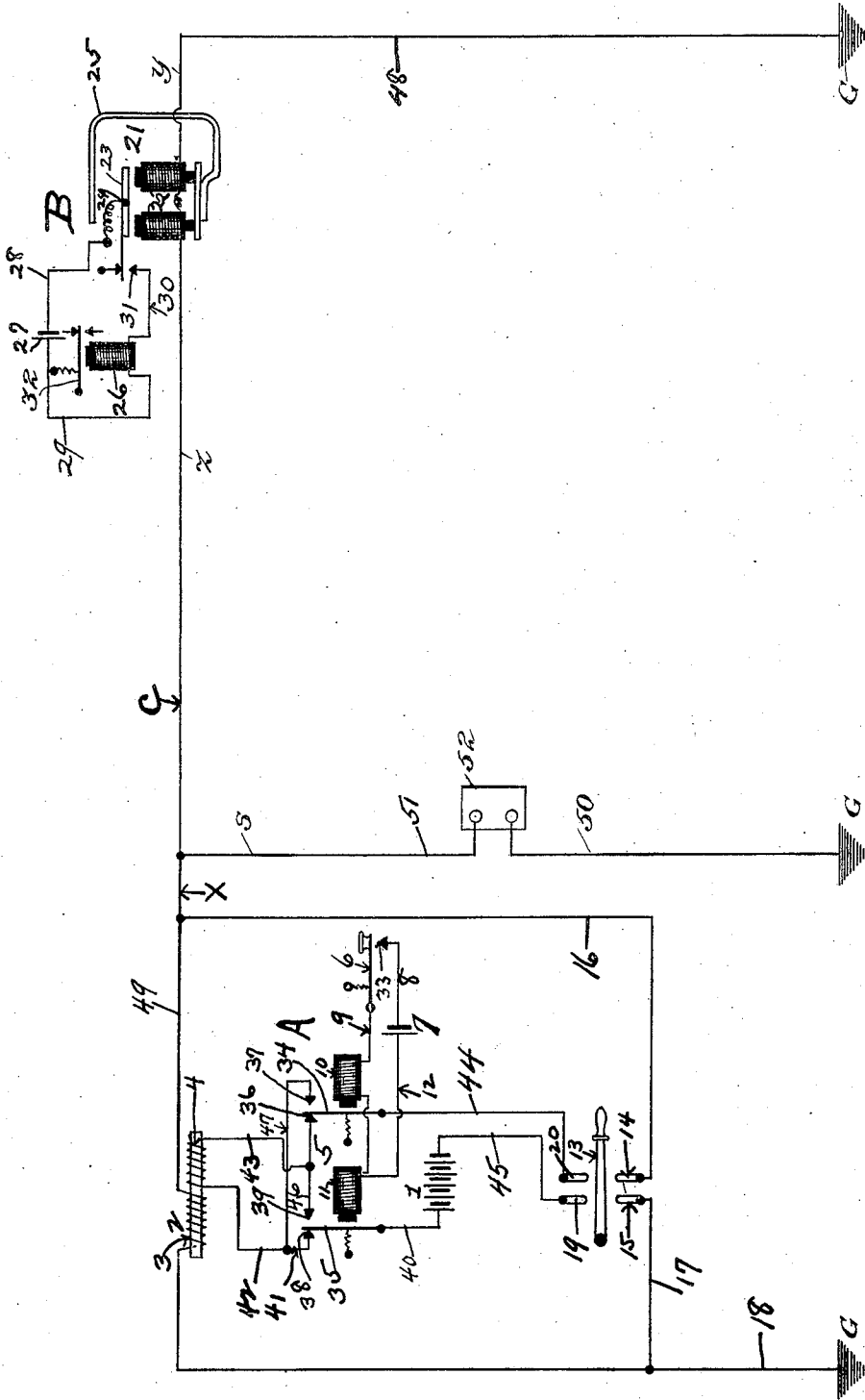


No. 852,502.

PATENTED MAY 7, 1907.

E. GARRETSON.
SIGNALING SYSTEM.

APPLICATION FILED JULY 17, 1906. RENEWED OCT. 11, 1906.



Witnesses.
C. A. Kelly.
W. H. Wedell.

Inventor
Eugene Garretson
by McCombs & Ellis
his attorneys

UNITED STATES PATENT OFFICE.

EUGENE GARRETSON, OF BUFFALO, NEW YORK.

SIGNALING SYSTEM.

No. 852,502.

Specification of Letters Patent.

Patented May 7, 1907.

Application filed July 17, 1905. Renewed October 11, 1906. Serial No. 338,514.

To all whom it may concern:

Be it known that I, EUGENE GARRETSON, a citizen of the United States, residing at Buffalo, county of Erie, and State of New York, have invented certain new and useful Improvements in Signaling Systems, of which the following is a specification.

This invention relates to improvements in electric signaling systems; more especially it relates to electric telegraph systems which involve the use of a transmitter and a line conductor and a suitable electro mechanical receiver and it relates more particularly to those systems which involve the use of inductively derived currents. As is well known, these inductively derived currents are made of a pulsation or pulsations or electric waves and the chief object of this invention is to enable the operator to control these pulsations or electric waves as to their form, intensity and as to the time of their creation.

As is well known, the previous signaling systems which involved the use of inductively derived currents, have been found impracticable and defective for the following reasons among others: By the use of previously employed commutating devices, the making and breaking of the circuit has been performed so slowly or by such an indirect method, that the reversal of magnetism in the core of the induction coil takes place in a very irregular manner, gradually losing its magnetism upon the breaking of the first contact, then after an interval, gaining a magnetism of the opposite polarity very rapidly upon the making of the next succeeding contact. The result of the gradual loss of magnetism, the interval of no variation of magnetism and the rapid gain of magnetism produces a double or compound wave of inefficient form in the secondary circuit. Such a wave is inefficient because of the re-active effect of a line having electrostatic capacity. The repeated rise and fall of a compound wave in such a line causes an oscillation of a static charge accompanying each rise of the wave. This oscillation is recorded by the receiving apparatus and prevents distinct and rapid signaling.

By means of my invention because I break one contact and make the next succeeding contact very quickly thereafter without short circuiting either the battery or the primary winding of the transformer, I am enabled to accelerate and render the variation of magnetism of the core of the induction

coil, uniform and continuous thus producing a wave of simple form containing all the energy of a compound wave. The generation of a wave produced by my system is not attended by the oscillatory effect accompanying the generation of a compound wave.

A pole changer which is capable of reversing the direction of the current through the primary winding of the transformer quickly enough to accelerate the first stage of change of magnetism in the core of the transformer, *i. e.* the loss of magnetism of the original polarity, and which completes said reversal of current without short circuiting the source of energy or the primary winding of the transformer, produces a uniform and continuous change of magnetism in the core of the transformer as above described. To such a pole changer I shall hereafter in my specification and claims refer as a "quick-acting, non-continuity-preserving pole changer." The term of "non-continuity-preserving pole changer" is in contradistinction to the so called "continuity-preserving pole changers" which have been heretofore used in the art, such pole changers serving to short circuit the primary coil of the transformer or the source of energy or both, during each reversal of the current. This short circuiting retards the change of magnetism in the core of the transformer making its rate of variation irregular and thereby producing a compound wave.

In some of the previous systems which have depended for their operation on the use of these inductively derived currents, pole changers (principally continuity-preserving) have been introduced, but whenever used they have had defects and even detrimental functions and in no case has a pole changer been used which quickly and simply reverses the direction of the current in the primary winding of the transformer, *i. e.* a quick-acting non-continuity-preserving pole changer; such a pole changer being the most efficient type of such devices. In the signaling system herein described I employ a non-continuity-preserving pole changer which has the additional advantage of the period of current reversal being regulable by means of adjusting the respective positions of the contact point 36 to the contact point 37 and likewise as to the contact points 38 and 39.

Previous systems which have employed inductively derived currents, have also been defective because of the absence of a means

for obviating or damping the oscillatory effect of the static charge of a line which accompanies each wave generated; nor have these previous systems afforded any means whereby the voltage of the secondary winding of the transformer of the induction coil could be limited and the result of this last named defect has been that in case the line of circuit opens, the voltage of the induction coil would rise proportionately to the increased resistance caused by such opening, and thereby the voltage would be sufficiently increased so that the current could leak to other lines and thus involve other instruments than those which belonged to its line. Such previous systems have also been defective because they have not afforded a means for regulating the sensibility of the receiving apparatus and because of this defect the receiving instruments have made a record of foreign influences such as are produced by leakages or induction from other lines. For the purpose of overcoming or obviating these several last named defects, a shunt circuit may be provided at the transmitting or receiving station or both which in addition to remedying these said defects, acts as a discharger of static electricity whose presence may be due to lightning, atmospheric conditions or other causes. These several points of advantage of my invention over those previously known to the art, will clearly appear from the following description and other advantages will be evident to any one skilled in the art.

The drawings herewith, consisting of one sheet, represent a diagrammatic view of a transmitting and receiving station of my improved signaling system.

A and B represent respectively the transmitting and receiving stations of a signaling system and these stations may be located at any distance apart, and are electrically connected by a line conductor C and ground G.

At the transmitting station is located a source of electric energy as a battery 1, a transformer 2, having a secondary winding 3 and a primary winding 4 which is in circuit with the main battery 1 through the pole changer or commutating device 5, controlled by means of a local circuit including the key or manual 6; this local circuit includes the local battery 7, wire 8, manual 6, wire 9, magnets 10 and 11 of the pole changer 5 and wire 12. The pole changer 5 herein illustrated is a quick-acting, non-continuity-preserving pole changer and is one capable of operating synchronously with the operation of the current controlling device or key 6, but it is evident that other well known forms of pole changers of like characteristics, or commutating devices capable of performing the same functions, are adaptable for use in my system.

The battery 1 may be of comparatively low

electromotive force in its relation to the line resistance but the respective windings of the transformer are such that a comparatively low voltage current passing through the primary winding produces an induced current of high electromotive force in the line for the purpose of energizing an electro-mechanical receiver at the receiving station. Whenever it is desirable to insert a receiving apparatus at the sending end of the line, it may be done by placing it at the point marked X. Whenever it is desirable to insert a transmitting apparatus at the receiving end of the line it may be done by placing it at the point marked Z. When a shunt is used with the transmitting apparatus and such an apparatus is not inserted at the receiving station, a shunt may be placed at the point marked Z to regulate the sensibility of the receiving apparatus of which it then becomes a part as hereinafter explained.

In connection with the apparatus is a switch 13 which has two positions one of which is the normal or receiving position and the other the reverse or sending position. In its normal position, it makes contact between contacts 14 and 15 thus shunting the secondary winding 3 of the transformer 2 and forming a path of low resistance from the receiving apparatus, X through wire 16, contacts 14 and 15 and wires 17 and 18 to the ground G. In its reverse position, it connects the contacts 19 and 20 thus completing the circuit of the battery 1.

Preferably a polarized relay of the well known type is used at the receiving station. I have illustrated such a relay at 21 and its electric magnets are represented at 22. 23 is an oscillatory and balanced armature pivoted at 24; 25 is a permanent magnet. This armature 23 may open and close another circuit which may be a local circuit or a line circuit or serve any other desirable purpose. In my drawing, I have illustrated it as a local circuit which opens the circuit of the sounder 26 and is supplied by battery 27 and connects with the armature 23 by means of the wires 28 and 29 and 30; this armature makes and breaks circuit by contact with contact point 31 and thereby operates the sounder 26.

It will be evident, of course, to those skilled in the art, that various forms of relays other than that described, may be used to answer the same purpose as that described and it is also evident that a local circuit which may operate a sounder is not a necessary part of my receiving apparatus but may be conveniently used for the purpose of making the received signals more audible.

Having thus described the several parts of my system, and its mechanism, I will now describe its method of operation. The operator depresses the key or manual 6 and makes contact with the contact point 33 thus establishing a local circuit and allowing current to

flow from battery 7 through wire 8, contact point 33, manual 6, wire 9, electro magnets 10 and 11, wire 12 back to battery 7. This energizes the magnets 10 and 11 and thus draws to them armatures 34 and 35. When thus energized, the armature 34 breaks contact with contact point 36 and makes contact with contact point 37 and this is done while armature 35 breaks contact with contact point 38 and makes contact with contact point 39 thus reversing the direction of the current through the primary winding 4 of the transformer, which flows from the battery 1 through the wire 40, armature 35, contact point 38, wires 41 and 42, primary winding 4 of the transformer 2, wire 43, contact 36, armature 34, wire 44, contact 20, switch 13, contact 19, wire 45 back to battery 1. It is apparent that the reversed current last above referred to flows from the battery 1 through wire 40, armature 35, contact 39, wires 46 and 43, primary winding 4 of the transformer 2, wire 42, wire 47, contact 37, armature 34, wire 44, contact 20, switch 13, contact 19, wire 45 back to battery 1. The reversal of the current just described through the primary coil 4 of the transformer 2 changes the polarity of the magnetism of the core of the said transformer thereby producing an electric wave or current which travels from the secondary winding 3 of the transformer 2 through the line wire C to the electro magnets 22 of the relay 21 through the wire 48 to the earth or a second line wire and thence back from the earth or second line wire to the wire 18 and thence to the secondary winding 3 of the transformer 2. This reversal of the current flowing through the primary coil of the transformer is practically instantaneous because of the quick action of the armatures 34 and 35 in making and breaking contact with the contacts 36 and 37 and the contact points 38 and 39 respectively. The result of such a current reversal is to accelerate the loss of magnetism of the original polarity in the core of the transformer and to rapidly re-magnetize such core but with opposite polarity. This continuous, uniform and rapid reversal of magnetism produces a uniform wave in the transmitting wire of regular form and high electromotive force which is the most efficient form of wave for signaling purposes. The devices in the prior art for reversing the magnetism of the core of the transformer have been such that they have caused an irregular change of such magnetism, the magnetism of original polarity gradually falling away when the normal circuit was opened, and then after an interval, rapidly building up to the opposite polarity when the reversed circuit was made. Thus such devices have produced a double or compound pulsation consisting of one wave at the breaking of the normal circuit and the other at the making of the reversed

circuit. During such reversal, a sufficient interval of time has been allowed to elapse due to slow action or short circuiting of the battery, to permit the first pulsation to fall away before the second was produced. The double or compound pulsation thus produced has been of low electromotive force and also inefficient because it has set up a re-action or oscillation in the line which has seriously interfered with rapid and distinct signaling and has been of insufficient strength for use on long lines.

The current flowing through the line circuit as last above described energizes the magnets 22 of the relay 21 and causes the armature 23 to move into contact with the contact 31 when it is retained in that position by the magnetism of the permanent magnet 25. In the system as illustrated, this establishes a local circuit and current flows from battery 27 through wire 28, armature 23, contact point 31, wire 30, sounder 26 and wire 29 back to battery 27. This energizes the magnet of the sounder 26 and draws down to it its armature 32 whose normal position is away from the magnet and is spring-held therefrom. It is apparent that when the pulsation ceases the armature 23 will still be held against the local circuit contact by the permanent magnet 25 and that the local circuit last above described will be established as long as the armature 23 is so held by the magnet 25.

A portion of the secondary current caused to flow by the reversing of the current heretofore described, starts from the secondary winding 3 of the transformer 2, and flows through the wire 49, the receiving relay which may be located at the point X, (and when a shunt is used at the transmitting station), shunt S, wire 51, regulator 52, and wire 50 to the earth or a second line wire and thence to the wire 18 back to the secondary winding 3 of the said transformer 2. By means of this shunt circuit we are able to control and regulate and in particular limit the electromotive force of the inductively derived currents which are employed for transmitting the signals upon the line wire. This shunt circuit may also be used to form a part of the receiving apparatus when not in use as a part of the transmitting apparatus and as a part of said receiving apparatus, any adjustment of the ratio of the resistance of the shunt to the resistance of the relay will regulate the sensibility of the receiving apparatus of which the relay is a part. Thus the relay may be prevented from responding to currents of less than the predetermined strength of the signal pulsations, *e. g.*, leakages and induced currents from other lines which might produce false signals. As heretofore mentioned, this shunt also acts as a discharger of static electricity which may be in the line wire.

Because of the discharging ability of the shunt circuit just described the oscillation between line and ground of any charge which may exist, is prevented. It is well known that the oscillation of the charge is due to electric interchange or reaction between the line and the ground.

It is evident that it is immaterial whether the wire C is a part of my system as described or whether it is a part of some other signaling system so far as it is used in the way I have described is concerned. Signals sent by way of means of my system may be sent over the wires of another system without interfering with the operation of the other system. Of course the local circuit described as governed by the relay, 22, is only an illustration and it will be evident to any one skilled in the art, that another signaling system might be as easily controlled by means of a relay or other suitable electromechanical means. It follows then, that by the means described, I am able to control all or any portion of the instruments of another signaling system by a suitable means located at any suitable point in that system and the circuit of such system may also form the controlling circuit.

Having thus described my invention, what I claim is:

1. In a signaling system employing inductively derived currents, a signal transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer.

2. In a signaling system employing inductively derived currents, a signal receiving apparatus comprising a relay for recording transmitted signals, and a regulable circuit for shunting said relay.

3. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer, and means for controlling and operating said pole changer of a regulable shunt circuit in connection therewith.

4. In a signaling system employing inductively derived currents, the combination with a transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer, and means for controlling and operating said pole changer of a relay for recording the transmitted signals.

5. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer of a signal receiving apparatus comprising a relay for recording

the transmitted signals and a regulable shunt circuit in connection with said relay.

6. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer, means for controlling and operating said pole changer and a regulable shunt in connection therewith of a relay for receiving transmitted signals.

7. In a signaling system employing inductively derived currents, the combination with a transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer, means for controlling and operating said pole changer and a regulable shunt in connection therewith of a signal receiving apparatus comprising a relay for recording the transmitted signals and a regulable shunt in connection with said relay.

8. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer of means for shunting the secondary coil of the transformer and disconnecting said source of energy, when the said signal transmitting apparatus is not in use.

9. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer of means for operating another signaling system.

10. In a signaling system employing inductively derived currents, the combination with a signal receiving apparatus comprising a relay for recording the transmitted signals and a regulable shunt in connection therewith of means for operating another signaling system.

11. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer and a regulable shunt in connection therewith of means for operating another signaling system.

12. In a signaling system employing inductively derived currents, the combination with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer of a relay for receiving

ing the transmitted signals and means for operating another signaling system.

13. In a signaling system employing inductively derived currents, the combination
5 with a signal transmitting apparatus, comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for controlling and operating said pole changer of a signal receiving
10 apparatus comprising a relay for recording the transmitted signals, a regulable shunt in connection therewith and means for operating another signaling system.

14. In a signaling system employing inductively derived currents, the combination
15 with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole changer and means for operating and controlling said pole changer, and a regulable shunt
20 in connection therewith of a relay for receiving the transmitted signals and means for operating another signaling system.

15. In a signaling system employing inductively derived currents, a signal transmitting apparatus comprising a source of
25 energy, a transformer, a quick-acting non-continuity-preserving pole changer, means for controlling and operating said pole changer and a regulable shunt in connection
30

therewith of a signal receiving apparatus comprising a relay for recording the transmitted signals and a regulable shunt in connection therewith and means for operating
another signaling system.

16. In a signaling system employing inductively derived currents, the combination
with a signal transmitting apparatus comprising a source of energy, a transformer, a quick-acting non-continuity-preserving pole
40 changer and means for controlling and operating said pole changer of means for shunting the secondary coil of the transformer and disconnecting said source of energy when
the said signal transmitting apparatus is
45 not in use, and means for operating another signaling system.

17. In a signaling system employing inductively derived currents, the combination
with a source of electric energy and a transformer of means for regulating and limiting
50 the voltage of the induced currents.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

EUGENE GARRETSON.

Witnesses:

R. P. RAY,

ARTHUR S. C. LOEPFEL.