Nov. 17, 1925.

S. I. CORY

1,561,532

TELEGRAPH SYSTEM

Filed July 26, 1923

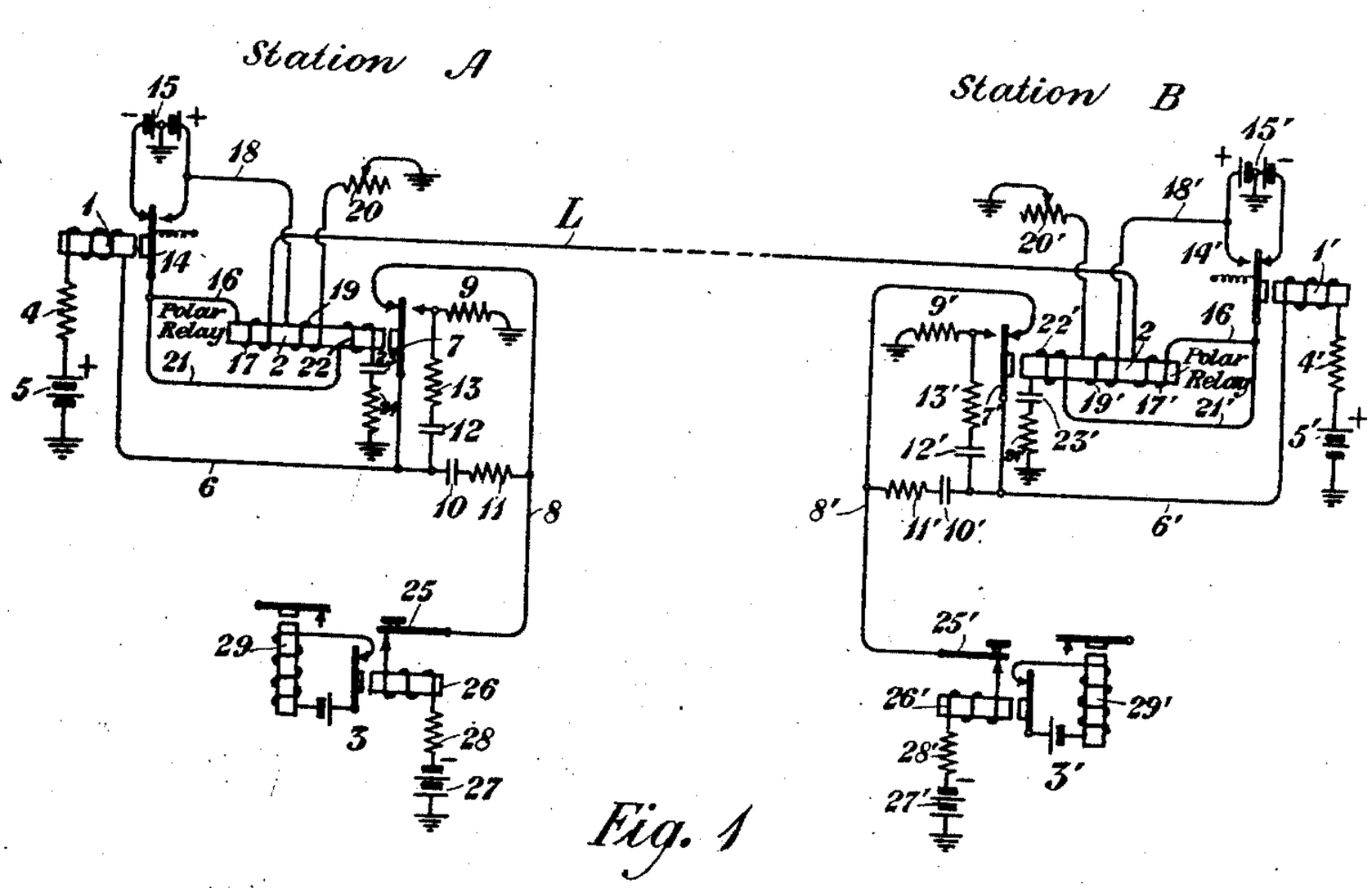

Fig. 1

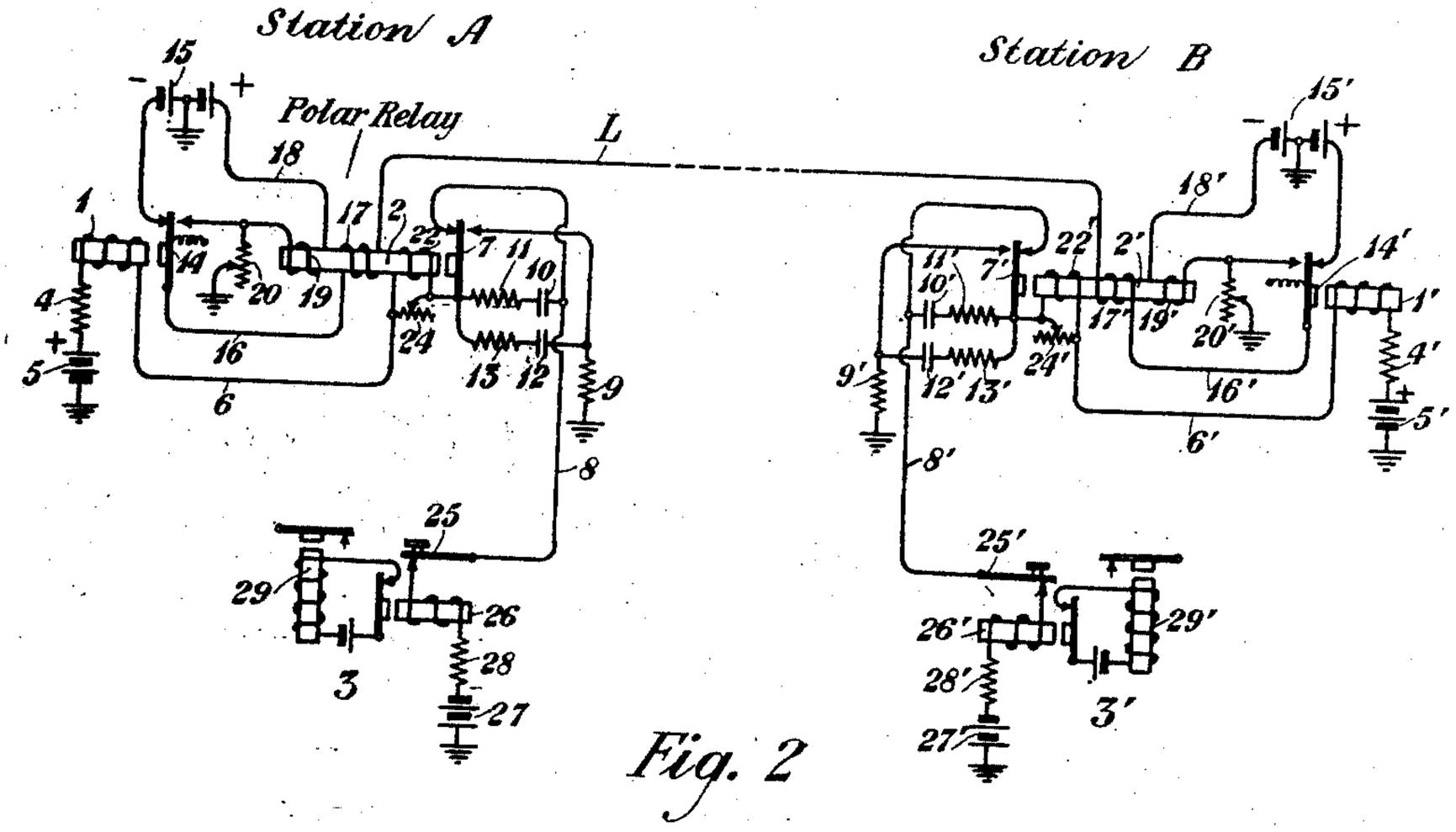

Fig. 2

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TELEGRAPH SYSTEM.

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To all whom it may concern:

Be it known that I, SAMUEL I. CORY, residing at Elmhurst, in the county of Queens and State of New York, have invented certain Improvements in Telegraph Systems, of which the following is a specification.

This invention relates to signaling systems and particularly to a single Morse telegraph system characterized by a polar receiving relay connected directly with the line circuit, the said system being so arranged that signals are sent by reversals of polarity rather than by opening and closing the line by the key at the sending station, as is customary in the present practice.

The principal causes contributing to the poor operation of single Morse telegraph circuits of the type heretofore used is that the line circuit is opened and closed by the operation of the key at the sending station, and that neutral relays are used as the receiving relays connected with the said line circuit.

It is the object of this invention to provide a single Morse telegraph system utilizing polar relays for receiving relays in the terminal circuits, the said system being so arranged that the line circuit will not be opened during the transmission of signals from the same station. Such a single Morse system compares favorably in operation with the polar duplex circuits.

Other objects of this invention will be apparent from the following description when read in connection with the attached drawing, of which Figure 1 shows one form of embodiment of the invention and Fig. 2 shows another form differing from the first in that the receiving polar relay is so arranged that the effect of the line charging currents when sending is to assist in maintaining the relay in operated position.

Fig. 1 shows two stations A and B, which preferably are identical in form and arrangement. The corresponding parts at station B have been given the same numerals as those at station A but are distinguished therefrom by the use of the prime mark. It will accordingly be necessary to describe in detail only the apparatus at station A. The circuit of A comprises a sending pole changer 1, a receiving polar relay 2 and a subscriber's telegraph station 3. With respect to the latter it is to be understood that any number of subscribers' stations may be connected with the subscriber's loop circuit in the manner well known in the art. One terminal of the winding of the pole changer 1 is connected through the resistance 4 with the grounded battery 5. The other terminal of the said winding is connected by conductor 6 with the armature 7 of the polar relay 2. The left-hand contact of this relay, which, for the convenience of description, will be referred to as the closed contact, is connected by conductor 8 with the subscriber's station 3. The right-hand contact of the said relay, which will be referred to as the open contact, is grounded through the resistance 9. Effectively connected between the armature 7 and the closed contact is a condenser 10, in series with a resistance 11, and similarly connected with the open contact is a condenser 12, in series with the resistance 13 which impedances function as spark killers. The armature 14 of the pole changer is adapted to move between its marking and spacing contacts, viz, those connected with the negative and positive poles respectively of the battery 15. The armature 14 is connected by conductor 16 with one terminal of the winding 17, the other terminal of which is connected with the line L. The positive terminal of the battery 15 is connected by conductor 18 with the biasing winding 19 of the polar relay, the other terminal of which is connected through the variable resistance 20 to ground. The armature 14 is also connected by conductor 21 with the winding 22, which is connected to ground, the said connection including a condenser 23 and a resistance 24, either or both of which may be variable.

The subscriber's telegraph station 3 comprises a key 25, the contact of which is connected with the winding of relay 26, which winding is also connected with the grounded battery 27 through the resistance 28. This relay controls, through the operation of its armature, the sounder 29. It will be seen that the batteries 5 and 27, which are in the circuit including the pole changer 1 and the key 25, are arranged in a series-aiding manner. By opening and closing the said key, the pole changer 1 and the local relay 26 will be released and operated respectively. When the key 25 is closed and the pole changer 1 is operated the negative pole of

the line battery 15 will be connected with the line L, thereby transmitting a marking impulse over the said line. The opening of the key 25 releases the pole changer 1 and its armature 14 will be connected with the positive pole of the line battery, thereby transmitting a spacing impulse over the said line. It should be noted that the circuit at station B is similarly arranged to connect the negative pole of the battery 15′ with the line for the transmission of a marking signal and the positive pole for the transmission of a spacing signal.

Having in mind the foregoing description of the circuit in which this invention is embodied the manner in which this circuit operates to produce the desired result is as follows:

Let it be assumed that station A is sending and station B is receiving, which means that the key 25′ at station B remains closed and the armature 14′ of the pole changer is therefore held against its right-hand contact, which is connected with the negative pole of the battery 15′. When the key 25 at station A is closed for the transmission of a marking impulse current will flow through a circuit containing the battery 5, resistance 4, the winding of the pole changer 1, conductor 6, armature 7 of the polar relay 2, conductor 8, key 25, the winding of relay 26, resistance 28 and battery 27, thereby energizing the pole changer 1 and the relay 26. The armature 14 of the pole changer 1 will be drawn to its left-hand contact, thereby connecting the negative pole of battery 15 with the line L, the connection including the armature 14, conductor 16 and winding 17 of the relay 2. Since the negative pole of the line battery 15′ at station B is also connected with the line L, only the line charging current will flow through the winding 17. As stated heretofore, the positive pole of the line battery 15 is connected by conductor 18 with the biasing winding 19 of the relay 2, which winding is so poled that the current flowing therethrough will attract and hold the armature 7 of the said relay against its closed contact, viz, its left-hand contact. Although no steady current will flow through the winding 17 when a marking impulse is transmitted over the said line there will be a flow of charging current, which would tend to interfere with the proper operation of the relay 2 unless suitable means were provided to compensate for the effect of such charging current. This suitable means comprises the auxiliary winding 22, which is connected with the armature 14 by conductor 21 and is also connected to ground through the condenser 23 and the resistance 24. The winding 22 is poled oppositely to winding 17, which is connected with the line. The condenser 23 will be charged in the same manner in which the line is charged because they are both effectively connected with the armature 14. By proper adjustment of the condenser and resistance connected with the winding 22 the charging current flowing through this winding when the armature 14 touches, for example, its negative contact will equal that flowing through the line winding 17. Since the said windings are oppositely poled, the effect of the charging current upon the armature of the polar relay will be substantially neutralized.

Let it be assumed that the key 25 is now opened for the transmission of a spacing impulse. Accordingly, the pole changer 1 will be deenergized and the armature 14 will be drawn by the retractile spring against its right-hand contact, which is connected with the positive pole of the line battery 15. When the armature 14 moves away from its negative contact, the charging currents, due to the capacity of the line, will tend to move the polar relay tongue 7 from its closed contact. This effect is neutralized by the discharge of the condenser 23 through the winding 22, so that the resultant effect of the line charging current upon the operation of the polar relay 2 is practically nil.

When the armature 14 touches its positive contact, current will flow through winding 17 and over the line L since the batteries now connected with the opposite ends of the said line are in series-aiding position. The winding 17 is so poled that the flow of current from station A to station B will assist the current through the winding 19 in holding the tongue 7 upon its closed contact. The line L and the condenser 23 will both be charged after the armature 14 touches the positive contact of the pole changer. In view, however, of the opposite poling of the windings 17 and 22 the effect of the charging current upon the armature of the polar relay will be neutralized. When the key 25 is closed for the transmission of a marking impulse the armature 14 will be drawn to the negative contact of the pole changer, thereby permitting the charging currents to flow through the windings 17 and 22. It will accordingly be seen that by means of the circuit arrangement shown, the tongue of relay 2 is held upon its closed contact by means of the biasing winding 19 regardless of whether the key 25 is open or closed and consequently the receiving relay at A is unaffected by the transmission of signals from A.

Breaking is accomplished as follows:—Assume that when the key 25 is closed for the transmission of a marking impulse the key 25′ at station B is opened for the transmission of a break signal. When key 25′ is open the pole changer 1′ will be released and its armature 14′ will move to its positive contact. Accordingly, current will flow

from the positive terminal of the line battery 15′ through the winding 17′, thence over the line L and through the winding 17 to the negative terminal of the battery 15. The current in winding 17′ will be in such direction as to assist in maintaining the armature 7′ upon its closed contact. The current in winding 17 will oppose the effect of the current in the biasing winding 19 and will be of sufficient magnitude to cause the armature 7 to move from its closed to its open contact, thereby opening the circuit of the relay 26 at the subscriber's telegraph station and in consequence thereof releasing the sounder 29, thus apprising the operator at that station that the operator at station B desires to send some message. If key 25 is open for the transmission of a spacing impulse at the instant that key 25′ is open to transmit the break signal, the positive poles of batteries 15 and 15′ would be connected with the opposite ends of the line L and either no current would flow in the line L or if current had started to flow before the opening of the key 25′ it would cease to flow as soon as the armature 14′ moved to its positive contact. Neither of the relays 2 or 2′ would be released by this operation but as soon as key 25 would be closed for the transmission of the next marking impulse, winding 17 of relay 2 would thereby be energized in such direction as to overcome the magnetization set up by the winding 19 and cause the armature 7 to move to its open contact, thereby opening the circuit of relay 26 and releasing the sounder 29. It is thus seen that the arrangement set forth in Fig. 1 produces as good results from an operating standpoint in the transmission of a break signal as is now obtained in the polar duplex systems.

The arrangement shown in Fig. 2 differs in one respect from that shown in Fig. 1 in that marking impulses are sent from the different stations by impulses of opposite polarity. Thus, in the figure, a marking impulse from station A is negative and from station B positive. The subscriber's set designated 3 at station A is connected with the closed contact, that is, the left-hand contact of the polar relay 2. One terminal of the winding of the pole changer 1 is connected through the resistance 4 with the grounded battery 5. The other terminal of the said winding is connected by conductor 6 with a winding 22 of the polar relay, which winding is connected with the armature 7. This winding 22 is shunted by resistance 24 in order to properly control the current passing therethrough. The negative pole of the line battery 15 is connected with the marking contact of the pole changer and the positive pole of the said battery is connected by conductor 18 with one terminal of a winding 19, the other terminal of which is connected with the spacing contact of the pole changer. This terminal of winding 19 is also connected to ground through a variable resistance 20, by means of which the current which flows continuously through the winding 19 may be controlled. The armature is connected with one terminal of the line winding 17, the other of which is connected with the line L. The circuit arrangement at station B is identical with that of station A except that the positive terminal of the line battery 15′ is connected with the marking contact of the pole changer 1′ and the negative terminal of the said battery is connected with the winding 19′ of the relay 2′, which winding is connected with the spacing contact of the said pole changer and is also connected to ground through the variable resistance 20′. The resistances 20 and 20′ are of such magnitude that a small current will always flow through their respective windings so as to normally hold the armatures of their respective relays upon the closed contact. The windings 22 and 22′ are so poled that the current flowing through each of them tends to move the armatures of their respective relays to the open position.

The manner in which the system shown in Fig. 2 operates is as follows:

Let it be assumed that station A is sending and station B is receiving and that the key 25 is closed for the transmission of a marking impulse. Current will flow, therefore, from the positive terminal of battery 15′ through the winding 17′ over the line L and through the winding 17 to the negative terminal of battery 15. The current through winding 17 will be in such direction as to assist the current flowing in winding 19 in keeping the armature 7 upon its closed contact. With the opening of the key 25 for the transmission of a spacing impulse the pole changer 1 will be deenergized, allowing its armature 14 to move to its spacing terminal, viz, that connected with the positive pole of the battery 15. Since the line L is now connected with the positive poles of batteries 15 and 15′, no current will flow through the windings 17 and 17′. Furthermore, since the key 25 is open, current will not flow through the winding 22 but the armature 7 will be maintained upon its closed contact by the steady flow of current through the winding 19. When the armature 14 moved to its positive terminal, a charging current would flow through the winding 17, which would tend to move the armature 7 from its closed contact, but such a tendency would be neutralized by the flow of current through the winding 19. With the closing of key 25 for the transmission of another marking impulse the armature 14 would be drawn to its negative pole. In this case the charging current through the

line winding 17 would be in such direction as to tend to keep the armature 7 upon its closed contact.

The method in which a break signal is transmitted from station B to station A while the latter is transmitting signals is as follows: If key 25 is closed when key 25′ is opened for the transmission of a break signal the pole changer 1′ will be deenergized and the armature 14′ will move to its negative terminal. This reduces the line current to zero, so that no current flows through the winding 17. At this instant current flowing through the winding 19 tends to keep the armature 7 upon its closed contact while that flowing from battery 5 through winding 22 and relay 26 to battery 27 is in such direction as to tend to move the armature 7 from its closed contact. By proper adjustment of the resistance 24 the effective strength of this current through the winding 22 may be sufficiently great as to overcome the tendency of the current through the winding 19 to keep the armature 7 on its closed contact, thereby causing the said armature to fall back to its open contact, thus opening the circuit through the relay 26 and in consequence thereof, releasing the sounder 29. The open condition of the sounder at the instant that the operator at station 3 had the closed would apprise him of the fact that the operator at station B was trying to get control of the circuit.

If key 25 is open for the transmission of a spacing impulse at the time key 25′ is opened to get control of the circuit, the positive pole of relay 15 will be connected with the line at station A and the negative pole of battery 15′ at station B, thus causing current to flow from station A to station B over the said line. This current flowing through winding 17 will not be of sufficient magnitude to overcome the effect of the current in the winding 19 and accordingly the armature 7 will remain upon its closed contact. With the closing of the key 25 for the transmission of the next marking signal, current will flow through the winding 22 from battery 5 to battery 27 and no current will flow through the line winding 17 since the armature 14 of the pole changer 1 will have moved to its negative contact. Accordingly, the armature 7 will be moved to its open contact since the current in the winding 22 is of sufficient magnitude to overcome the effect of the current in the winding 19. Accordingly, the circuit through the relay 26 will be opened and the sounder 29 will be released, thus apprising the operator at station 3 that the distant operator is seeking to get control of the line.

The line circuit arrangement shown in Fig. 2 in the form of a single Morse telegraph system may be used also in connection with the present grounded polar duplex loop circuit or with the metallic system circuit. While the system is particularly applicable for use in fine wire cable circuits where the line leakage is relatively small, it may also be used on open wire lines.

Although this invention has been disclosed as embodied in a particular form and arrangement of parts, it is not so limited but is capable of embodiment in other and different forms without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a single Morse telegraph system, the combination with a line circuit of a polar receiving relay having a plurality of windings, one of which is connected with the said line circuit, a pole changer having its armature connected with that winding of the said polar relay with which the said line circuit is connected, and also with another winding of the said polar relay, the said relay having also a third winding connected between the positive contact of the pole changer and ground.

2. In a single Morse telegraph system, the combination with a line circuit of a multi-winding polar receiving relay, a pole changer having sources of potential of opposite polarity and means for controlling the said pole changer, one winding of the said polar relay being connected between the said line circuit and the armature of the said pole changer, a second winding connected between the said armature and ground, the said latter winding being so poled as to neutralize the effect upon said relay of charging current through the winding connected with the said line circuit, and a third winding connected with one of said sources of potential and so poled as to normally attract the armature of the said polar relay.

3. In a single Morse telegraph system, the combination with a line circuit of a transmitting pole changer having connected with the contacts of the armature thereof sources of potential of opposite polarity, a subscriber's loop circuit controlling the said pole changer, and a polar relay having a plurality of windings, one of which is connected between the said armature and the said line, a second winding between the said armature and a grounded condenser, and a third winding connected between one of said sources of potential and ground and being so poled as to normally attract the armature of the said relay.

4. In a single Morse telegraph system, the combination with a transmitting pole changer having an armature and sources of potential connected with the contacts thereof, the polarity of the said sources being opposite, and a polar relay having a plu-

rality of windings, two of which are connected with the armature of the pole changer, and a third winding connected with one of said sources of potential and so poled as to attract the armature of the said relay.

5. In a single Morse telegraph system, the combination with a line circuit of transmitting means having sources of potential of opposite polarity adapted for connection with the said line circuit for signalling thereover, and a polar relay having a winding adapted for alternate connection between each of said sources and said line, a second winding adapted for alternate connection between each of said sources and a grounded impedance simulating the said line, and a third winding connected between one of said sources and ground and being so poled and exerting a magneto motive force of such strength as to normally hold the armature of the polar relay until a break signal is transmitted over the said line circuit.

6. A single Morse telegraph system characterized by a line circuit having stations connected therewith comprising a transmitting pole changer having sources of potential of opposite polarity and also having means to control the said pole changer to effect the transmission of signals, and a polar relay having one winding effectively connected between the said pole changer and the said line circuit, a second winding effectively connected between the said pole changer and a grounded impedance, and a third winding normally connected with one of said sources of potential and adapted to bias the said polar relay, the biasing force being of such magnitude as to be overcome only when a break signal is transmitted from another station upon the said line circuit.

In testimony whereof, I have signed my name to this specification this 25th day of July, 1923.

SAMUEL I. CORY.