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TELEGRAPH REPEATER

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FIG. 1

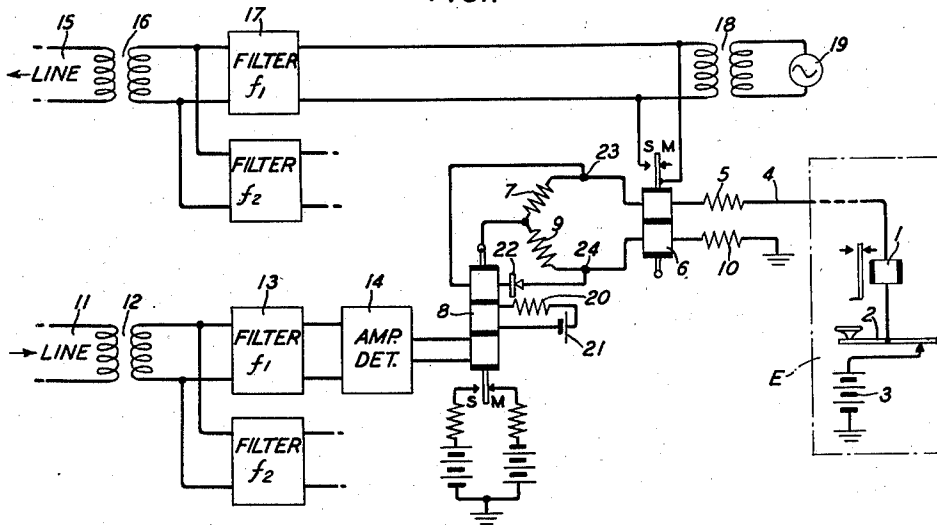
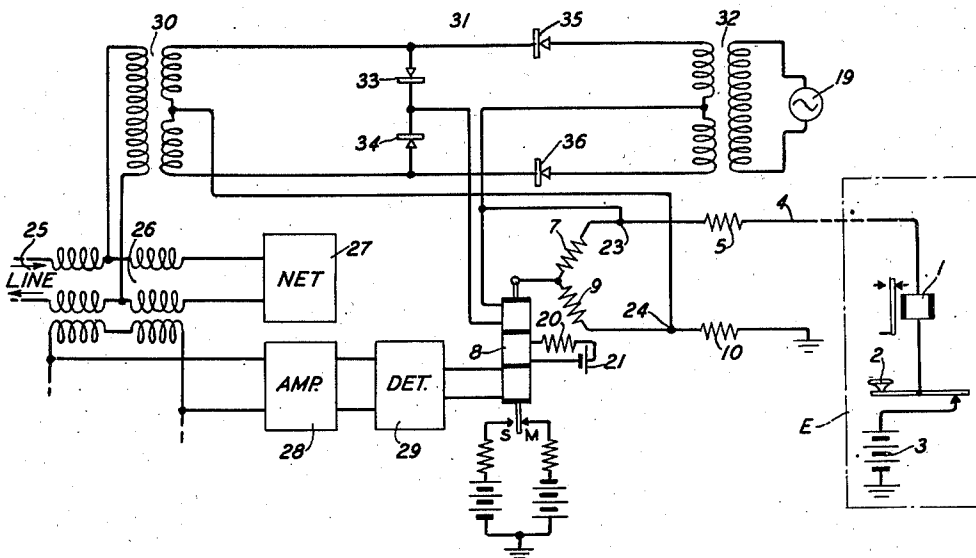


FIG. 2



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TELEGRAPH REPEATER

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10 Claims. (Cl. 178—71)

This invention relates to telegraph systems and more particularly to a terminal repeater for repeating signal impulses from a telegraph line to a subscriber's loop or vice versa.

Heretofore in telegraph systems of the half duplex type, three polarized relays have been required at the terminal repeater, one functioning as a receiving relay for response to signal impulses incoming to the repeater from the telegraph line for repeating impulses to the subscriber's loop, a second functioning as a sending relay responsive to signal impulses incoming to the repeater from the subscriber's loop for transmitting impulses to the telegraph line, and the third, known as a break relay, to enable the subscriber to break in while signal impulses are being received from the telegraph line and to cause the transmission of a signal to the distant operator that the subscriber desires to request a correction or repetition of signals previously received.

The object of the invention is to efficiently repeat signals with a minimum amount of equipment.

In accordance with the present invention this object is attained by entirely eliminating the break relay through the provision of an auxiliary biasing winding on the receiving relay, which is bridged across the duplex bridge in which the subscriber's loop terminates through a unilateral conducting device, for example, a copper-oxide rectifier. This copper-oxide rectifier is so poled that current will flow through such auxiliary biasing winding to hold the armature of the receiving relay on its marking contact regardless of signals incoming over the telegraph line whenever the subscriber's loop key is opened during the reception of a marking signal. This permits a clean-cut break signal to be transmitted to the distant operator.

The invention has been illustrated herein as applicable to systems in which a polarized sending relay is employed and to systems in which the sending relay is replaced by a copper-oxide sending circuit. It will be obvious that the invention is equally applicable to other well-known types of telegraph systems.

The operation of the repeater circuit contemplated by this invention as well as the advantages thereof will be apparent from the following description when considered in connection with the accompanying drawing of which:

Fig. 1 shows a repeater circuit terminating a four-wire line circuit and employing a polarized sending relay; and

Fig. 2 shows a modification of the repeater circuit for connection with a two-wire line circuit and having a sending circuit of the copper-oxide type.

Referring now to Fig. 1, a subscriber's station is schematically indicated by the dot-dash rectangle E and comprises a line relay 1 and normally closed key 2 connected in series with battery 3 and the subscriber's loop conductor 4. The remainder of the figure discloses the equipment of the terminating repeater. The subscriber's loop conductor 4 is associated with the sending portion of the repeater, extending through the series resistance 5, one winding of the sending relay 6 and one arm 7 of the duplex bridge to the armature of the receiving relay 8. The other arm 9 of the duplex bridge is also connected to the armature of the receiving relay 8 and through the other winding of the sending relay 6 to the artificial line including the balancing resistance 10.

The receiving leg 11 of the telegraph line terminates in the primary winding of a transformer 12, the secondary winding of which is connected through a filter circuit 13 to the input of an amplifier and detector panel indicated by the box 14. The output of the detector is connected to the lower or operating winding of the polarized receiving relay 8. The sending leg 15 of the telegraph line terminates in the secondary winding of a transformer 16, the primary winding of which is connected through the filter circuit 17 to the secondary winding of transformer 18 and thence through to the high frequency generator 19. Normally the generator 19 impresses a sending carrier current of a frequency determined by the characteristics of filter 17 upon the sending leg 15 of the telegraph line and, carrier current incoming over the receiving leg 11 of the telegraph line of a frequency determined by the filter 13, is impressed upon the amplifier and detector panel 14.

The sending relay 6 controls the modulation of the sending carrier frequency for transmitting signal impulses over the sending leg 15 of the telegraph line in any well-known manner, as for example, by the closure of a shunt path around the secondary winding of transformer 18.

The receiving relay 8 is normally operated by its lower winding to hold its armature against its marking contact against the biasing effect of its middle winding which is connected in a closed circuit through resistance 20 and the biasing battery 21. In accordance with the present invention, the receiving relay 8 is also provided with

an auxiliary biasing circuit extending in a bridge across the arms of the duplex bridge. This auxiliary biasing circuit may be traced from point 23 between the upper winding of sending relay 6 and bridge arm 7, through the upper winding of relay 8, copper-oxide rectifier 22 to point 24 between the lower winding of sending relay 6 and bridge arm 9. With the loop conductor 4 closed over the contacts of key 2 at the subscriber's station E and the armature of the receiving relay 8 on its marking contact, the potential at point 23 will be positive with respect to the potential at point 24 and consequently the rectifier 22 will present a high resistance to the flow of current through the upper biasing winding of relay 8.

It will now be assumed that the distant operator is sending signals to the terminating station E by modulating the carrier current allocated for transmission to such substation, and that such modulated signaling current is therefore passed by the filter 13 and detected by the detector 14. Each spacing signal will therefore deenergize the operating winding of receiving relay 8 and since the upper biasing winding of relay 8 is at this time unenergized, the middle biasing winding thereof will take control and cause such relay to move its armature from its marking contact to its spacing contact. Each time that the receiving relay 8 closes its spacing contact, current will flow from the spacing battery over arm 9 of the duplex bridge through the lower winding of sending relay 6 to the artificial line thus biasing the sending relay 6 to hold its armature on its marking contact and, the circuit over loop conductor 4 now being connected to similarly poled batteries at each end thereof, the line relay 1 at station E will release or move its armature to its spacing contact.

Should the subscriber at station E now desire to break in upon the transmission from the distant station he will operate key 2 to open the loop conductor 4. As soon thereafter as the receiving relay 8 moves its armature to its marking contact, current will flow from the artificial line through the lower biasing winding of sending relay 6, over arm 9 of the duplex bridge and the marking contact of relay 8 to the marking battery and no current will flow through the upper winding of sending relay 6 since the loop conductor 4 is now open. As a consequence, relay 6 will be operated by its biasing winding to close its spacing contact thereby transmitting a break signal over the sending leg 15 of the telegraph line to the distant station. Under these conditions the potential at point 24 now becomes positive with respect to the potential at point 23 and rectifier 22 will therefore offer a low resistance to the flow of current from point 24 through rectifier 22 and the upper winding of relay 8 to point 23. With both its middle and upper biasing windings now energized, the current flowing through the upper biasing winding is sufficient to overcome the opposite biasing effect of the middle winding and to thus hold the armature of relay 8 firmly on its marking contact regardless of further spacing signal impulses incoming from the distant station over the receiving leg 11 of the telegraph line and controlling the lower or operating winding of relay 8.

Reference will now be made to the modified form of the invention illustrated in Fig. 2 in which the repeater is disclosed as terminating a two-wire, two-way telegraph line and in which a copper-oxide sending circuit is employed in lieu

of a polarized sending relay. The subscriber's station is schematically indicated by the dot-dash rectangle E and comprises a line relay 1 and normally closed key 2 connected in series with battery 3 and loop conductor 4. The loop conductor 4 is connected through resistance 5 and one arm 7 of the duplex bridge to the armature of receiving relay 8. The other arm 9 of the duplex bridge is also connected to the armature of relay 8 and to the artificial line including the balancing resistance 10.

The telegraph line 25 extends through the line windings of hybrid coil 26 to the balancing network 27, the tertiary windings of the hybrid coil being connected to the input of amplifier 28. By the amplifier 28 and detector 29 signals incoming from the line 25 through the hybrid coil are amplified, detected and impressed upon the lower or operating winding of receiving relay 8. The mid-points of the line windings of hybrid coil 26 are bridged through the secondary winding of output transformer 30, the primary windings of which are connected through the copper-oxide rectifiers 35 and 36 to the secondary windings of transformer 32. The primary winding of transformer 32 is connected to the high frequency generator 19.

The receiving relay 8 is normally operated by its lower winding to hold its armature against its marking contact against the biasing effect of its middle winding which is connected in a closed circuit through resistance 20 and the biasing battery 21. The receiving relay is also provided with an auxiliary biasing winding which when energized opposes the biasing effect of its middle winding. The circuit through this auxiliary biasing winding may be traced from point 23 through the upper winding of relay 8, thence either through the rectifier 33 and upper primary winding of transformer 30 or through the rectifier 34 and the lower primary winding of transformer 30, thence to point 24.

With the armature of receiving relay 8 in engagement with its marking contact and the loop conductor 4 closed at substation E, the potential at point 23 will be positive with respect to the potential at point 24 and consequently the rectifiers 33 and 34 will present high resistance to the flow of current through the upper biasing winding of relay 8 and will present a high impedance in shunt of the primary windings of transformer 30. Since point 23 is also connected to the mid-point between the secondary windings of transformer 32 and thence through such windings to one terminal of each of the rectifiers 35 and 36 and point 24 is connected to the mid-point between the primary windings of transformer 30 and thence through such windings to the other terminal of each of the rectifiers 35 and 36, and point 23 is now positive with respect to point 24, the rectifiers 35 and 36 will offer a low impedance path to the flow of alternating current over the series path through the secondary windings of transformer 32, rectifier 35, the primary windings of transformer 30 and rectifier 36. A marking signal will therefore be transmitted to the distant station.

It will now be assumed that the distant operator is sending signals to the terminating station E by modulating the sending carrier current whereby through the functioning of amplifier 28 and detector 29, impulses are applied to the lower operating winding of receiving relay 8. Since the upper biasing winding of relay 8 is at this time

unenergized, the deenergization of the operating winding of relay 8 in response to each spacing impulse will permit the middle winding thereof to take control and cause the receiving relay to move its armature to its spacing contact. Each time that relay 8 closes its spacing contact current ceases to flow over the loop conductor 4 and relay 1 at station E will release or close its spacing contact.

Should the subscriber at station E now desire to break in upon the transmission from the distant station, he will operate key 2 to open the loop conductor 4. As soon thereafter as the receiving relay 8 moves its armature to its marking contact, current will flow from the artificial line over arm 9 of the duplex bridge and the marking contact of relay 8 to marking battery and no current will flow over arm 7 of the duplex bridge and the loop conductor 4. Under these conditions the potential at point 24 now becomes positive with respect to the potential at point 23 and rectifiers 33 and 34 will therefore offer a low resistance to the flow of current through the upper biasing winding of relay 8 and will offer a low impedance shunt across the primary windings of transformer 30. The upper winding of relay 8 will now be energized and overcome the biasing effect of its middle winding and firmly hold the armature of relay 8 on its marking contact regardless of further spacing signal impulses incoming from the distant station and controlling the lower winding of receiving relay 8.

With point 24 now more positive with respect to point 23, the rectifiers 35 and 36 now offer a high impedance to the passage of alternating current therethrough thereby reducing the potential impressed on transformer 30. This potential is still further reduced since rectifiers 33 and 34 now provide a low impedance shunt around the primary windings of transformer 30. A break signal is therefore transmitted to the distant station.

Although in the foregoing description particular reference has been made to the use of copper-oxide rectifiers, the invention is not so limited, but contemplates the use of other types of unilateral conductive devices.

What is claimed is:

1. In a telegraph system, two line sections and means for repeating signal impulses between said line sections including a sending device and a polarized receiving relay, said relay having an operating winding associated with one line section, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being connected to said other line section through a unilateral polarity discriminative device.

2. In a telegraph system, two line sections and means for repeating signal impulses between said line sections including a polarized sending relay and a polarized receiving relay, said receiving relay having an operating winding associated with one line section, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being connected to said other line section through a unilateral polarity discriminative device.

3. In a telegraph system, two line sections and means for repeating signal impulses between said line sections including a sending device and a polarized receiving relay, said receiving relay having an operating winding associated with one line section, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being

connected to said other line section through a copper-oxide rectifier.

4. In a telegraph system, a first line section terminating in a duplex bridge, a second line section and means for repeating signal impulses between said line sections including a sending device associated with said duplex bridge and a polarized receiving relay, said relay having an operating winding associated with said second line section, a biasing winding, and an auxiliary biasing winding, said auxiliary biasing winding being bridged across said duplex bridge through a polarity discriminative device.

5. In a telegraph system, a first line section terminating in a duplex bridge, a second line section, and means for repeating signal impulses between said sections including a sending device associated with said duplex bridge and a polarized receiving relay, said relay having an operating winding associated with said second line section, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being bridged across said duplex bridge through a copper-oxide rectifier so poled that said auxiliary biasing winding is energized to hold the armature of said relay on its marking contact when said first line section is opened to transmit a break signal to said second line section.

6. In a telegraph system, a subscriber's loop terminating in a duplex bridge, a telegraph line, and means for repeating signal impulses between said loop and said line including a polarized sending relay associated with said duplex bridge and a polarized receiving relay, said receiving relay having an operating winding associated with said line, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being bridged across said duplex bridge through a copper-oxide rectifier so poled that said auxiliary biasing winding is energized to hold the armature of said receiving relay on its marking contact when said loop is opened to transmit a break signal to said line.

7. In a telegraph system, two line sections and means for repeating signal impulses between said line sections including a sending device comprising a plurality of polarity discriminating devices and a polarized receiving relay, said relay having an operating winding associated with one line section, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being connected to said other line section through certain of said polarity discriminating devices.

8. In a telegraph system, a subscriber's loop terminating in a duplex bridge, a telegraph line, and means for repeating impulses between said loop and said line including a sending device comprising a plurality of copper-oxide rectifiers associated with said duplex bridge and a polarized receiving relay, said receiving relay having an operating winding associated with said line, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being bridged across said duplex bridge through certain of said rectifiers which are so poled that said auxiliary biasing winding is energized to hold the armature of said receiving relay on its marking contact when said loop is opened to transmit a break signal to said line.

9. In a telegraph system, a subscriber's loop, a telegraph line and means for transmitting impulses from said loop to said line including a generator, a sending circuit associated with said generator, copper-oxide rectifiers connected serially in said circuit and so poled as to normally

offer low impedance to the transmission of energy over said circuit, copper-oxide rectifiers connected in shunt of said circuit and so poled as to normally offer high impedance to the passage of energy therethrough, and means responsive to each opening of said loop for causing said first rectifiers to offer high impedance and said latter rectifiers to offer low impedance to the transmission of energy therethrough.

10 10. In a telegraph system, a subscriber's line terminating in a duplex bridge, a telegraph line, and means for repeating impulses between said loop and said line including a sending circuit comprising a generator, a sending loop associated with said generator having copper-oxide rectifiers connected serially in said loop and so poled as to normally offer low impedance to the transmission of energy over said loop, and copper-oxide rectifiers connected in shunt of said

20 loop and so poled as to normally offer high im-

pedance to the transmission of energy therethrough, a polarized receiving relay having an operating winding associated with said telegraph line, a biasing winding and an auxiliary biasing winding, said auxiliary biasing winding being bridged across said duplex bridge through said latter rectifiers, said latter rectifiers normally offering high resistance to the transmission of current through said auxiliary biasing winding, and means responsive to the opening of said subscriber's line to cause said first rectifiers to offer high impedance and said latter rectifiers to offer low impedance to the transmission of energy from said generator therethrough and to cause said latter rectifiers to offer low resistance to the passage of current through said auxiliary biasing winding whereby a signal is transmitted to said telegraph line and said receiving relay is held on its marking contact.

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