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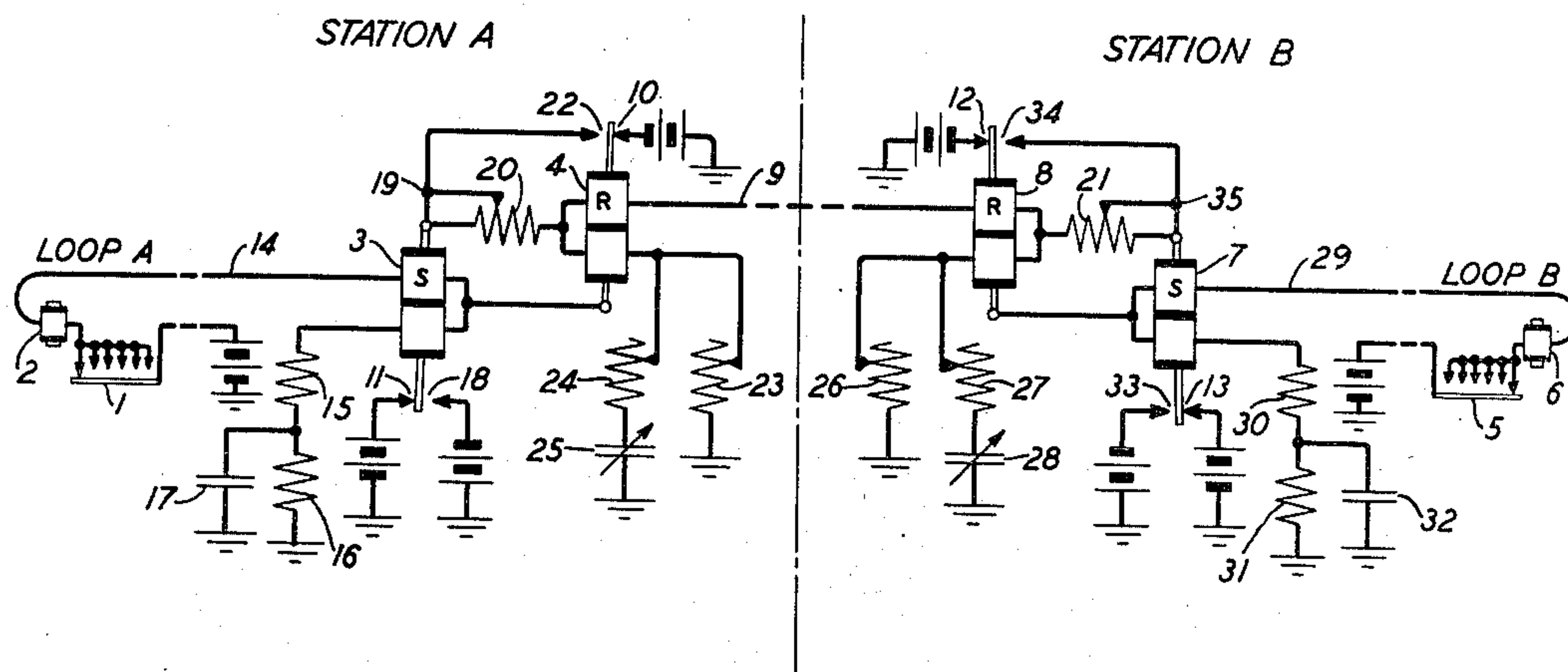
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TELEGRAPH REPEATER

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FIG. 1



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TELEGRAPH REPEATER

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This invention relates to telegraph systems and more particularly to an improved half-duplex direct current telegraph system which includes a telegraph repeater at each terminal in which repeater a separate break relay is not required.

By a half-duplex telegraph system, as used herein, is meant a system which is arranged for transmission in only one direction at a time. That is to say, if station A at one terminal is transmitting to station B at the opposite terminal, station B cannot transmit simultaneously to station A. In such a system it is necessary to provide some means whereby a station which is normally receiving may interrupt transmission from the sending station so as to permit the receiving station to transmit toward the sending station. In all half-duplex direct current telegraph systems, so far as is known, separate means, known generally as a break relay, have been provided in the repeater at each terminal to perform the breaking function in response to a breaking signal transmitted from the distant station. In the arrangement of the present invention, the break relay or any separate element equivalent thereto, is dispensed with.

An object of the present invention is the provision of a half-duplex direct current telegraph system in which separate means for performing the break function is not required.

The invention may be understood from the following description when read with reference to the associated drawing, which taken together, disclose a preferred embodiment of the invention, and in which the single figure of the drawing shows a half-duplex direct current telegraph system which includes the break feature but has no break relay.

In the drawing there is shown at the left, a telegraph repeater station, station A, to which is connected a subscriber's loop station, loop A, and at the right of the figure, a telegraph repeater station, station B, to which is connected a subscriber's loop, loop B.

Loop A extends from repeater station A, to the subscriber's premises, whereat are located a telegraph transmitter 1 and a telegraph receiver 2, which may for instance be parts of the well known teletypewriter transmitter and receiver instrument. At station A are located the repeater polar sending relay 3, and the repeater polar receiving relay 4. Similarly, a transmitter 5 and receiver 6 are located at the subscriber's station in loop B, and a polar transmitting relay 7, and a polar receiving relay 8 are located

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at repeater station B. Repeater station A and repeater station B are interconnected by telegraph channel 9.

When the system is in the marking condition, the armature of receiving relay 4 at station A is in engagement with its marking contact 10, and the armature of sending relay 3 is in engagement with its marking contact 11. Similarly, the armature of receiving relay 8, at station B, is in engagement with its marking contact 12, and the armature of sending relay 7 is in engagement with its marking contact 13. A circuit may therefore be traced from negative battery through marking contact 10 of station A to the apex of relay 3. From this point one branch of the circuit extends through the top winding of relay 3 through conductor 14, magnetic receiver 2, and transmitter 1, to positive battery. From the apex of relay 3 a second branch of the circuit may be traced through the bottom or biasing winding of relay 3, resistance 15 and resistance 16 to ground. From the junction between resistance 15 and 16, a condenser 17 is connected to ground. The effect of the current through the top winding of relay 3 for this condition tends to actuate its armature to engage its marking contact 11. This effect is opposed by the effect of current flowing through the bottom winding of relay 3, which is tending to actuate the armature of relay 3 to engage with its spacing contact 18. The effect of the current in the top winding is dominant, however, and the armature of relay 3 is therefore maintained in engagement with its marking contact 11.

When the armature of relay 3 is in engagement with its marking contact 11, a circuit may be traced from positive battery through marking contact 11, to junction 19 where the circuit branches. The main transmission path of the circuit continues through variable resistance 20, to the apex of relay 4, where the circuit again branches. The main transmission path continues through the top winding of relay 4, telegraph channel 9, top winding of relay 8, variable resistance 21 and marking contact 13, to positive battery. From junction 35 a branch of the circuit extends to spacing contact 34 of relay 8. From junction 19 a branch of the circuit extends to spacing contact 22 of relay 4. From the apex of relay 4 a branch of the circuit extends through the bottom or biasing winding of relay 4 and variable resistance 23 to ground. Variable resistance 23 is shunted by a series branch consisting of variable resistance 24 and condenser 25. Since positive battery is connected to each

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end of the main transmission path, no current flows through the top windings of relays 4 and 8 for the marking condition. The effect of the current flowing through the bottom or biasing winding of relay 4 for this condition maintains the armature of relay 4 in engagement with its marking contact 10. A circuit may be traced from positive battery through marking contact 13, variable resistance 21, bottom or biasing winding of relay 8 and variable resistance 26, to ground. Variable resistance 26 is shunted by a series branch consisting of variable resistance 27 and condenser 28. The effect of the current flowing in the bottom or biasing winding of relay 8 for this condition, maintains the armature of relay 8 in engagement with its marking contact 12.

A circuit may be traced from negative battery through marking contact 12 to the apex of relay 7. The main transmission path extends through the top winding of relay 7, loop conductor 29, magnetic receiver 6 and transmitter 5, to positive battery. From the apex of relay 7 a branch of this circuit extends through the bottom or biasing winding of relay 7, resistance 30 and resistance 31, to ground. A condenser 32 is connected between ground and the junction between resistances 30 and 31. The effect of the current flowing in the top winding of relay 7 tends to actuate its armature to engage with its marking contact 13 and this effect is dominant over the effect of current flowing in the bottom or biasing winding of relay 7 tending to actuate the armature of relay 7 to engage with its spacing contact 33, so that the armature of relay 7 is maintained in engagement with marking contact 13 for this condition. Since current flows in both loop A and loop B, magnetic receivers 2 and 6 are energized for the marking condition.

It will be assumed that the subscriber in loop A wishes to transmit to the subscriber in loop B. For this purpose, the contacts of the teletypewriter transmitter 1, will be actuated so as to alternately open and close the loop. When the loop is open, no current will flow through the top winding of relay 3. The armature of relay 3 will therefore be actuated to engage with its spacing contact 18 under the influence of current in the bottom winding of relay 3. When the armature of relay 3 engages its spacing contact 18 negative battery at station A is connected to one end of the main transmission path, while positive battery remains connected to the opposite end. The current through the bottom or biasing winding of relay 4, will therefore be reversed, and its effect will tend to actuate the armature of relay 4 to engage with its spacing contact 22. However, current of considerably larger magnitude will flow through the top or line winding of relay 4, and its effect, tending to maintain the armature of relay 4 in engagement with its marking contact 10, will be dominant over the effect of the current flowing in the biasing winding, so that the armature of relay 4 will be maintained on its marking contact. At station B, however, the current through the top or line winding of relay 8 will be dominant over the effect of the current in the lower or biasing winding and the armature of relay 8 will be actuated to engage with its spacing contact 34. When the armature of relay 8 engages with its spacing contact 34, a circuit may be traced from positive battery through marking contact 13 of relay 7 and spacing contact 34 of relay 8, to the apex of relay 7. For this condition no current will

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flow through the top winding of relay 7 since positive battery is connected to each end of subscriber's loop B. The polarity of the current through the bottom or biasing winding of relay 7 has now been reversed. Since it formerly tended to actuate the armature of relay 7 to engage with its spacing contact 33, it will now be effective when no current flows through the top winding of relay 7 to maintain its armature in engagement with its marking contact 13. The spacing signal transmitted over loop conductor 29, through receiver 6 deenergizes the receiving magnet and this will be effective to actuate the receiver so as to register a spacing signal. When subscriber's loop A is reclosed, the marking condition described heretofore will be reestablished. Thus marking and spacing communication signal elements may be transmitted from loop A to loop B. In a generally corresponding manner, marking and spacing communication signal elements may be transmitted from loop B to loop A.

When such signals are transmitted from loop B, it should be understood from the foregoing that relay 7 will actuate its armature between its marking and spacing contacts 13 and 33. Relay 8 will be unaffected as was relay 4 and the armature of relay 8 will be maintained in engagement with its marking contact 12. Relay 4 will respond to the signals received at station A from station B in the same manner as did relay 8 at station B for the signals received from station A. The armature of relay 4 will be actuated between its marking contact 10 and its spacing contact 22. Relay 3 will not respond to these signals, however, for the same reason as described for relay 7, and the receiving device 2 in loop A will register the communication signal.

It will be now assumed that loop B is transmitting communication signals and loop A wishes to break. To perform this function, a long spacing signal is transmitted from loop A. In response to this, assuming station A marking, the armature of relay 3 will be actuated to engage its spacing contact 18.

There are two conditions now to be considered. If the armature of relay 7 is on its marking contact 13 at this instant, a spacing signal will be received by relay 8 and its armature will engage its spacing contact 34. For this condition no current flows in loop B because positive battery is connected to each end of loop B and the loop is closed since a marking signal is being transmitted. Loop B is deenergized. Positive battery through contacts 13 and 34 will flow through the bottom winding of relay 7, resistance 30 and resistance 31 to ground, and the armature of relay 7 will be maintained in engagement with its marking contact 13. When loop B is opened to transmit the next spacing signal element, it will be ineffective since there is no current in loop B to interrupt. Thus, loop B will remain deenergized, informing the operator that loop A wishes to transmit communication signals. If loop B is transmitting a spacing signal, however, at the instant when the armature of relay 3 is actuated to engage its spacing contact 18 in response to a break signal, and relay 7 at station B has responded while relay 8 has not yet responded, negative battery will be connected to both ends of the main transmission path at stations A and B. The armature of both relays 4 and 8 will be actuated to engage their spacing contacts 22 and 34 respectively. Negative battery will be connected to the station side of loops A and B. Both loops will be open for the assumed

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transmission of a spacing signal from each. Since there will be no current in the top winding of relay 7, current from negative battery through contact 33 and contact 34 and the bottom winding of relay 7 will maintain the armature of relay 7 on spacing contact 33 while the spacing signal which is being transmitted from loop B persists. When loop B is again closed full loop current will flow from negative battery on spacing contact 33, through the armature of relay 7, through the spacing contact 34 and armature of relay 8, through the top winding of relay 7, through conductor 29, through loop B and back to positive battery. When this occurs the armatures of relays 4 and 8 will be maintained in engagement with their spacing contacts 22 and 24. This full loop current flowing in the top winding of relay 7 is dominant and causes relay 7 to actuate its armature to its marking contact 13 and positive battery will be reconnected to both ends of loop B, deenergizing loop B to provide the break signal condition.

Variable resistances 20 and 21 are provided to adjust the line current. Variable resistances 23, and 24 and variable condenser 25 are provided to adjust the current in the biasing winding of relay 4 and variable resistances 26 and 27 and variable condenser 28 are provided to perform the same function for relay 8.

It should be obvious that the polarities of the potential sources connected to the marking and spacing contacts of each sending relay in each repeater and the polarities of the potential sources connected to the two terminals of each of the loops may be interchanged without affecting the operation of the repeater. There are other obvious changes, which may be made, which will be readily apparent to those skilled in the art, which changes are comprehended by the invention and it is to be understood that the invention is not limited to the particular embodiment shown and described herein.

What is claimed is:

1. A half-duplex direct current telegraph system, a telegraph repeater in said system, a polar transmitting relay and a polar receiving relay in said repeater, a marking contact, a spacing contact and an armature on each of said relays, a line winding and a biasing winding on each of said relays, said windings on each of said relays connected to an apex individual to each of said relays, a connection from the apex of said transmitting relay directly to a fixed end of said armature of said receiving relay, a connection from the fixed end of said armature on said transmitting relay to said apex on said receiving relay, and a connection from said spacing contact on said receiving relay directly to said fixed end of said armature on said transmitting relay and said apex of said receiving relay.

2. In a half-duplex direct current telegraph system, a first and a second telegraph repeater, a first and a second telegraph loop circuit connected to said first and said second repeater respectively, a telegraph channel interconnecting said repeaters, two telegraph relays only, namely a sending relay and a receiving relay, in each of said repeaters, means in said second repeater, responsive to the transmission of a break signal

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from said first loop circuit while said second loop circuit is transmitting, for actuating said receiving relay in said second repeater to engage its spacing contact, and means in said second repeater consisting of said sending and receiving relays in said second repeater, the conductors interconnecting said relays in said second repeater and the magnitudes and polarities of the potentials impressed on said second repeater and on said second loop, responsive to said actuation for preventing further transmission of effective communication signals from said second loop circuit while said break signal persists.

3. A half-duplex direct current telegraph system, a telegraph repeater in said system, a telegraph line and a telegraph loop connected to said repeater, a polar telegraph sending relay in said repeater, a line winding on said sending relay in series with said loop, a biasing winding on said sending relay having one terminal connected to one terminal of said line winding to form an apex and the opposite terminal connected through a lumped impedance to ground, a polar receiving relay in said repeater, a line winding on said receiving relay connected between said line and the fixed end of an armature on said sending relay, a biasing winding on said receiving relay connected from a point intermediate said fixed end of said armature on said sending relay and said line winding on said receiving relay and through a lumped impedance to ground, an armature on said receiving relay having a fixed end connected to said apex on said sending relay and a spacing contact on said receiving relay connected directly to a fixed end of said armature on said sending relay.

4. A half-duplex direct current telegraph system, said system comprising a first telegraph station, a first telegraph repeater, a second telegraph repeater, a second telegraph station, a first telegraph loop circuit interconnecting said first station and said first repeater, a single telegraph channel interconnecting said repeaters, a second telegraph loop circuit interconnecting said second telegraph repeater and said second telegraph station, a sending and a receiving polar relay in each of said repeaters, said repeaters devoid of any other relay, an armature and a marking and spacing contact on each of said relays, a transmitter at each of said stations for opening and closing its connected loop, said sending relays applying polar signals through its respective marking and spacing contact to said channel in response to said openings and closings and a break feature in each of said repeaters, said feature comprising an individual direct connection from said spacing contact of said receiving relay to a fixed end of said armature on said sending relay in each repeater.

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