance between the transmitting and receiving stations or for any other cause, it is reinforced by the induction-generator K. This induction-generator comprises a primary winding included in series in the circuit of *s*. The rotor consists of a cylinder or disk of magnetizable metal properly laminated and carrying short-circuited conductors, as well understood in the electrical art. By rotating the rotor at a rate in excess of synchronism for the frequency of the impulses or groups of impulses passing through its primary the current is reinforced or boosted. By the arrangement shown in Fig. 2, therefore, the efficiency of a wireless-telegraph receiving system is increased, and with a given amount of energy employed or radiated at the transmitting-station a greater effect may be produced in the recording instrument of the receiver or any other translating device.

In Fig. 3, A and A′ represent aerial receiving-conductors, between which and the earth *e* are serially connected the inductances 9 and 10, respectively. The inductance 9, with the aerial A, constitutes a tuned or selective receiving-conductor selective of the waves of one series of transmitted wave-trains. Similarly, the inductance 10 and aerial A′ are selective of the waves of another series of wave-trains. The wave-responsive devices W and W′, preferebly self-restoring, are associated with the inductances 9 and 10. Controlled by W is a local circuit including the choke-coils *f f*, battery B, and a primary winding *p* of a transformer. The secondary *s* of the transformer is in series with the condenser C, one phase-winding of the two-phase induction-generator K^m, the winding X on the core Z, and the inductance L. The condenser C and inductance L are so chosen and adjusted as to make the circuit containing them selective of impulses succeeding each other at the rate of or at a mulitple of the rate of succession of the wave-trains emitted by the transmitter shown in Fig. 1. Similarly, the wave-responsive device W′ controls a local circuit including the primary of the transformer whose secondary *s′* is in series with the condenser C′, the other phase-winding of the induction-generator K^m, the winding Y on the core Z, and the inductance L′. C′ and L′ are so chosen and adjusted as to render the circuit containing them selective of impulses or groups of impulses succeeding each other at a rate equal to or a multiple of the rate of succession of the wave-trains emitted by the transmitter shown in Fig. 1. By rotating the rotor of the induction-generator K^m above synchronism for the frequency of the impulses or groups of impulses in the circuits of its windings the currents of such windings will be amplified or boosted and will coöperate in magnetizing the core Z. Since the transmitted wave-trains do not overlap, but alternate with each other, the core Z receives twice as many or a multiple of twice as many magnetizations per unit of time as there are wave-trains in a single series per unit of time. The result is that the armature *c* is more positively attracted and prevented from fluttering and the operation more certain and effective. When the armature *c* is attracted, it engages the contact *a*, thus closing a circuit through the battery *b* and a signal translating or recording instrument, a Morse recorder M. The spring *d* opposes the attraction of the armature *c*.

This application is a division of my prior application, filed July 27, 1903, and bearing Serial No. 167,129.

What I claim is—

1. The method of rendering intelligible messages or signals transmitted through the natural media in electroradiant form, which consists in transforming the received electroradiant energy into the energy of electric currents or charges, controlling by such currents or charges locally-generated electrical energy to produce changes or fluctuations thereof, amplifying the fluctuations or changes of said energy, and controlling or actuating a signal-translating instrument by the amplified energy.

2. The method of rendering intelligible messages or signals transmitted through the natural media in electroradiant form, which consists in transforming the received electroradiant energy into the energy of electric currents or charges, controlling by said currents or charges the production of current fluctuations representing the transmitted messages or signals, increasing or amplifying said current fluctuations, and employing said amplified or increased fluctuations to reproduce the messages or signals.

3. The method of rendering intelligible messages or signals transmitted through the natural media in electroradiant form, which consists in transforming the received electroradiant energy into the energy of electric currents or charges, controlling by said currents or charges the production of fluctuations of current locally generated, boosting or reinforcing said current and reproducing the messages or signals by said boosted or reinforced current.

4. The method of rendering intelligible messages or signals transmitted through the natural media in electroradiant form, which consists in transforming the electroradiant energy into the energy of electric currents or charges, controlling by said currents or charges the production of a fluctuating current, boosting or reinforcing said current without destroying its message or signal representing form, and reproducing the messages or signals by said boosted or reinforced current.

5. As an improvement in the art of reproducing signals or messages represented in transmission by electroradiant energy, the step which consists in amplifying the current changes or fluctuations representing the messages or signals.

In testimony whereof I have hereunto affixed my signature in the presence of two subscribing witnesses.

CORNELIUS D. EHRET.

Witnesses:

ALICE S. MARSH,

ELEANOR ROBERTS.