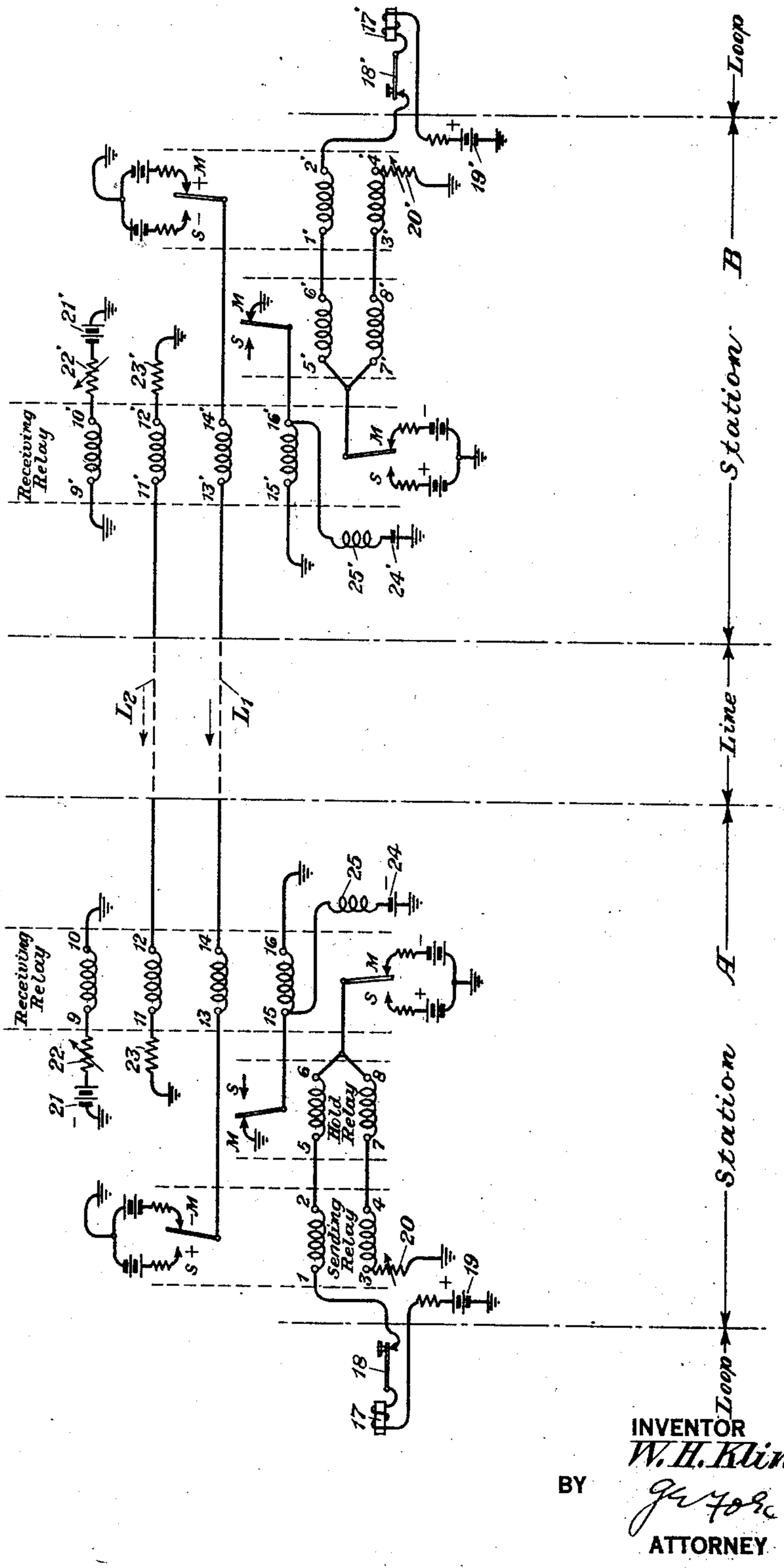
July 5, 1932. W. H. KLINE 1,865,571

MEANS FOR ELIMINATING INTERFERENCE IN GROUNDED TELEGRAPH SYSTEMS

Filed June 24, 1931



INVENTOR
W. H. Kline

BY

ATTORNEY

Patented July 5, 1932 1,865,571

UNITED STATES PATENT OFFICE

WILLIAM H. KLINE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK

MEANS FOR ELIMINATING INTERFERENCE IN GROUNDED TELEGRAPH SYSTEMS

Application filed June 24, 1931. Serial No. 546,655.

This invention relates to grounded telegraph systems, and particularly to a method and means for eliminating from such systems the effects of interfering currents created by earth potential differences, power line induction and other similar sources.

In the operation of grounded telegraph systems difficulty is sometimes experienced due to the presence in such systems of interfering currents created by sources external to the system itself, such as differences of earth potential or power line induction. Those currents created by the sources of interference affect the receiving relays of the telegraph system and produce a distortion of the telegraph signals being transmitted between stations of the said system.

The present invention resides in a method and means for substantially eliminating the effect upon the receiving relays of the telegraph system of currents created by sources of interference external to the said system.

This invention will be clearly understood from the following description when read in connection with the attached drawing showing schematically a simple form of embodiment of the invention.

In the drawing the apparatus at station A is connected to that at station B by the line conductors L_1 and L_2, the former conductor being intended to transmit signals from each station to the other, and the latter conductor being intended to provide a source of neutralizing current by means of which interfering currents set up in L_1 by a source external to the system may be prevented from affecting the signals transmitted over L_1. Connected to station A is a telegraph loop comprising a sounder 17 and a key 18, the said loop being connected to the winding 1—2 of the sending relay and also to the battery 19 at the station A. The sending relay has two windings 1—2 and 3—4 which windings are connected to corresponding windings 5—6 and 7—8 of the holding relay. The terminals 6 and 8 of the windings of the latter relay are both connected to the armature of the receiving relay. The contacts of the latter relay are connected to batteries of opposite polarity. A variable artificial line 20 is connected to the terminal 3 of the sending relay, and it is designed to control the magnitude of the current traversing the windings 3—4 and 7—8. The armature of the sending relay is connected to the terminal 13 of the winding 13—14 of the receiving relay, the other terminal of which is connected to the line L_1. The contacts of the sending relay are connected to sources of potential of opposite polarity for the transmission of signaling impulses over the line. The receiving relay includes also a winding 9—10 that is connected in series with a source of potential 21 and a variable resistance 22 whereby the magnitude of the current flowing through the winding 9—10 and its direction may be such as to cause the armature of the receiving relay to move to its spacing contact whenever current in the winding 13—14 becomes zero as the result of the operation of the sending relay at station B. The winding 11—12 which is connected to the conductor L_2 and also to ground through the resistance 23 serves to neutralize the effect of interfering currents upon the receiving relay at station A. The manner in which that result is accomplished will be understood from the description of the operation of the system set forth hereinafter. The winding 15—16 has its terminal 15 connected to the armature of the holding relay and also to the source of potential 24, the latter connection including a choke coil 25. The terminal 16 of that winding is connected to ground. The function of the holding winding is to neutralize the effect of the biasing winding 9—10 and to keep the armature of the sending relay upon its marking contact whenever the current in the winding 13—14 falls to zero as the result of the transmission of a spacing impulse from station A to station B.

The apparatus at station B and in the loop connected thereto is similar to that shown at station A, and the corresponding parts have been given the same numerals primed.

The manner in which the circuit operates for the transmission of signals is as follows: For the transmission of a marking impulse from station A to station B the apparatus will be in the position shown in the drawing.

Thus, with the key 18 closed, current will flow from the source 19 through the sounder 17, key 18, windings 1—2 and 5—6, marking contact of the receiving relay, and the negative battery to ground. Current will also flow from ground through the artificial line 20, windings 3—4 and 7—8, marking contact of the receiving relay to the negative pole of the grounded battery. Since the current through windings 1—2 and 5—6 is twice as great as that through windings 3—4 and 7—8 the armatures of the sending relay and of the holding relay will be moved to their marking contacts. Since the marking battery of the sending relay at station A is opposite in polarity to the corresponding battery at station B, current will flow over line L_1 in the direction of the arrow, said current traversing the windings 13—14 and 13′—14′. The magnitude of that current and the direction of flow through the winding 13—14 are such as to keep the armature of the receiving relay at station A upon its marking contact. At station B the current through 13′—14′ will move the armature of the receiving relay to its marking contact, the said current being sufficient to overcome that flowing through the biasing winding 9′—10′. With the armature of the receiving relay at station B upon its marking contact the current will flow from the battery 19′ through the sounder 17′ and the key 18′, thence through the windings 1′—2′ and 5′—6′ to the armature and the negative battery of the receiving relay. Current will also flow from ground through the windings 3′—4′ and 7′—8′ to the said armature and the negative battery of the receiving relay. Since the current through the windings 1′—2′ and 5′—6′ is twice that through the other windings of the sending relay and the holding relay, it will maintain the armatures of the respective relays upon their marking positions. The flow of current over the circuit that includes the sounder 17′ will operate the said sounder and produce a marking signal.

When the key 18 at station A is opened to transmit a spacing signal the current through the windings 1—2 and 5—6 through the sending relay and the holding relay will drop to zero. The current through windings 3—4 and 7—8 will however, continue to flow in the same direction as during the transmission of a marking signal and it will cause the movement of the armatures of the respective relays to their spacing contacts. Since the polarity of the spacing battery at station A is the same as that of the marking battery at station B, no signaling current will flow over the line conductor L_1, and consequently, there will be no current in the windings 13—14 and 13′—14′. The absence of current in the windings 13′—14′ will permit the armature of the receiving relay at station B to be moved to its spacing contact under the influence of the current flowing through the biasing winding 9—10. Since the polarity of the spacing battery of the receiving relay at station B is the same as that of battery 19′, current will not flow through the windings 5′—6′ and 1′—2′. Current will flow however, through windings 3′—4′ and 7′—8′, but its direction will be such as to keep the armatures of the holding relay and the sending relay respectively, upon their marking contacts. Since no current flows through the sounder 17′ its armature will drop back and a spacing signal impulse will be indicated.

If, during the transmission of a spacing impulse from station A to station B, the operator of the loop at B attempted to get control of the circuit by opening the key 18′, no indication of such attempt would be evident to the operator at station A. The reason for that is as follows: The opening of the key 18′ effects no change in the current flow through the windings 1′—2′ and 5′—6′ inasmuch as during the transmission of a spacing impulse from station A to station B no current flows through those windings because the spacing battery of the receiving relay at station B opposes battery 19′ connected with the loop of the same station. Consequently, the opening of key 18′ effects no change in the position of the armatures of the holding relay and the sending relay, and therefore, there will be no abnormal operation of the sounder 17 at station A due to the opening of the key 18′ when station A is sending a spacing impulse to station B. If, however, key 18′ remains open and the operator at station A closes key 18 for the transmission of a marking impulse, the break signal will be transmitted and will be evidenced by the failure of the sounder 17 to indicate the transmission of a marking impulse. The reason for that is as follows: When key 18 is closed, the sending relay and the holding relay at station A move their armatures to the marking positions. The armature of the sending relay thereupon connects the negative battery to the line L_1 and current will flow through the windings of both receiving relays connected to that line. The movement of the armature of the holding relay at station A to its marking contact effectively shunts the holding winding 15—16. The flow of current through the winding 13′—14′ moves the armature of the receiving relay at station B to its marking contact. Since the key 18′ remains open, current will not flow through the windings 1′—2′ and 5′—6′ but will flow through the windings 3′—4′ and 7′—8′. The direction of flow of current through the latter pair of windings causes the armatures of the sending relay and of the holding relay at station B to move to their spacing contacts. The movement of the armature of the sending relay

connects negative battery to the line L_1 which opposes the negative battery of the marking contact at station A and causes the signaling current in L_1 to fall to zero. Consequently, no current flows through the winding 13—14, and since the winding 15—16 is ineffective, due to its being shunted, the armature of the receiving relay at station A will be moved to its spacing contact as a result of the flow of current through the biasing winding 9—10. When the armature of the receiving relay touches its spacing contact the positive battery connected to that contact will oppose the positive battery 19 and there will be no flow of current through the loop that includes the sounder 17. Consequently, its armature will not be attracted as would be the case during the transmission of a marking signal from station A to station B when the key at station B is closed. The operator of the loop at station A accordingly knows that the other operator is attempting to get control of the circuit.

The manner in which neutralization of the effects of interfering currents is obtained is as follows: Since both of the conductors L_1 and L_2 have the same impedance to ground a source of interference would cause currents of the same magnitude to flow in each of the said conductors and through the windings and over apparatus connected to them. The compensating windings 11—12 and 11′—12′ are poled to oppose the effect upon the receiving relay of a current of equal magnitude flowing through the winding 13—14 or 13′—14′. Equalization of the currents is effected by the adjustment of the resistances 23 and 23′. The use of a compensating circuit such as that represented by the conductor L_2 and the associated windings of the receiving relays and the resistances, results in substantial elimination of the effects upon the signals due to differences of ground potential, power line induction or other similar sources.

While the invention has been disclosed in a particular form, it is to be understood that such showing is simply for illustration, and that the invention is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claim.

What is claimed is:

In a telegraph signaling system, the combination with a pair of wires of a sending relay, a holding relay, a receiving relay having a plurality of windings one of which is connected between one of said wires and ground, the second winding is connected between the other of said wires and the armature of the sending relay, the third is connected in series with a source of current to form a biasing circuit, and a fourth is connected in series with a source of potential and the armature of the holding relay to form a holding circuit, the said first and second windings being effectively opposed, the said receiving relay having its armature connected to the windings of the holding and sending relays, and also having sources of potential of opposite polarity connected to its contacts.

In testimony whereof, I have signed my name to this specification this 19th day of June 1931.

WILLIAM H. KLINE.