

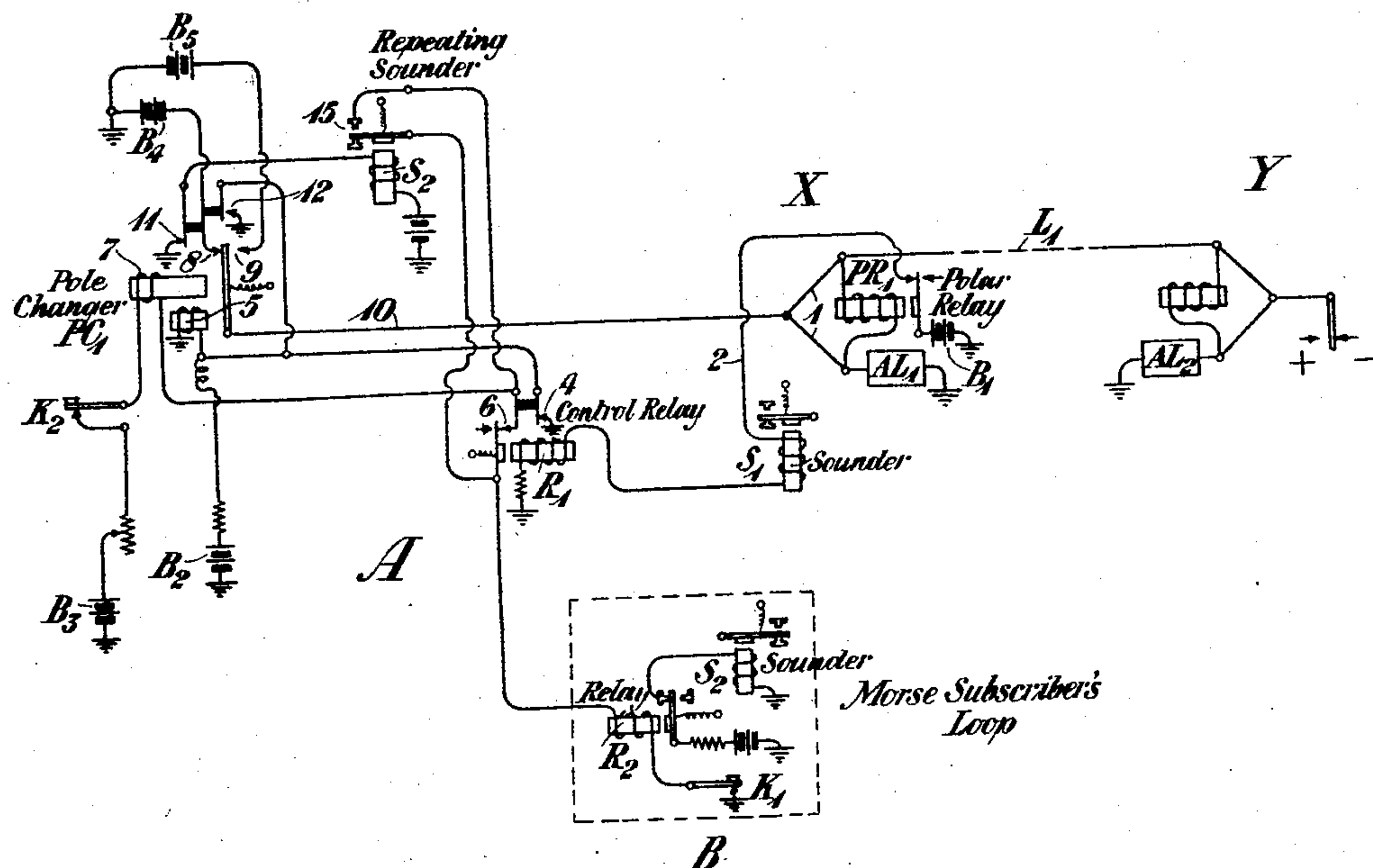
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J. I. MITCHINER

TELEGRAPH SIGNALING SYSTEM

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TELEGRAPH SIGNALING SYSTEM.

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To all whom it may concern:

Be it known that I, JAMES I. MITCHINER, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain Improvements in Telegraph Signaling Systems, of which the following is a specification.

This invention relates to telegraph signaling systems and especially to means associated with such systems for improving the rate of establishing the "break" condition of the circuit.

Heretofore in the half-duplex operation of the well known duplex telegraph systems, it has been found that when an operator on a Morse subscriber's loop desired to "break" the circuit over which signals were being transmitted from the distant end the time required to secure control of the circuit by the breaking operation, that is, to establish a "break" condition of the circuit varied, and even with the best circuit arrangements the speed was somewhat retarded.

In a well known duplex system the marking and spacing signals received over a line circuit actuate a polar relay which in turn operates a control relay. The control relay not only controls the transmission of marking and spacing impulses to the subscriber's loop station, but also controls the operation of a locking coil associated with the transmitting pole changer. Associated with the pole changer is a repeating sounder, the function of which is to insure the maintenance of the control relay in its operative position when a "break" signal is being transmitted to the distant station. In such an arrangement the time required to establish a "break" condition is dependent upon three separate factors, namely, (1) the period of time for the decay of the flux in the core of the pole changer to permit release of its armature; (2), upon the period of time for the pole changer armature to move such distance as to open its supervisory contacts; and (3), upon the period of time necessary for the repeating sounder to release and permit its armature to close its back contact.

It is the object of this invention to provide means whereby at least one of these operations may be eliminated and the time required to establish the "break" condition may be materially reduced.

Other and further objects of this invention will appear from the following description, when read in connection with the attached drawing showing one form of embodiment of the invention.

In the drawing A represents a bridged polar duplex set connected with one end of a telegraph line L_1 . It may be assumed that the apparatus connected with the other end of the said line is similar to that represented by A. Associated with the duplex set A is a Morse subscriber's loop B, represented schematically by the apparatus within the dash lines, which may be one of a number of such loops adapted for connection with the polar duplex set connected with the line L_1 . This polar duplex set comprises the unity ratio arms 1, which have connected therewith the line L_1 and an artificial line AL_1 , designed to balance the line L_1 . Bridged across the ratio arms is a polar relay PR_1 , having associated therewith a receiving leg battery B_1 . The inner contact of the polar relay is connected by the conductor 2 with a sounder S_1 and thence with the winding of the control relay R_1 , which is grounded. The control relay R_1 over its inner contact 4 is adapted to short-circuit the locking coil 5 of the pole changer PC_1 , which coil normally receives its energy from the battery B_2 . The other contact 6 of the control relay R_1 is adapted to control the transmission of the impulses to the relay R_2 of the Morse subscriber's loop B, in accordance with the signals received over the line L_1 . The pole changer PC_1 has a main winding 7 which is adapted to be energized by current from the sending leg battery B_3 . This pole changer also has associated therewith a locking coil 5 heretofore referred to, the function of which, when energized, is to hold the armature of the pole changer against the left hand contact 8 when the main winding 7 is de-energized. By means of the contacts 8 and 9 potentials of opposite polarity from the main line batteries B_4 and B_5 may be impressed upon the conductor 10 which is connected to the midpoint of the ratio arms 1. Associated with the pole changer are the contacts 11 and 12, the function of the former being to provide a ground for the control of the repeating sounder S_2 , and the function of the latter being to facilitate the breaking opera-

tion, the manner of doing which will be made clear hereafter. The apparatus connected with the Morse subscriber's loop B comprises a sending key K_1 , a relay R_2 , and a sounder S_2 , all of which are well known types of apparatus and need no further description.

Having in mind the foregoing description of the various parts of apparatus comprising this system, and the relations of the various parts to each other, the invention will now be made clear by the following description of the mode of operation of the system in which it is embodied.

It is well understood in the art of telegraphy that in duplex telegraph systems when the artificial line, as for example AL_1 is made the equivalent of the line circuit plus the equipment connected in the distant end of the line circuit, as line L_1 plus the equipment at station Y, current flowing from the line batteries at one end of the system, as from battery B_1 or B_5 at station X, divides equally between the line and artificial line circuits at that end (X) and have no effect upon the adjacent polar relay (polar relay PR_1) and that a battery connected to the distant end of the line, as at station Y, causes current to flow through the polar relay at the near end, as polar relay PR_1 at station X, in one direction or the other depending upon the polarity of the distant battery.

Let it be assumed that when the key at the distant station Y is closed negative battery is connected to the line and that this negative battery causes the armature of polar relay PR_1 to close its local contact thereby allowing current to flow from the battery B_1 over conductor 2 and through the windings of the sounder S_1 and the control relay R_1 , to ground, thereby operating the said sounder and the control relay. By the operation of the control relay contacts 4 and 6 are closed. The closing of contact 4 puts a ground upon battery B_2 and thereby prevents the energization of the locking coil 5 of the pole changer PC_1 . Through the closing of contact 6 current will flow from battery B_3 through the test key K_2 , which is closed, through the main winding 7 of the pole changer, contact 6 of relay R_1 , winding of relay R_2 , and through key K_1 , to ground, thereby operating relay R_2 and in turn operating the sounder S_2 , thus giving a marking signal at the Morse subscriber's station.

When the distant key is open, positive battery is connected to the distant end of the line which causes the armature of the polar relay PR_1 to move to its opposite position, thereby opening its local contact, whereupon current will cease to flow through the sounder S_1 and the control relay R_1 , thereby releasing both of these devices.

When the control relay R_1 is released, its contacts 4 and 6 are opened. By the opening of contact 4 the shunt path around the locking coil 5 of the pole changer is opened, thereby permitting the energization of the said locking coil which holds the armature of the pole changer against its contact 8. Through the opening of contact 6 of the control relay the circuit from the battery B_3 through the main winding of the pole changer to the relay R_2 of the Morse subscriber's loop B is opened, thereby allowing said relay R_2 to fall back and to produce a spacing signal at the said Morse loop station.

When the operator at the Morse subscriber's station B desires to send a "break" signal during the reception of signals from the distant station Y he will open his key K_1 , thereby removing ground from the circuit connected with the said key. Let it be assumed that the said key is opened at a time when a marking signal is being received at the Morse subscriber's station from the distant station Y, during which time the control relay is operated and its contacts 4 and 6 are closed. As has been shown, the closing of contact 4 puts a shunt path around the winding of the locking coil 5 of the pole changer and prevents the energization of the said locking coil. During normal operation the armature of the pole changer is held against its contact 8 by the energization of the main winding 7 due to the flow of current from the battery B_3 through the said winding and over the circuit containing the key K_1 , to ground. When key K_1 is opened to effect the transmission of a breaking signal, current ceases to flow through the winding 7 and consequently the armature of the pole changer will be released as soon as the flux in the core of magnet falls below a certain value. The armature, when released, will move towards the right opening contact 11, closing contact 12, opening contact 8 and closing contact 9 in sequence. This operation of the armature results in three things: First, by the opening of contact 11, the circuit embracing the winding of the repeating sounder S_2 is opened, allowing its armature to drop back, which closes contact 15, the function of which will be made clear later in describing what occurs when the breaking signal is transmitted at the instant a spacing signal is being received over the line. Secondly, through the closing of contact 12, a shunt path is provided around the winding 5 of the pole changer PC_1 in parallel with the shunt path through contact 4 of the control relay, the function of which will also be clear from the description of the operation of the circuit when a spacing signal is being received at the instant of transmission of a breaking signal. Thirdly, by the

opening of contact 8 and the closing of contact 9, the terminal of opposite polarity of the main line battery B_4 is connected through conductor 10 to the line L_1 , which causes the polar relay at the distant end to open its local circuit and thereby, through the medium of the distant control relay, to open the distant subscriber's loop which fact is indicated to the operator at the distant end by the opening of his sounder to make a spacing signal.

Let it be assumed that during the period of reception of a spacing signal at station B from the distant station Y the key K_1 at B is opened for the transmission of a "break" signal. The control relay R_1 will be de-energized by a spacing signal from station Y allowing its contacts 4 and 6 to open. Through the opening of contact 6, the circuit through the winding 7 of the pole changer is opened, which would tend to allow the armature to fall back, but this is prevented through the opening of contact 4 which removes the shunt around the locking coil 5, thereby energizing the said coil and maintaining the armature of the pole changer in such position as to keep its contact 8 closed. Under such condition the "break" signal will not be transmitted to the line until the reception of the next marking signal from the distant station Y. The reception of this marking signal operates the control relay R_1 , thereby closing its contacts 4 and 6, the closing of contact 4 shunting the winding 5 and the closing of contact 6 producing no effect upon the winding 7 of the pole changer since the key K_1 is open for the transmission of a breaking signal. Consequently the pole changer PC_1 is de-energized, which allows its armature to fall back, closing contact 9 and effecting the operation of the other contacts in a manner previously made clear in connection with the description of what occurs when key K_1 is opened to transmit a breaking signal at a time when a marking signal from distant station Y has closed polar relay PR_1 thereby closing the control relay and through its contact 6 closing the loop circuit to station B.

From the foregoing description, it will be seen that the function of the extra contact 12 of the pole changer is to provide an extra shunt path to ground around the coil 5 of the pole changer PC_1 , which insures the maintenance of this coil in its inoperative condition regardless of the opening or closing of contact 4 of the control relay. It will furthermore be seen that the time required to secure control of the circuit for the transmission of the "break" signal from the Morse subscriber's station B is dependent only upon the period of time in which the flux in the core of the winding 7 will diminish to such point as to release the armature of the

pole changer plus the period of time for the said armature to move from contact 8 to contact 9, which of course is appreciably small. It will be seen that it is independent of the time for the repeating sounder to operate which, in the system previously used, was part of the time required to secure control of the circuit for the transmission of a "break" signal.

The object of the circuit through the contact 15 of the repeating sounder is to enable the operator at the Morse subscriber's station B to restore the apparatus for the reception of signals after a "break" signal has been transmitted over the line from the station B to the distant station Y. When the operator at B closes his key K_1 for the reception of signals, a circuit is established from battery B_3 , winding 7 of the pole changer PC_1 , through contact 15 of the repeating sounder (even though contact 6 of the control relay is open) and thence through winding of relay R_2 and key K_1 , to ground. This flow of current causes the operation of the pole changer, which causes its armature to close contacts 8 and 11 and to open contacts 12 and 9, thereby restoring the apparatus of the duplex circuit A to its normal position for the reception of signals.

Although this invention has been shown and described in connection with a bridged polar duplex system, it is to be understood that this has been done for the purpose of illustration only and it is not to be construed as a limitation of the invention to a particular system since it is obviously applicable to any well known duplex telegraph system and to any well-known telegraph repeater system.

Furthermore, although this invention has been described as embodied in a particular circuit arrangement, it is apparent that it is capable of embodiment in other and different arrangements without departing from the spirit and scope of the appended claims.

What is claimed is:

1. A telegraph signaling system comprising a line circuit having a receiving relay connected therewith, a pole changer having main and auxiliary windings, a Morse loop circuit and a control relay responsive to the operation of the said receiving relay, the said windings of the pole changer being so arranged and connected with the said loop circuit and the said control relay that normally one of said windings will be energized when the other is deenergized, and both windings are deenergized when a break signal is to be transmitted.

2. In a telegraph receiving circuit, the combination with a receiving relay responsive to line signals of a control relay responsive to the operation of the said receiving relay, a Morse loop circuit and a pole changer having a main winding normally

connected with the said Morse circuit through a contact of the said control relay, and an auxiliary winding arranged to be effectively shunted by the operation of the control relay when the said main winding is energized, and means controlled by the said pole changer to prevent the energization of the said auxiliary winding when the said main winding is deenergized during the sending of a break signal.

3. In a telegraph signaling system, the combination of a line circuit, a loop circuit, a receiving relay responsive to signals received over the said line circuit, a pole changer, and a control relay responsive to the operation of the said receiving relay and arranged to control the action of the said pole changer, the said pole changer having means associated therewith whereby the transmission of a "break" signal by the said loop circuit may be rendered independent of the duration of time in which the said control relay remains operative.

4. In a telegraph signaling system, the combination with a line circuit of a receiving circuit connected therewith comprising a loop circuit, a control relay responsive to marking and spacing signals, a transmitting pole changer having an armature connected with the said line circuit, a source of potentials of opposite polarity connected therewith and also having a main winding controlled by the said loop circuit, and a locking winding controlled by the said control relay to normally prevent the movement of the said armature when the said main winding is deenergized during the reception of a spacing signal over the said line circuit, and

means controlled by the armature of the said pole changer to prevent the energization of the said locking winding when a break signal is being transmitted by the said loop circuit to the said line circuit.

5. In a telegraph signaling system the combination of a line circuit, a control relay responsive to impulses transmitted over said line circuit, a pole changer having main and locking windings and a source of current associated therewith, a loop circuit connected with the said pole changer and having signal indicating means responsive to operation of the said control relay, and means associated with the said pole changer to render the said locking winding inoperative when a breaking signal is transmitted from the said loop circuit.

6. In a circuit of the type defined by claim 1, the method of transmitting a break signal over the said line circuit when a marking signal is being received over the said line circuit, which consists in opening the said loop circuit, deenergizing the main winding of the said pole changer, and shunting the said auxiliary winding of the said pole changer, thereby insuring the release of its armature and preventing the subsequent energization of the said auxiliary winding when the means for effecting the aforementioned shunting action is effectively removed during the receipt of a spacing signal over the said line circuit.

In testimony whereof, I have signed my name to this specification this 30th day of December, 1920.

JAMES I. MITCHNER.