

June 13, 1933.

R. B. HEARN

1,913,443

TELEGRAPH REPEATER

Filed Feb. 10, 1932

FIG. 1

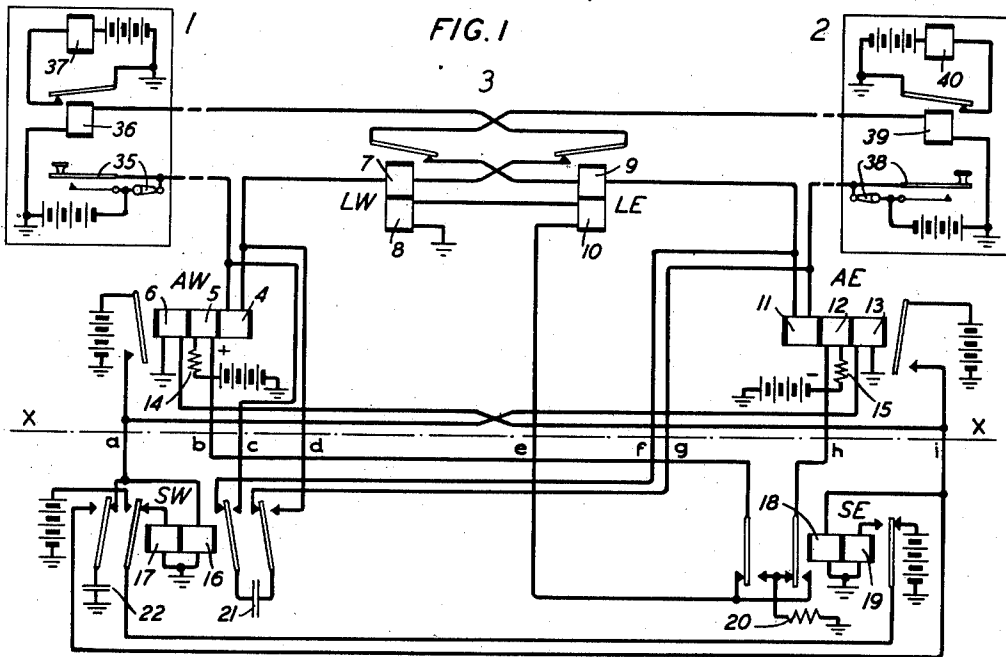


FIG. 2

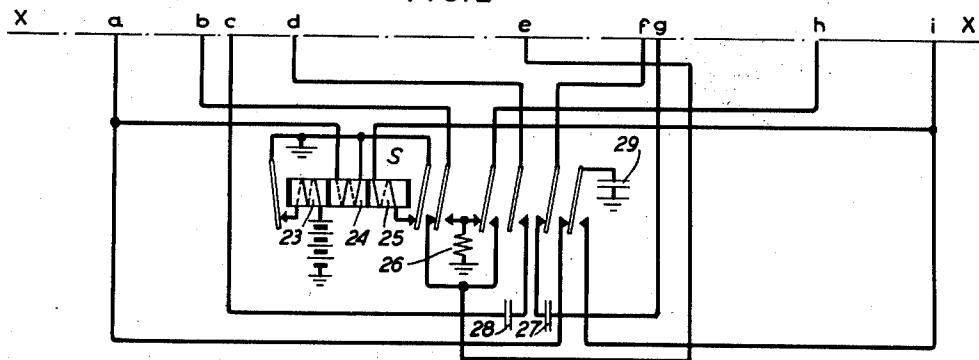
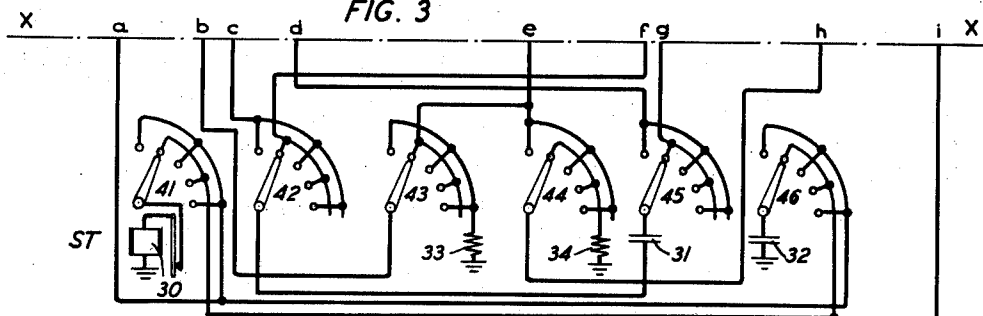


FIG. 3



INVENTOR
R. B. HEARN
BY *E. V. Griggs*
ATTORNEY

UNITED STATES PATENT OFFICE

RICHARD B. HEARN, OF BROOKLYN, NEW YORK, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

TELEGRAPH REPEATER

Application filed February 10, 1932. Serial No. 591,934.

This invention relates to repeater circuits for use in communication systems and more particularly to telegraph repeater circuits.

An object of this invention is to improve and to increase the efficiency and the speed of operation of telegraph repeater circuits.

A feature of this invention resides in the novel circuit retarding means provided for insuring the proper operation of the polar relays of the repeater in a predetermined order.

Another feature is the polar relay biasing arrangement provided for effecting repeater operation.

It is well known in the art that single line telegraph repeater circuits employing polar relays have been used for repeating signals in telegraph communicating systems. Repeater circuits of this type are disclosed in U. S. Patents 1,479,430, to J. M. Fell, January 1, 1924 and 1,752,436, to F. S. Kinkad, April 1, 1930. Heretofore the speed of operation of the repeater circuits has been limited to a degree at least by the ability of the repeater relays to operate quickly and in a predetermined order. This limitation on the speed of operation has been successfully overcome by the circuit scheme designed in accordance with the principles underlying this invention.

Briefly this invention comprises a four polar relay repeater arrangement for a single line telegraph system which is capable of repeating signals more efficiently and at higher speeds than heretofore. Electrical retarding means are employed in this arrangement which comprise a plurality of condensers connected to one or more neutral relays for holding the polarized relays in the operated position for a slight interval of time during the signaling intervals until other circuit arrangements seize control of the polar relays. The operation of this repeater except for the condenser holding circuit is similar, to an extent at least, to the operation of the usual four polar relay single line repeaters.

A modified form of this invention utilizes a rotary selector scheme for replacing the neutral holding relay.

The invention may be more fully under-

stood from the following description together with the accompanying drawing which illustrates one form of embodiment of the invention. It is to be understood, however, that this description is not to restrict or limit the scope of this invention as defined in the appended claims.

Fig. 1 illustrates a simple embodiment of the invention employing four polar relays, two being the line relays LW and LE and the remaining two being auxiliary relays AW and AE. Two neutral relays SW and SE are employed for switching purposes.

Fig. 2 shows a modification employing only one neutral relay S having a large number of springs for switching purposes.

Fig. 3 shows a rotary selector replacing the neutral relays.

For purposes of explanation let it be assumed that station 1 is transmitting signals through repeater 3 to station 2. When the contacts of the transmitting device 35 at station 1 are opened, the line current is interrupted. This interruption of the line current in the line windings 4 and 7 of relays AW and LW, respectively, allows the current flowing in windings 5 and 8, respectively, to operate these relays to their spacing positions. In the spacing position the AW relay closes a holding circuit for the AE relay from battery through its contact, winding 13 of the AE relay to ground, thus tending to hold the AE relay operated. Also, the LW relay interrupts the line current from station 2 which actuates the associated receiving apparatus, such as relay 39 and sounder 40. Since the current in winding 10 of relay LE tends to hold this relay in the marking position, the interruption of the line current from station 2 flowing through winding 9 of this relay will not affect this relay. Condenser 21 is connected in parallel with the winding 11 of relay AE, through contacts of relay SW to retard the operation of relay AE, so the current in winding 13 will have time to reach the value required to hold this relay in the marking position so that this relay, also, will not be affected by these line current interruptions. Then, when the transmitting device 35 at station 1 recloses its contacts at the

end of the signal impulse, current over the associated transmission line will start to flow in windings 4 and 7 of relays AW and LW, respectively. Since this line current opposes and overcomes the effect of the current in windings 5 and 8, respectively of these relays, they are operated to their marking position where the LW relay recloses the line circuit to station 2 and thereby actuates the associated receiving squipment such as relay 39 and sounder 40. Relay AW in moving to the marking position interrupts the holding current for relay AE. Condenser 22, however, is provided through contacts of relay SW in parallel with winding 13 of relay AE to retard this relay so the line current through the line winding 11 may have time to reach the value required to hold this relay in the marking position. Thus signal impulses from station 1 are repeated to station 2.

Should station 2 desire to interrupt the signals from station 1, the transmitting device 38 at station 2 is actuated opening the line circuit. If the line is already open at station 1, this will have no effect until the line is reclosed at station 1. However, with the line closed at station 1 and open at station 2, the AE relay will be operated to its spacing position by winding 12 since the opposing current in the line winding 11 which has been holding the relay in the marking position is now interrupted. The AE relay in the spacing position completes a circuit from battery through its contacts and winding 6 of relay AW to ground to hold this relay in its marking position. The AE relay also completes the circuit through the operating winding 18 of relay SE, thus operating this relay. The SE relay in operating interrupts the locking circuit for the SW relay from ground through winding 17 of relay SW, operated contacts of the SE relay and normal contacts of the SE relay. This releases the SW relay which then completes the locking circuit of the SE relay from ground to winding 19 of relay SE, operated contacts of relay SE and normal contacts of the SW relay to battery. The operation of the SE relay also reverses the current in the biasing windings 8 and 10 of relays LW and LE, respectively, so that current in winding 8 of relay LW now tends to hold this relay in the marking position, while the current in winding 10 of relay LE now tends to operate this relay to its spacing position. Relay SW in releasing also transfers condenser 21 from a path in parallel with winding 11 of relay AE to a path in parallel with winding 4 of relay AW and condenser 22 from winding 13 of relay AE to winding 6 of relay AW.

Since the line is still open at station 2, the LE relay will now be operated to its spacing position. This will interrupt the line circuit from station 1 so that the associated re-

ceiving apparatus such as relay 36, and sounder 37 will not follow the sending impulses from the sending device 35. This indicates that station 2 wishes to interrupt the signals from station 1. The sending will be stopped at station 1 and station 2 will then send to station 1 through repeater 3 in a manner similar to station 1 sending to station 2. When station 1 again wishes to transmit, its line circuit is again interrupted which releases the AW relay. This operates relay SW and releases relay SE and restores the circuit to its original condition. Resistances 14, 15 and 20 are used to adjust the biasing current of relays LW, LE, AW and AE to their proper values.

Fig. 2 shows a modification of the switching arrangement employing only one relay S, instead of the two relays SW and SE. Here, again with station 1 transmitting to station 2, the S relay has been operated by a circuit from ground through winding 24 of this relay and through the spacing contact of the AW relay to battery. The relay then locks operated in a circuit from battery through winding 23 and its operated contacts to ground, connects condenser 29 in parallel with winding 13 of relay AE, and condenser 27 in parallel with winding 11 of the same relay. The biasing current in winding 10 of relay LE tends to hold the relay in the marking position, while that in winding 8 of relay LW tends to operate the relay to the spacing position, as in Fig. 1 with station 1 transmitting to station 2.

Then, when the AE relay operates to its spacing position due to station 2 interrupting the line circuit, a circuit is completed from battery through the spacing contact of relay AE, winding 25 of relay S and operated contacts of relay S to ground. The current in this circuit opposes the current in the locking winding 23 so that the relay will release. In releasing it prepares the repeater for repeating signals from station 2 to station 1 by reversing the direction of the biasing current in windings 8 and 10 of relays LW and LE, respectively transferring condenser 29 from winding 13 of relay AE to winding 6 of relay AW and disconnecting condensers 27 from winding 11 of relay AE and connecting condenser 28 in parallel with winding 4 of the AW relay. When station 1 again wishes to transmit to station 2, the line circuit at station 1 is interrupted allowing the AW relay to release when the line is closed at station 2. The release of the AW relay holds the AE relay operated and operates the S relay as before which restores the circuit to its original position. Resistance 26 is used to adjust the biasing currents to a satisfactory value.

It should be noted that the S relay contacts associated with winding 23 should break at the same time or slightly before the contacts associated with winding 25 break as this

relay is releasing to insure that it will fully release.

Fig. 3 illustrates another method of switching condensers 31 and 32 from windings 11 and 13, respectively of relay AE to windings 4 and 6 of relay AW and also the direction of the biasing current in windings 8 and 10 of relays LW and LE, respectively. As shown, station 1 is transmitting to station 2. When the AE relay is operated to its spacing position due to the line circuit at station 2 being interrupted, a circuit for advancing the selector is completed from battery through the spacing contact of the AE relay and the arc 41 of the selector to operate the SE magnet which will advance the selector. This in turn will switch the condensers and bias the circuit so that station 2 will be able to send to station 1. The same process is repeated when station 1 again wishes to transmit to station 2. In this case when relay AW releases, it again advances the selector and the circuit is returned to its original condition. Resistances 33 and 34 are provided to adjust the biasing current to their proper values.

It should be noted that the polar relays may be sensitive and fast-operated so that a high signaling speed may be employed. The condensers are connected only to the relay subject to false operations due to the different rates of current change in its windings. By retarding the action of only this relay, the other relays may be operated at their maximum speed and still not be interfered with by false operations of this relay. Also the switching arrangement permits the direction of transmission to be automatically changed and still be maintained at the high speed since it applies to retarding condensers to either of the auxiliary relays which is subjected to false operations and disconnects them from the relay which must follow the high speed signal impulses.

The circuits described comprise one specific embodiment of the invention with several of the many possible switching arrangements to transfer the condensers from one relay to another. It is to be understood that the same results may be obtained with many different embodiments and modifications without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A telegraph line repeater comprising relay means for repeating telegraph signals, electrical retarding means whereby false operations of said relay means are prevented, and switching means for automatically connecting said retarding means to either side of said repeater dependent upon which side of said repeater is receiving said signals.

2. A four polar relay repeater for a single line telegraphic system, for repeating signals from one line section of the system to another line section, of the type wherein current from

each line section is caused to traverse the line windings of two polar relays in series, characterized in this, that electrical retarding means, comprising condenser apparatus and switching means for automatically connecting said apparatus across the line winding of one of said polar relays, are provided for insuring the proper operation of one or more of said relays in a predetermined order.

3. A repeater in accordance with claim 2, characterized in this, that said switching means is a relay arrangement adapted to connect the condenser apparatus alternately across one line section or the other in accordance with which line section is transmitting the signals.

4. A repeater in accordance with claim 2, characterized in this, that said switching means is a rotary selector arrangement adapted to connect the condenser apparatus alternately across each line section in accordance with which line section is transmitting the signals.

5. Means for repeating signals from one transmission line section to another comprising four polar relays constituting means for connecting said sections, biasing windings and line windings individual to each of said polar relays, said relays being so connected that current from each transmission line traverses the line windings of two of said polar relays in series and a contact of a third polar relay, electrical retard means for preventing the operation of the fourth of said polar relays for an interval of time during which signals are being received from a line section, and switching means for automatically connecting said retarding means to either of said fourth polar relays dependent upon from which of said line sections the signals originate.

6. A high speed telegraph repeater for repeating telegraph signals from either of two line sections to the other line section comprising two sets of polar relays, each having line windings and local circuit windings, each of said line sections extending through the line windings of one set of relays and a contact of the other set, switching means whereby the currents in the local circuit windings of each set of relays are controlled by contacts of the other set of relays in such a manner that signals repeated from one line section to the other line section are unable to actuate the set of relays associated with said other line section, electrical retarding means to prevent false operation of said relays, and switching means to automatically connect said retarding means to the set of relays associated with the line section to which the signals are repeated.

7. A high speed telegraph repeater for repeating signals received from a telegraph station over a transmission line to a second telegraph station over a second transmission

line comprising a plurality of polarized relays, electrical retarding means to insure proper operation of said relays, switching means to connect said retarding means with
5 the side of the repeater connected to the transmission line associated with the station receiving the signals, and means whereby a break signal transmitted from the receiving station is repeated over the associated trans-
10 mission circuit to the sending station.

8. A telegraph repeater for repeating telegraph signals from one telegraph line section to a second line section comprising two polarized line relays and two polarized auxiliary relays each having line and biasing
15 windings, each of said line sections extending through the line windings of one of the line relays and of the auxiliary relays and the contacts of the other line relay, the biasing windings of said line relays being connected in series, and switching means for automatically connecting said line relay biasing windings in series with the biasing windings of either of the auxiliary relays dependent upon in which of said line sections the
20 signals originate.

9. A telegraph repeater in accordance with claim 8 wherein electrical retarding means are provided to prevent false operations of said auxiliary relays, and means for automatically connecting said retarding means to either of said auxiliary relays dependent upon in which of said line sections the signals
25 originate.

30 In witness whereof I hereunto subscribe my name this 5th day of February, 1932.

RICHARD B. HEARN.

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