R. A. FESSENDEN.

WIRELESS SIGNALING.

APPLICATION FILED DEC. 14, 1904.

1,178,507.

Patented Apr. 11, 1916.

Fig. 1.

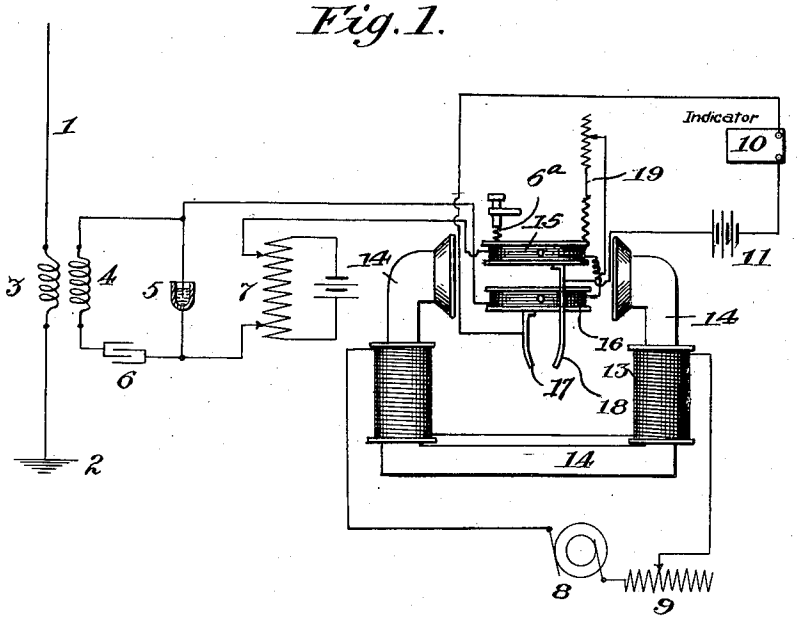
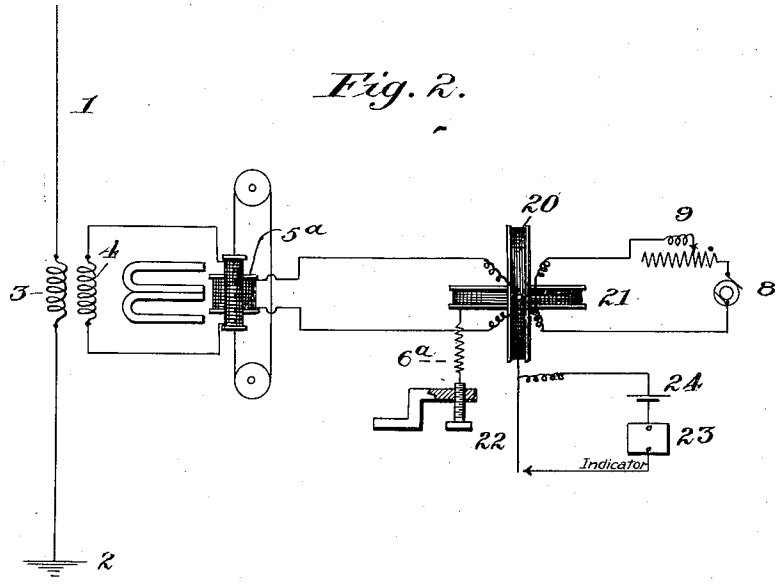


Fig. 2.



Witnesses:

Geo. E. Garrett

Andrew McLuckie.

Inventor:

Reginald A. Fessenden

by Dennis S. Wolcott

Attorney.

by

UNITED STATES PATENT OFFICE.

REGINALD A. FESSENDEN, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SAMUEL M. KINTNER, OF PITTSBURGH, PENNSYLVANIA, AND HALSEY M. BARRETT, OF BLOOMFIELD, NEW JERSEY, RECEIVERS.

WIRELESS SIGNALING.

1,178,507. Specification of Letters Patent. Patented Apr. 11, 1916.

Application filed December 14, 1904. Serial No. 236,862.

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, a citizen of the United States, and resident of Washington, District of Columbia, have invented certain new and useful Improvements in Wireless Signaling, of which the following is a specification.

The invention herein described relates to improvements in apparatus for wireless telegraphy and has special reference to the apparatus employed for producing indications.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings forming a part of this specification, Figures 1 and 2 are diagrammatic views illustrating different forms of this invention.

The current of voltages generally produced in the indicating circuit at the receiving station of the wireless telegraph system are sufficient to operate a telephone or other delicate indicating instrument, but are not sufficient to actuate a call or a recording mechanism directly. This is a great disadvantage in the art, as it does not permit of the receiving station being called up when it is desired to communicate with it.

In the practice of my invention two frequencies are generated at the sending station, one being the wave frequency and the other being the frequency of recurring groups of the waves, called a group frequency. Currents or voltages which have the same frequency as the group frequency are thereby produced in the indicating circuit at the receiving station.

In order to obtain an increased effect to permit the use of a call or a recording mechanism I employ in the receiving station a source of intermittent or alternating current having the same frequency as the group frequency of the signaling impulses. Other frequencies independent of the wave frequency may be used in lieu of the group frequency, but the group frequency is generally preferred. By the use of this independent source of intermittent or alternating current, I obtain a powerful alternating magnetic field and arrange in said field a coil or coils connected in the receiver circuit through which flow the currents produced by the receiver waves having the group frequency of the sending station, so that there will be a mutual action between this coil or coils and the independent alternating magnetic fields.

As the independent alternating magnetic field may be made as strong as desired, the amount of this interaction may be made very much greater than would otherwise be the case.

It is preferred that the frequency of the independent alternating current source should differ slightly from that of the group frequency at the sending station in order to prevent the phases of the independent alternating magnetic field and the current in the receiver circuit from accidentally becoming such as to produce no interaction, in which case, of course, no indication would be produced but a dead point would exist. By making the frequency slightly different this possibility of no response is obviated, as the phase difference is constantly changing.

In Fig. 1, 1 is a receiving antenna grounded at 2, 3 is the primary and 4 the secondary of the transformer, the receiver 5 and condenser 6 being in the secondary circuit. The secondary circuit 4, 5, 6 and the receiving conductor are preferably tuned to the wave frequency. 7 is a potentiometer. 8 is a source of alternating current and 9 a means of regulating the current, 10 is an indicating mechanism, for example a siphon recorder or relay, 11 is the battery of the local circuit. 12 and 13 are coils in the local alternating circuit wound upon the magnet 14, which is constructed of laminated iron. 15 and 16 are coils in series with each other and arranged in the receiver circuit as shown and carrying contact points 17 and 18 adapted to close the local circuit 10, 11. The coils 15 and 16 are wound oppositely so that the voltages induced by the alternating flux of the magnet 14 neutralize each other. An exact neutralization can be obtained by any suitable means, as for example, by a shunt 19 placed around one of the coils or by adjusting the angle at which one of the coils naturally rests, as by the spring 6^a.

With the construction here shown the receiver 5 being a liquid barretter, a continuous current will constantly flow through the coils 15 and 16 but since the magnetic flux from the magnet 14 is alternating, the coils

will not tend to move. Should, however, electromagnetic waves reach the receiving station intermittent currents caused thereby and having the same frequency as the group frequency at the sending station, will flow through the coils. These fluctuating currents will interact with the magnetic field caused by the local source 8 and will cause one coil to move in one direction and the other coil in the other direction, since the coils are oppositely wound. Hence the contacts 17 and 18 will approach each other and close the circuit of call or recording or other mechanism 10.

Fig. 2 shows another form, in which the receiver is a magnetic receiver and the coil 5^a of the magnetic receiver arranged in the circuit in which the telephone is usually placed, is connected to a movable coil 20 placed at right angles to a fixed coil 21. The local alternating current from the source 8 flows through the fixed coil, and the variable currents from the magnetic receiver flow through the movable coil 20. The movable coil carries a contact point 22 which when the coil is moved closes a local circuit containing an indicating mechanism 23 and battery 24.

The neutralization of the voltage in the coils 20 and 21 may be effected by allowing one coil to swing freely and making the other coil adjustable in the field.

No claim is made herein to apparatus for the carrying out of the method, as such apparatus forms the subject-matter of an application filed Aug. 21, 1905, Ser. No. 275,163.

What I claim is:

1. As an improvement in the art of signaling by electro-magnetic waves, the method herein described which consists in generating at the receiving station an alternating magnetic flux and producing currents having a frequency different from the frequency of the alternating magnetic flux in the magnetic field, so that the current and flux will interact one upon the other.

2. As an improvement in the art of signaling by electro-magnetic waves the method herein described which consists in generating at the receiving station an alternating magnetic flux, producing currents having a frequency different from the frequency of the alternating magnetic flux in the magnetic field and utilizing this interaction to produce an indication.

3. As an improvement in the art of signaling by electro-magnetic waves, the method herein described which consists in generating at the receiving station an alternating dynamic field of force having a predetermined frequency, and also generating at the receiving station a second alternating dynamic field of force having a frequency the same as and generated by means of the groups of electromagnetic waves received at the receiving station from the sending station, said two frequencies being different and the two alternating electrodynamic fields being in such relation as to interact one upon the other, so as to produce an indication.

4. As an improvement in the art of signaling by electro-magnetic waves the method herein described which consists in generating at the receiving station an alternating magnetic flux, producing currents by electro-magnetic waves received at the station having a frequency different from the frequency of the alternating magnetic flux so that the current and flux will interact one upon the other.

5. As an improvement in the art of signaling by electro-magnetic waves the method herein described which consists in generating at the sending station electromagnetic waves having a wave frequency and a group frequency, producing by such waves at the receiving station currents or voltages having a frequency corresponding to the group frequency, generating an alternating magnetic flux and causing the current and the flux to interact one upon the other.

6. As an improvement in the art of signaling by electro-magnetic waves, the method herein described, which consists in generating at the sending station electromagnetic waves having a wave frequency and a group frequency, generating at the receiving station an alternating magnetic flux, producing currents by the received electro-magnetic waves having a frequency the same as the transmitted group and different from the frequency of the alternating magnetic flux, in the magnetic field, so that the current and flux will interact one upon the other, and utilizing this interaction to produce an indication.

7. As an improvement in the art of signaling by electro-magnetic waves, the method herein described which consists in generating at the receiving station, an alternating magnetic flux and producing currents having a frequency different from the frequency of the alternating magnetic flux in the magnetic field, said alternating field and alternating flux having such a number of sustained oscillations that beats are produced, so that the current and flux will interact one upon the other.

8. As an improvement in signaling by electromagnetic waves, the method herein described which consists in generating at the receiving station an alternating magnetic flux, producing currents having a frequency different from the frequency of the alternating magnetic flux in the magnetic field, said alternating currents and alternating magnetic flux having such a number of sustained oscillations that beats are produced

and utilizing this interaction to produce an indication.

9. As an improvement in the art of signaling by electromagnetic waves, the method herein described which consists in generating at the receiving station an alternating magnetic flux, producing currents by electro-magnetic waves received at the station having a frequency different from the frequency of the alternating magnetic flux in the magnetic field, said alternating current and alternating flux having such a number of sustained oscillations that beats are produced so that the current and flux will interact one upon the other.

10. As an improvement in the art of signaling by electro-magnetic waves, the method herein described which consists in producing a local alternating magnetic field, producing a second alternating magnetic field by impulses transmitted from the sending station, producing an indication by the inter-action of said fields and compensating the action of the local alternating field.

11. As an improvement in the art of signaling by electro-magnetic waves the method herein described which consists in producing a local alternating magnetic field, producing a second alternating magnetic field by impulses transmitted from the sending station, producing an indication by interaction of said magnetic fields and annulling the local action of the local magnetic field.

12. The method of detecting periodic electromagnetic wave impulses in wireless telegraphy, which comprises producing an intermittent field in a coil, passing the impulses to be detected through another coil to produce another intermittent field, causing said fields to interact and by their combined action to produce an indication, and meantime neutralizing the action of one intermittent field on the indicator, substantially as described.

13. The method of detecting periodic electromagnetic wave impulses in wireless telegraphy by passing them through a coil to produce an intermittent field, maintaining an alternating field in another coil and neutralizing its action on the indicator, and producing an indication by the interaction of the fields, substantially as described.

Signed at Washington, District of Columbia, this 14th day of December, A. D. 1904.

REGINALD A. FESSENDEN.

Witnesses:
THOMAS P. BROWN,
JESSIE E. BENT.