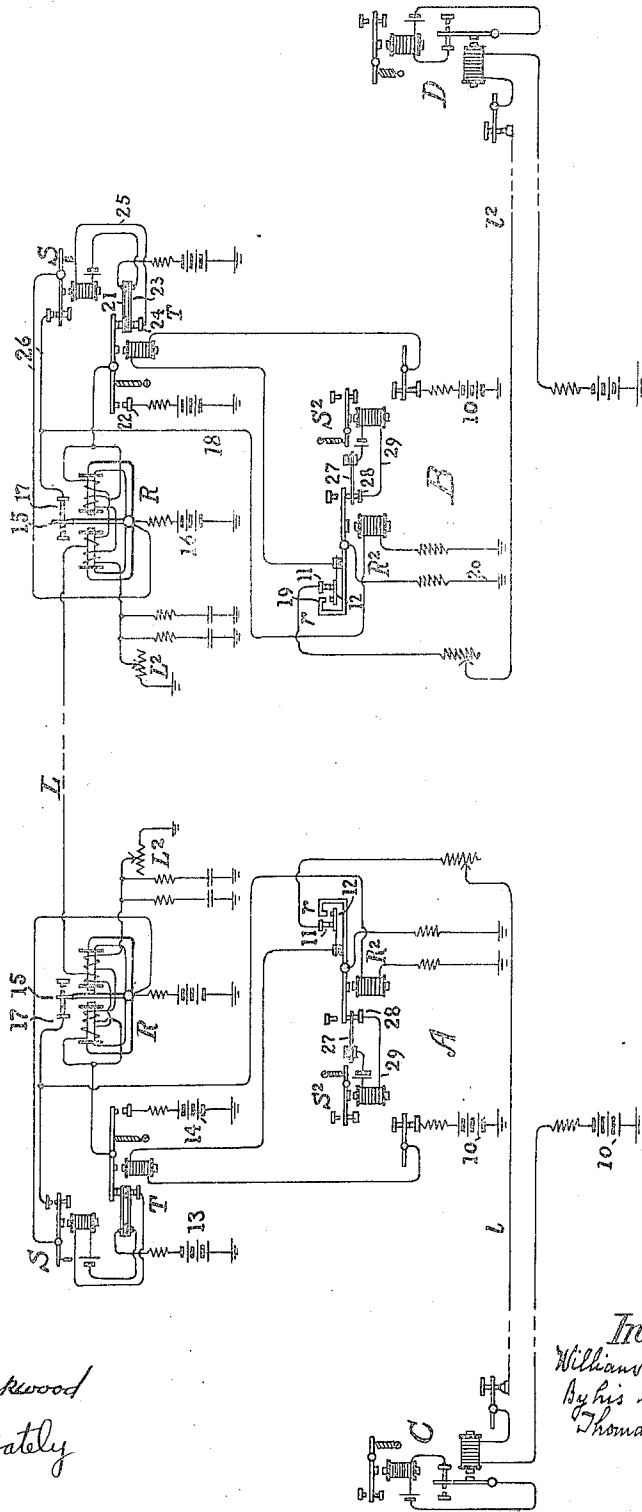


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 TELEGRAPHIC REPEATING APPARATUS.
 APPLICATION FILED JUNE 12, 1909.

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Attest.
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TELEGRAPHIC REPEATING APPARATUS.

942,807.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, WILLIAM E. ATHEARN, residing at New York, borough of Brooklyn, in the county of Kings and State of New York, have invented certain improvements in Telegraphic Repeating Apparatus, of which the following is a specification.

This invention relates to telegraphic repeating systems, and especially to those in which the apparatus of a multiplex line is employed to connect said line to one over which at any time transmission is in a single direction only, as a substation loop from a central station at which the multiplex line terminates. Such a system is described in my Patent No. 905,628, dated December 1, 1908, in which the multiplex line illustrated is a polar bridge duplex operating over one side of a composite circuit, and which uses as repeating apparatus only the usual polar relays and pole changing transmitters of the duplex. While this system has proved highly efficient, it sometimes happens that unskilled operators will not maintain the proper bias upon the polar relays necessary to hold the armatures against the front stops, while the energizing circuits of said relays are open at the pole changers, without interfering with full contact of the armatures against the back stops under the influence of the operating current. This difficulty will be increased with a poorly insulated line and in bad weather. Therefore, under some conditions it may be desirable to employ a repeating system wherein this bias is unnecessary, as for example, one in which a secondary neutral relay is made a portion of the receiving apparatus with the polar or other primary relay, said neutral relay controlling in its contacts the circuit of the single transmission line with respect to signals transmitted from a distant station. But in systems thus organized, and especially with lines which are sluggish, as those composited or otherwise having high capacity, there is liable, for reasons which hereinafter appear, to be difficulty for the receiving operator on the substation line to "break" or interrupt the sending operator when transmission is rapid.

The principal object of the present invention is to provide such a repeating system in which the receiving operator will be enabled to break at any time regardless of the speed of signaling.

The accompanying drawing is a diagrammatic illustration of my invention in connection with a single polar bridge duplex apparatus so arranged as to serve solely as a repeater between a main line and associated substation loops.

It will be obvious that, as in the patent previously mentioned, the main line might be one side of a composite, and that the repeating apparatus could be made to operate as the transmitting and receiving apparatus of a duplex system instead of as a repeater, but these features do not affect this invention and are omitted in interest of clearness and brevity.

It is also to be understood that the invention is limited to the particular form of multiplex system shown and described only so far as its relation thereto is defined in the claims.

At A and B are telegraph central stations joined by a line L and provided with instruments for duplex operation upon the polar bridge method, there being at each station the usual polar relay R with its winding connected between the real line and an artificial line L², and a pole changer or transmitter T with its contacts included in the line L. Beyond the stations A and B and linked thereto by lines l and l² are substations C and D, respectively, arranged for ordinary Morse transmission. As previously indicated, for the purposes of this invention, the duplex apparatus at the central stations is to be considered as furnishing sections of a repeating apparatus, with each section adapted to either transmit or receive in accordance with the direction of signaling, each section including transmitting apparatus under the control of the home substation and receiving apparatus governed by the distant substation. The relation of these elements to one another and to the associated elements, including a secondary controlling neutral relay R² provided with a continuity preserving contact device r and forming a part of the receiving apparatus of each section, will now be described in connection with a brief statement of the operation of that portion of the system which involves no marked departure from previous practice.

Assume the substation operator at C to be sending. His key governs the circuit from battery 10 (shown as divided) over the loop

7 through the contacts 11 and 12 of the device r belonging to the relay R^2 at the home central station A and through the winding of the associated pole changer T to battery.

5 This causes the pole changer to oscillate its lever and send from the oppositely poled batteries 13 and 14 reverse impulses of current through the line L and winding of polarized relay R at the distant station B

10 and its artificial line L^2 to ground. The primary relay R under the influence of these pulses operates its armature 15 to interrupt the circuit including battery 16, normal contact 17 of relay R, conductor 18 and winding of the neutral control relay R^2 at central station B. Relay R^2 in turn responds, opening and closing at its contacts 11 and 12 the circuit of the loop L^2 , including the winding of pole changer T at station B.

20 The consequent operation of the relay and sounder at substation D permits the transmitted message to be read. The simultaneous actuation of the pole changer at the repeater station B and the resulting mutilation of the signals is prevented by the continuity preserving device r , which before its spring 12 separates from the contact 11 makes contact at 19 with the lever of the relay R^2 which is grounded by a conductor

25 20. The pole changer is therefore energized by way of this ground connection after the circuit over the substation loop is opened.

Suppose now the receiving operator at D wishes to interrupt the operator at C by breaking the circuit. To do this it is necessary that the lever of the pole changer T at central station B controlled by the operator at D travel the full distance from its resting contact furnished by a spring 21 to the opposite contact 22. This is to provide for a complete reversal of polarity in the relay R at central station A, to open at its contacts 15, 17 the circuit of the secondary relay R^2 , the latter breaking at contacts 11, 12, the circuit through which the sending operator at C is working the pole changer at the central station A. It will be evident that as far as has been described this must be done while the contacts 11, 12 of relay R^2 , at B

50 are closed and the receiving operator has direct control of the pole changer in the receiving section of the repeater, since while this is being energized by current through the contacts 12 and 19, the substation loop L^2 is open. If the operator at C is making rapidly recurring signals, as might be the case if a series of dots were being sent by means of a semi-automatic transmitter, the pole changer at B may not have time to effect the reversal before the operator at D loses control over it by the separation of the contacts 11, 12. The pole changer in the receiving section will therefore simply vibrate upon its normal contact and transmission from C will continue. To remedy this

defect in the system and give the receiving operator power to break without regard to the condition of the apparatus in the transmitting section of the repeater, I provide means whereby as soon as the receiving operator exercises control during the period that the substation loop is connected to the pole changer, this capability is extended by removing the associated receiving apparatus from the control of the transmitting operator at C. This change is produced by the current traversing the substation line L^2 and its pole changer, and I prefer to actuate by means of the lever of the pole changer itself contacts consisting of an extra spring 23 and the front stop 24. As soon as the operator at D breaks and the pole changer lever moves toward its back stop, the contacts 23, 24 open a local circuit 25 containing the winding of a controlling apparatus which is illustrated as a repeating sounder S. This sounder completes at its back stop the continuity of a conductor 26, thus closing a circuit including the conductor 18 together with the winding of relay R^2 and battery 16. That is, the contacts of the polarized relay are short circuited, and, without reference to the position of the armature of said relay, the lever of the secondary relay holds the contacts 11, 12 closed as soon as the receiving operator has opened the substation loop L^2 and released the pole changer. The secondary relay is now entirely beyond the control of the sending operator, and is so held by the receiving operator who determines its position until he again closes his key, restoring the pole changer at B and the repeating sounder to their normal positions.

In systems of this character the condition of the line is under the supervision of the attendants at the repeater stations, and it is desirable that they should be able to readily determine in what portion of the circuit trouble exists. In the organization of Patent No. 905,628, there is a single sounder responding to signals in both directions between the substations. Consequently in case of a momentary fault, such as a cross between the swinging line conductors, the only way in which the repeater operator can learn whether it is upon the main line or upon the substation loop is by sharply watching the polar relay and pole changer to note irregularities in the operation of either.

My invention furnishes means to enable the central station operators to exercise auricular supervision without inspection of the apparatus. For this purpose the repeating sounder S properly designed serves also as a reading sounder, making audible signals coming into the repeating station over the substation line. Then by providing the secondary relay R^2 with extra contacts 27, 28 governing a local circuit 29, a

second sounder S^2 therein is caused to respond to the impulses arriving from the main line. With these two instruments of different tone, the ear of the operator gives him at once a certain indication of the direction in which the trouble is located.

I claim:

1. The combination with a line including telegraph stations and intermediate repeating apparatus having sections each organized to act either as transmitting or receiving elements in accordance with the direction of transmission, the sections when receiving being under the direct control of the receiving station during a portion of the operation of the transmitting section, of means dependent upon the exercise of such direct control for extending the capability of control by the receiving station.
2. The combination with a telegraph line having transmitting and receiving stations and intermediate repeating apparatus comprising sections for the respective stations, each section being provided with transmitting apparatus and with primary and secondary receiving apparatus, the transmitting apparatus of each section being controlled by the home station and the receiving apparatus being controlled by the distant station, of means operable upon the exercise of control by the receiving station over its transmitting apparatus for removing the associated secondary receiving apparatus from the control of the transmitting station.
3. In a telegraph system, the combination with a multiplex line and a line for single transmission, of a repeating apparatus connecting said lines and comprising a primary and a secondary receiving apparatus and a transmitting apparatus each having an energizing winding and a movable contact member, the winding of the transmitting apparatus being in circuit with the single transmission line and with the contact member of the secondary receiving apparatus, in certain positions of the contact member being under its sole control and in other positions of said contact member being under its control and that of the single transmission line, and means under the influence of current through the winding of the transmitting apparatus for determining the position of the contact member of the secondary receiving apparatus.
4. A telegraphic repeating apparatus hav-

ing two sections each comprising a transmitter, a primary relay operable by the transmitter of the other section and a secondary relay operable by the primary relay, and means associated with the transmitter for controlling the circuit of the secondary relay in the same section of the apparatus.

5. A telegraphic repeating apparatus having two sections each comprising a transmitter, a primary relay operable by the transmitter of the other section and a secondary relay operable by the primary relay, extra contacts upon the transmitter, and a controlling apparatus having a winding in circuit with the extra contacts and being provided with contacts in circuit with the secondary relay.

6. A telegraph repeater having two sections each comprising a pole changer, a polar relay operable by the pole changer of the other section and a neutral relay operable by the polar relay, extra contacts upon the pole changer, and a repeating sounder having its winding in circuit with said extra contacts and controlling in its contacts the circuit of the neutral relay.

7. In a telegraph system, the combination with a multiplex line and a line for single transmission, of repeating apparatus connecting said lines and comprising a receiving apparatus and a transmitting apparatus, and sounders operable by both the receiving and transmitting apparatus.

8. In a telegraph system, a repeating apparatus comprising a receiving apparatus and a transmitting apparatus, and sounders operable by both the receiving and transmitting apparatus, one of said sounders controlling the circuit of the receiving apparatus.

9. A telegraphic repeating apparatus comprising a receiving apparatus and a transmitting apparatus, and sounders operable by both the receiving and transmitting apparatus, the sounder associated with the transmitting apparatus controlling the circuit of the receiving apparatus.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this eighth day of June 1909.

WILLIAM E. ATHEARN.

Witnesses:

IRA L. ANDERSON,
HILLYER EGGLESTON.