

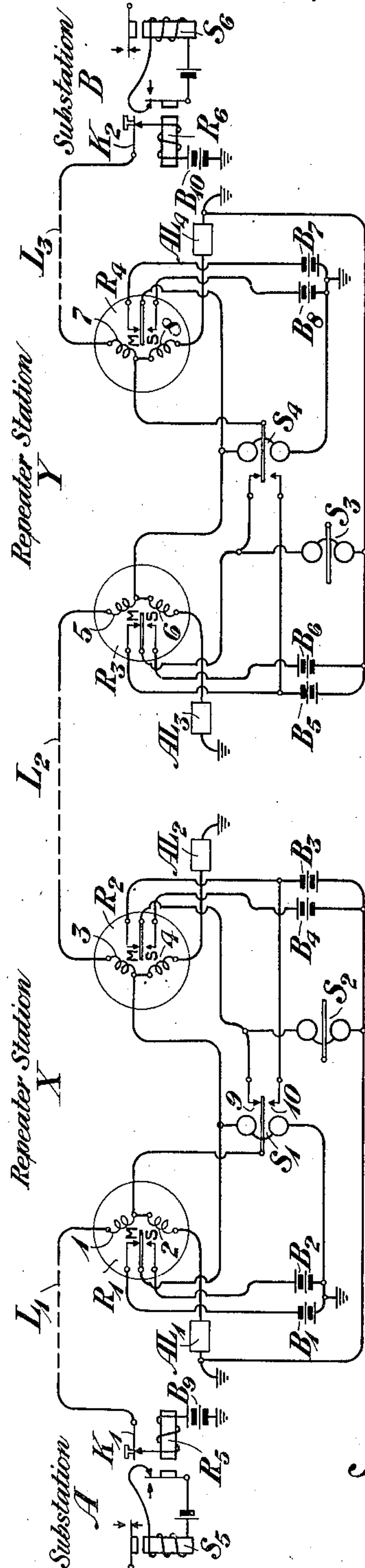
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J. M. FELL ET AL

TELEGRAPH SIGNALING SYSTEM

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TELEGRAPH SIGNALING SYSTEM.

Application filed March 15, 1920. Serial No. 365,935.

To all whom it may concern:

Be it known that we, JOHN M. FELL and RALPH E. PIERCE, residing at Hackensack and Larchmont, in the counties of Bergen and Westchester and States of New Jersey and New York, respectively, have invented certain Improvements in Telegraph Signaling Systems, of which the following is a specification.

10 This invention relates to telegraph signaling systems and particularly to means for preventing the undesirable reaction between the polar relays of a duplex system when a receiving operator opens his key in order
15 to get control of the circuit.

One of the most common faults found in operating duplex sets on a half duplex basis is the mutual reaction between the transmitting and receiving relays of the duplex set.

20 This reaction occurs when an operator who is receiving signals from another station at the other end of the circuit opens his key in order to get control of the circuit. This reaction manifests itself in a chattering or
25 buzzing of the relays arising from the vibration of the armatures of the relays between their respective marking and spacing contacts when the transmitting keys at opposite ends of the line are simultaneously in
30 the open position. In the standard polar duplex set this fault is remedied by means of a back contact repeating sounder operated by a pole changer which closes the receiving circuit whenever the pole changer
35 is open irrespective of whether or not the circuit is closed at the receiving relay. The set is thus locked against the said mutual reaction. Our invention is particularly related to a circuit of the type disclosed in the
40 copending application of J. M. Fell, Serial Number 365,911, filed March 15, 1920, which provides for the use of polar relays as transmitting pole changers. It is the object of our invention to provide a simple
45 and effective means to prevent the reaction between the relays shown in the Fell circuit, thereby improving the "breaking" operation so as to enable a receiving operator to get control of the circuit promptly, thus
50 improving the general efficiency of the service.

Other and further objects of this invention will appear from the following descrip-

tion when read in connection with the attached drawing which shows one form of
55 its embodiment.

In the drawing X and Y represent two repeater stations which are joined by the line circuit L_2 . At the stations X and Y are terminated the loop circuits L_1 and L_3
60 respectively, which serve to connect the telegraph substations A and B respectively with the said repeater stations. At substation A the equipment comprises a key K_1 , a relay R_5 , a sounder S_5 , and a source of direct current, B_9 , the polarity of which is opposite to
65 that of battery B_3 , associated with relay R_2 at station X. At substation B the equipment is similar, comprising a key K_2 , a relay R_6 , a sounder S_6 , and a battery B_{10} , the polarity of which is opposite that of battery
70 B_5 associated with the relay R_3 at station Y. Although the equipment at stations A and B is represented as being of the simple Morse type, it is to be understood that the inven-
75 tion is not limited to the use of this particular type of apparatus at the substations but that any of the well known types of telegraph station apparatus may be used.

The equipment at each repeater station
80 embraces a group of two polar relays having polarized sounders connected in a leak circuit from the armatures to ground and having the usual artificial lines adapted to balance the circuits connected with the said
85 polar relays. Thus at station X, R_1 and R_2 represent two polar relays each having two windings connected differentially. The windings 1 and 2 of relay R_1 are connected respectively with the loop circuit L_1 , and
90 with the artificial line AL_1 . The midpoint, or apex of the said windings is connected with the armature of the polarized sounder S_1 , the windings of which are connected in a leak circuit from the armature of relay R_1
95 to ground. Windings 3 and 4 of relay R_2 are connected respectively with the line circuit L_2 and with the artificial line AL_2 . The apex of these windings is connected, with the armature of relay R_1 . The arma-
100 ture of relay R_2 is connected with the normal contact 9, of the sounder S_1 , and the said armature is also connected through the windings of polarized sounder S_2 to ground. The other contact 10, of the sound-
105 er S_1 is connected with the marking battery

B_3 . Associated with the relays R_1 and R_2 are the marking batteries B_1 and B_3 respectively and the spacing batteries B_2 and B_4 respectively. The equipment at the repeater station Y is similar to that at station X, comprising the polarized relays R_3 and R_4 having windings 5—6 and 7—8 respectively. Also associated with these relays are the artificial lines AL_3 and AL_4 and the sounders S_3 and S_4 respectively. Marking batteries B_5 and B_7 and spacing batteries B_6 and B_8 are associated with the contacts of the armatures of relays R_3 and R_4 respectively.

Having in mind the foregoing description of the parts of the apparatus comprising the circuit in which this invention is embodied, the invention will be clear from the following description of the mode of operation of this circuit.

Let it be assumed that station A is transmitting signals and that station B is receiving signals. That is to say, that key K_1 is being closed and opened to transmit marking and spacing signals and that key K_2 remains closed for the reception of the transmitted signals. Since batteries B_9 and B_3 are of opposite polarity, the closing of key K_1 will cause current to flow over a circuit comprising battery B_9 , relay R_5 , key K_1 , loop L_1 , winding 1 of relay R_1 , contact 9 of sounder S_1 , marking contact of relay R_2 and battery B_3 to ground. Current will also flow through winding 2 and artificial line AL_1 to ground. The difference in value and direction of the currents in windings 1 and 2 will be such as to hold the armature of relay R_1 upon its marking contact. Since batteries B_1 and B_7 associated with relays R_1 and R_4 respectively are opposed to each other no current will flow through the line L_2 or through windings 3 and 5 of relays R_2 and R_3 respectively. Current flowing in windings 4 and 6 of the said relays will maintain the respective armatures upon their marking contacts. Since batteries B_5 and B_{10} are in conjunction, current will flow over the line L_3 and produce a marking signal at the substation B. If a spacing signal is transmitted from station A to station B no current will flow through winding 1 of relay R_1 and in consequence thereof the armature of this relay will be moved to its spacing contact as the result of the current in the winding 2. This results in the connection of the battery B_2 to the line L_2 and since B_2 and B_7 are in conjunction current will flow through the line L_2 and the windings connected thereto. Current will also flow in windings 4 and 6 of relays R_2 and R_3 respectively. The difference in value and direction of the currents in windings 3 and 4 will hold the armature of relay R_2 upon its marking contact. The difference in value and direction of the currents

in windings 5 and 6 will move the armature of relay R_3 to its spacing contact. This results in the connection of the battery B_6 to the line L_3 and since B_6 and B_{10} are opposed to each other no current will flow through the said line. In consequence thereof the spacing signal transmitted from substation A will be received at station B. It is desirable to point out that the sounders S_1 and S_3 respond to the transmission of signals from station A to station B. Sounders S_2 and S_4 respond to the transmission of signals from station B to station A. Thus when a marking signal is being sent from A to B the armature of S_1 will remain on contact 9 and that of S_3 on its marking contact. The transmission of a spacing signal from A to B moves the armature of S_1 to contact 10 and that of S_3 to its corresponding spacing contact. Sounders S_2 and S_4 operate in a similar manner when signals are transmitted from B to A.

Let it be assumed now that when station A is transmitting a spacing signal the operator at station B opens his key K_2 for the purpose of getting control of the circuit. By the opening of key K_1 the armature of relay R_1 will be moved to its spacing contact as a result of the flow of current from battery B_3 . Since key K_2 is opened at the same instant the armature of relay R_4 will be moved to its spacing contact as the result of the flow of current from battery B_5 . Since now batteries B_2 and B_7 are opposed to each other no current will flow in the line L_2 or windings 3 and 5 of relays R_2 and R_3 respectively, and the flow of current in windings 4 and 6 respectively will be in such direction as to move the respective armatures to their spacing contacts. Considering repeater station X the flow of current from battery B_4 through winding 2 would be in such direction as to tend to move the armature of relay R_1 to its marking contact if contact 9 remained closed. However, when the armature of relay R_1 is on its spacing contact, the polarized sounder S_1 is operated and the apex of windings 1 and 2 of relay R_1 is connected through the armature of sounder S_1 and contact 10 to battery B_3 . The flow of current through the winding of relay R_1 is then in such direction as to hold its armature on its spacing contact. The operation of sounder S_4 at station Y acts in a similar manner to prevent the movement of relay R_4 . By means of this invention the buzzing or chattering of the polar relays resulting from the vibration of their armatures between their respective contacts when both keys are open is prevented by the interposition of the polarized sounder or equivalent switching means which reverses the polarity of the current flowing through the windings of one of the relays. Heretofore in duplex

circuits in which no special preventive means were employed this buzzing would continue until the armatures had swung sufficiently out of phase to rest simultaneously upon contacts of opposite polarity. Our invention provides positive means for changing the polarity of the windings when conditions which are capable of producing such undesirable reaction have arisen.

Another object of our invention is to prevent the interference by incoming signals with a spacing signal transmitted for the purpose of obtaining control of the circuit. For example, if station A is sending signals to station B and the key K_2 at station B is opened to get control of the circuit, the reception of the signal at repeater station Y, corresponding to the closing of key K_1 , will cause relay R_3 to connect battery B_5 through its armature and the armature of sounder S_4 to the apex of windings 7 and 8 of relay R_4 . Since key K_2 is opened in order to get control of the circuit, no current will flow in line L_3 , and the direction of current in winding 8 will be such as to operate relay R_4 , moving its armature to its spacing contact. This serves to connect battery B_5 to the armature of relay R_4 and operates the sounder S_4 which connects battery B_5 to the apex of windings 7 and 8 of relay R_4 over a circuit which avoids the contacts of relay R_3 . If a spacing signal is now received at repeater Y over line L_2 , the relay R_3 will have a spacing battery connected to its armature, but the connection between this armature and the apex of the windings 7 and 8 of relay R_4 is broken at the contacts of the polarized sounder, and in consequence, the armature of relay R_4 remains on its spacing contact. If this connection had not been broken the spacing current from battery B_5 would have passed through winding 8 of relay R_4 in such direction as to move its armature to its marking contact, and a marking signal would have been sent from this relay instead of a spacing signal, corresponding to the open position of key K_2 . It will be seen, therefore, that by using a polarized switching device such as the sounder S_4 , the interference by incoming signals with the "break" operation is thereby avoided.

Although this invention has been disclosed in a particular form in which a polarized sounder, connected into a leak circuit from the armature of a polar relay, serves to prevent the interference heretofore described, it is to be understood that a relay may be substituted for the said sounder, or that the function of the sounders may be performed by relays connected in the loops L_1 and L_3 in series with said polar relays, or by other and different arrangements without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a telegraph signaling system, the combination with two line circuits of two polar relays, each individual to a line circuit and each having an artificial line designed to balance its respective line circuit, sources of potential of opposite polarity connected with the contacts of each relay, means to connect the armature of each relay with the midpoint of the winding of the other relay, one of the said connections including the armature and one contact of a polarized sounder having its winding connected with the armature of the other of said relays and having its other contact connected with one of the sources of potential to reverse the polarity of the current applied to the midpoint of the winding of one relay when spacing signals are being sent simultaneously from both ends.

2. In a telegraph signaling system, the combination with two line circuits of two polar relays, each individual to a line circuit, one terminal of each winding being connected with its line circuit and the other with an artificial line, sources of potential of opposite polarity connected with the marking and spacing contacts of each of said relays, means to connect the midpoint of the winding of one relay with the armature of the other relay, means to connect the midpoint of the winding of the said other relay with the armature of the said first mentioned relay, the said latter connecting means including the armature and one contact of a polarized switching means, the winding of which is connected with the armature of the said other relay.

3. In a telegraph signaling system, the combination with two line circuits of a repeater comprising two polar relays and polarized switching means, one winding of each of said relays being connected with one of said line circuits and the other winding of each relay with an artificial line, the midpoint of the windings of one relay being connected with the armature of the second relay, and the midpoint of the windings of the said second relay being connected with the armature of polarized switching means having one of its contacts connected with the armature of said first mentioned relay and its second contact connected with the marking battery of said first mentioned relay, said switching means being located in a leak circuit between the armature of said second relay and ground and controlled by said second relay whereby the polarity of the current applied at the midpoint of the windings of said second relay may be reversed when both line circuits are transmitting spacing signals.

4. In a telegraph signaling system, the combination of two repeaters, each comprising two polarized relays having the

armature of each relay of a repeater connected with the windings of the other relay of said repeater, a line connecting the said repeaters, a loop circuit connected with each
5 repeater, and means associated with each repeater to maintain the armature of one of the relays of a repeater upon its spacing contact regardless of the change of position of the armature of the other relay
10 whenever spacing signals are simultaneously transmitted from the stations of both loop circuits.

5. In a telegraph repeater, the combination of two polar relays, each having a plurality of primary and secondary windings,
15 the junction point of the primary windings

of one relay being connected with the armature of said second relay, and the junction point of the primary windings of said second relay being connected with the armature of a polarized sounder, one of the contacts of which is connected with the armature of said first mentioned relay, and the other contact directly connected with the marking battery of said first mentioned relay, the said sounder being controlled by the vibrating circuit of said second relay. 20 25

In testimony whereof, we have signed our names to this specification this 12th day of March, 1920.

JOHN M. FELL.
RALPH E. PIERCE.