

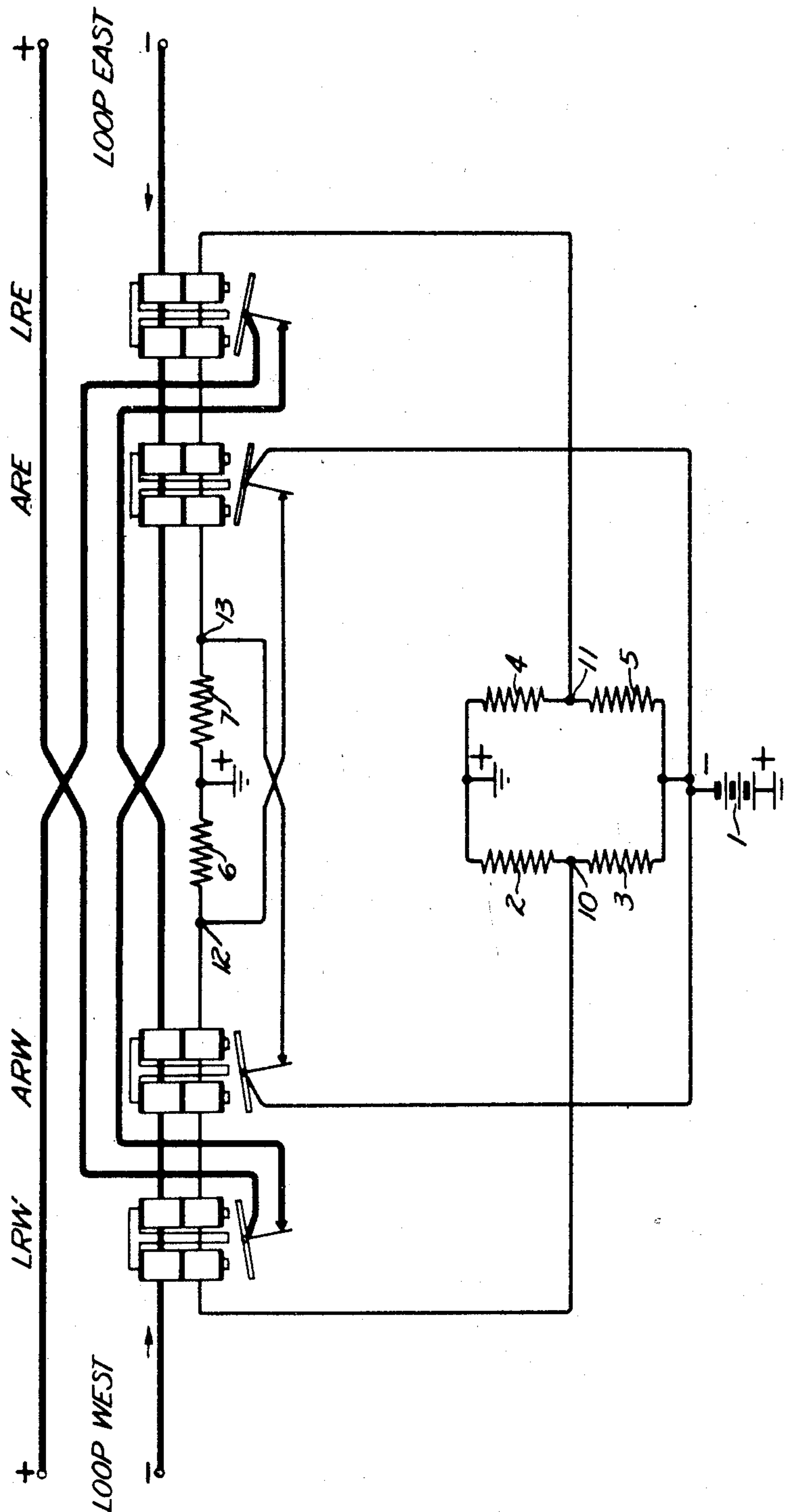
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TELEGRAPH REPEATING SYSTEM

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TELEGRAPH REPEATING SYSTEM

REISSUED

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This invention relates to telegraph systems and particularly to repeaters for repeating telegraph signals from one closed, non-polar telegraph circuit to another.

5 An object of the invention is to reduce the installation and maintenance expense of a telegraph repeating system by reducing the number of sources of power required.

10 A feature of the invention is a repeater system adapted to repeat signals from either of two connected line sections into the other, and utilizing polar relays operated from a single grounded battery of either polarity.

15 It was long the practice in designing repeaters for single line telegraph systems to utilize neutral or non-polarized relays or combinations of such relays with other non-polarized instruments. Non-polarized relays are less efficient than polarized relays, being more sluggish in their action and requiring more current to operate, and, accordingly, repeaters utilizing polar relays were developed and adopted. A repeating system of the latter type is disclosed in patent to J. M. Fell 25 1,479,430, January 1, 1924. Such systems operate satisfactorily but require for their operation two sources of current of opposite polarities with respect to ground. In practice this is usually supplied from two batteries connected in series with the mid-connection grounded. 30

35 In accordance with this invention a repeater circuit is provided which utilizes polar relays but requires for its operation only a single grounded source of current of either positive or negative polarity. The effect of a second source of current of opposite polarity is produced by means of potentiometer arrangements of resistances.

40 The drawing contains a diagram showing a simplified circuit of a repeater in accordance with this invention.

45 The repeater comprises, referring to the drawing, four polar relays properly associated with a single source of grounded potential 1, and resistors 2 to 7.

50 The relays are arranged in pairs, one pair comprising a line relay west LRW, and an auxiliary relay west ARW, having their upper, or line, windings connected in series with

the loop west circuit; and the other pair comprising a line relay east LRE, and an auxiliary relay east ARE, having their upper windings connected in series with the loop east circuit. The loop west circuit also includes the contacts of the opposite line relay LRE and the loop east circuit includes the contacts of the opposite line relay LRW. 55

60 For purposes of explanation let it be assumed that an electron flow through any winding of any relay, as they are shown in the drawing, tends to urge the relay tongue in the same direction. For instance, when no signals are being repeated the loop west is closed through a source of current, at the distant station, of such polarity as to cause an electron flow from left to right through the upper windings of relays LRW and ARW and hold the tongues of those relays against their contacts. At the same time the loop east is 70 closed through a source of current, at the eastern station, of such polarity as to cause an electron flow from right to left through the upper windings of relays LRE and ARE and hold the tongues of those relays against their contacts. 75

80 When no signals are being repeated, the relay tongues are in the positions shown in the drawing, and a local circuit is completed from the negative terminal of the battery 1, through the contacts on relay ARE and resistor 6 to the positive terminal of the battery. Resistor 6 has an impedance large as compared with that of the path from the negative terminal of the battery through the relay contacts and, therefore, point 12 is at substantially the potential of the negative terminal of battery 1. Now there is a path in parallel to the one just outlined through resistors 3 and 2. These resistors have substantially equal impedances, and therefore the voltage across each is about half the voltage of battery 1. Hence point 10 is positive with respect to point 12 and there is a resultant electron flow from right to left through the lower or biasing windings of relays LRW and ARW. This biasing current tends to move the relay tongues to the left, but its effect is overcome by the stronger line current flowing 100

in the opposite direction through the upper windings of the relay.

There is also a flow of current through the contacts of relay ARW and resistor 7 which maintains point 13 negative with respect to point 11 and causes an electron flow from left to right through the biasing windings of relays ARE and LRE. This current, however, is weaker than the line current flowing in the opposite direction through the upper windings, and the relay tongues are held against their contacts by the stronger line current.

When telegraph signals are transmitted from loop west to loop east, the loop west is opened, breaking the normal flow of line current through the upper windings of relays LRW and ARW. These relays thereupon move their tongues to the left in response to the biasing current in their lower windings. Relay LRW repeats the open signal to the loop east by opening the latter circuit at the relay contacts.

This opening of the loop east at the contacts of relay LRW breaks the normal flow of line current through the line windings of relays ARE and LRE, but the tongues of those relays remain against their contacts because the direction of the normal biasing current through their lower windings was reversed when relay ARW operated and opened the circuit from the negative terminal of battery 1 to point 13. Thus, with the contacts of relay ARW open, resistor 7 and the lower windings of relays ARE and LRE are connected in series across resistor 4. Hence electrons flow from the negative terminal of battery 1 through resistor 5, from right to left through the lower windings of relays ARE and LRE, through resistor 7, to the positive terminal of battery 1.

When the loop west is again closed, the normal line current overcomes the biasing current in the windings of relays LRW and ARW and moves the tongues of those relays to the right, restoring the circuit to its original condition and repeating a closed impulse into the loop east.

When signals are transmitted from east to west the operation of the repeater is the converse of that outlined, relay LRE operating to open the loop west, and relay ARE operating to reverse the direction of the biasing current in relays LRW and ARW so that they will not operate when their line windings are opened at relay LRE.

Should the operator at one line terminal transmit a break signal while the operator at the distant terminal is transmitting, the break signal will be transmitted through the repeater in the following manner.

Assume that signals are being transmitted from loop west to loop east and the operator at the eastern station breaks the loop east. If an open signal is being transmitted from loop

west at that instant there will be no change in the positions of the relays at the repeater, but as soon thereafter as loop west is closed, the tongues of relays LRW and ARW move to the position shown in the drawing. This closes the normal biasing circuit through the contacts of relay ARW and the lower windings of relays ARE and LRE, moving the tongues of those relays away from their contacts and opening the loop west. The loop west thereupon remains open as long as the loop east is open, thus transmitting the break signal to the west operator.

The operation of the repeater in transmitting a break signal from west to east is the converse of that outlined above.

The biasing current in the lower windings of the relays may be varied by changing the relative impedances of the resistors 2, 3, 4 and 5 with respect to resistors 6 and 7. Ordinarily it is desirable to have the biasing current about half as strong as the line current.

What is claimed is:

1. A telegraph repeater for repeating between two closed, non-polar telegraph circuits each containing a source of current, comprising a first and a second polar relay means, each having a first and a second independent actuating winding and a first and a second pair of contacts, the first winding of said first means being connected through the first set of contacts on said second means to one line section and the first windings of said second means being connected through the first set of contacts on said first means to the other line section, means comprising a single source of electromotive force of constant polarity, a first resistor, and the second pair of contacts on one of said relay means, for supplying a current to the second winding on the other relay means opposite in effect to the normal line current in the first winding of said other relay means, and means comprising said source of electromotive force, a second and a third resistor for supplying a current to the second winding in the same sense as the normal line current, independently of the second pair of contacts on the other relay.

2. A telegraph repeating system comprising two line sections, a pair of relays connected with each section, each relay having an armature and two windings, each of said windings being serially connected to a corresponding winding of the other one of the same pair, a line circuit for each section normally closed through one winding of each relay of one pair and contacts of a relay of the other pair, two local circuits one for the other windings of each pair, a single source of electromotive force and resistance elements, one of said local circuits extending from one terminal of said source through one of said resistance elements, said other windings of one pair, and a second resistance, to the other terminal of said source, and the other local

circuit extending from said one terminal through the contacts of the other relay of said other pair of relays through said other windings in opposite sense to said first local circuit, through a third resistance, to the other terminal of said source.

3. A telegraph repeater system comprising two line sections, relay means for each section, each relay means having a line winding, an auxiliary winding and a set of contacts, the line winding of each relay means being connected to the corresponding line section through the set of contacts on the other relay means, instrumentalities for supplying a current in one direction through the auxiliary winding of one relay means, said instrumentalities comprising a source of electromotive force, a potentiometer bridged across said source, one auxiliary winding terminal being connected to an intermediate point on said potentiometer, the other winding terminal being connected through a resistance to one terminal of the source, and means for reversing the flow of the auxiliary winding current comprising a second set of contacts on the other relay means for connecting the other auxiliary winding terminal directly or through a lower resistance to the other terminal of the source.

In witness whereof, I hereunto subscribe my name this 13th day of July, 1928.

FULLERTON S. KINKEAD.

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