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TELEGRAPH SYSTEM

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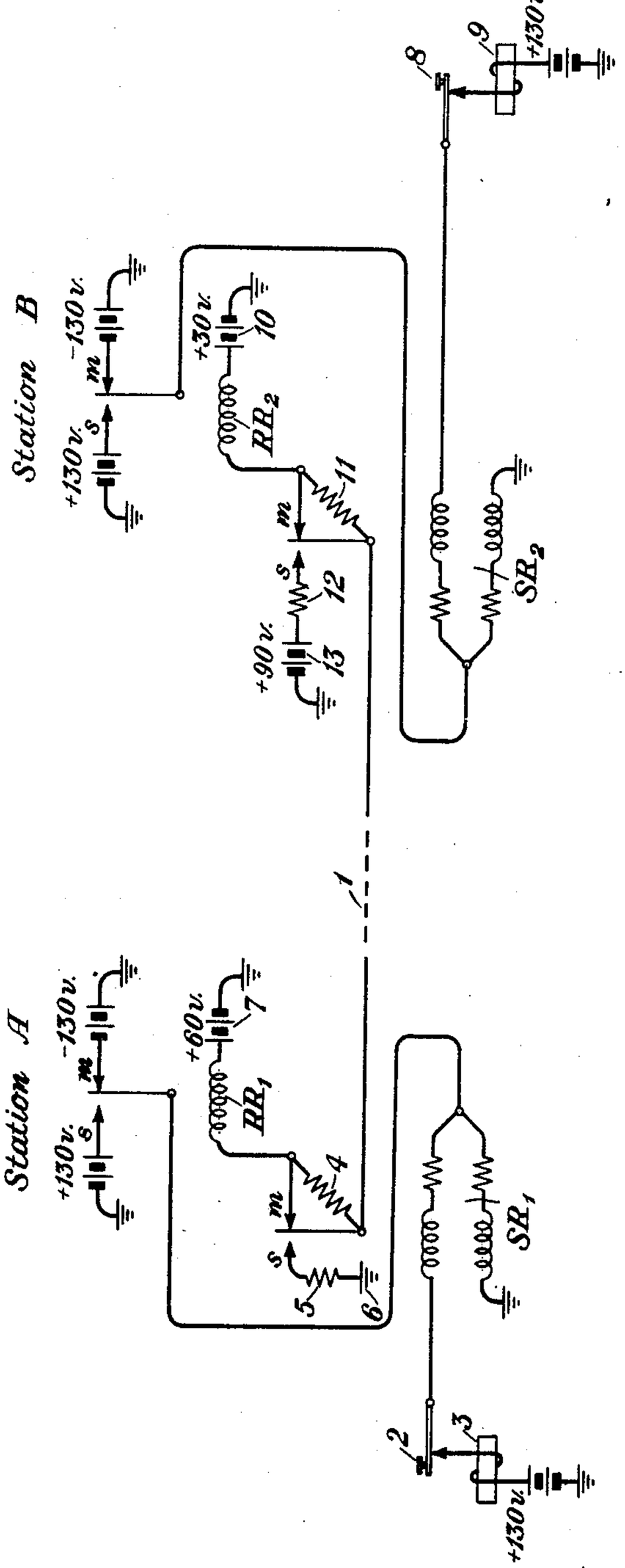

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TELEGRAPH SYSTEM

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10 Claims. (Cl. 178—58)

This invention relates to telegraph systems and more particularly to repeater arrangements adapted to be used in such systems.

The telegraph system of the invention is arranged to provide polar transmission in both directions on a half-duplex basis over one conductor. In the arrangements of the invention signals are transmitted by applying to opposite ends of the line sources of potential all poled so as to oppose each other and all of different values and the receiving relays are so connected in the circuit that they require only one winding and no balancing arrangements. Hence the use of balancing artificial lines for the receiving relays may be eliminated. A further feature of the arrangements of the invention is that normal line resistance changes will have no effect on transmission. Other objects and features of the invention will appear more fully from the detailed description thereof hereinafter given.

The invention may be more fully understood from the following description together with the accompanying drawing in the figure of which is shown a circuit diagram embodying a preferred form of the invention.

In the drawing is shown a line 1 interconnecting the stations A and B. At station A is shown a sending relay SR_1 having its windings connected to a key 2, a sounder 3 and a source of potential. Its windings would also be connected to the armature of a receiving relay RR_1. One end of the receiving relay winding is connected to a source of potential, such as battery 7. The other end of the receiving relay winding would be connected to the line 1 either by the marking contact and armature of the sending relay or through the resistance 4. The spacing contact of the sending relay is connected to ground potential 6 through a resistance 5. At station B is shown a sending relay SR_2 having its windings connected to a key 8, a sounder 9 and a source of potential. Its windings would also be connected to the armature of the receiving relay RR_2. One end of the receiving relay winding is connected to a source of potential, such as battery 10. The other end of the receiving relay winding is connected to the line 1 either by the marking contact and armature of the sending relay SR_2 or by the resistance 11. The spacing contact of the sending relay SR_2 is connected through a resistance 12 to a source of potential, such as battery 13. From the foregoing it will be noted that there are four sources of potential which may be connected to the line, the ground potential 6 and the potentials from the batteries 7, 10 and 13. It will also be noted that these sources of potential are all poled so as to be in opposing relationship to each other. Furthermore, as will appear more fully from the detailed description hereinafter given, the values of these sources of potential must have a certain relative ratio to each other. The value of the potential connected to the marking contact of the sending relay SR_1 should lie between the values of the potentials connected to the marking and spacing contacts of sending relay SR_2 and the value of the potential connected to the marking contact of sending relay SR_2 should lie between the values of the potentials connected to the marking and spacing contacts of sending relay SR_1. For purposes of illustration the potential of battery 13 is shown as +90 volts, the potential of battery 10 as +30 volts, the potential of battery 7 as +60 volts and at ground 6 is a zero potential.

In describing the operation of the arrangements of the invention the line 1 and resistances 4 and 11 may, for example, be assumed to have a resistance of 3,000 ohms and resistances 5 and 12 and the windings of the receiving relays may be assumed to be each 135 ohms. When the armatures of each of the sending relays SR_1 and SR_2 are on their marking contacts current will flow from the 60 volt battery 7, through winding of receiving relay RR_1 from right to left, over marking contact and armature of sending relay SR_1, over line 1 from stations A to B, over armature and marking contact of sending relay SR_2, through winding of receiving relay RR_2 from left to right, to 30 volt battery 10. This will result in a current flow of approximately 10 mils

$$\left(\frac{+60 \text{ v. minus} +30 \text{ v.}}{3270 \text{ ohms}}\right)$$

from stations A to B and through the windings of receiving relay RR_1 and RR_2 in the direction indicated and will hold these receiving relays in the marking condition. If a spacing signal is now sent from station A the armature of the sending relay SR_1 will be moved to its spacing contact. This will result in a current flow from 30 volt battery 10, through the winding of receiving relay RR_2 from right to left, marking contact and armature of sending relay SR_2, over line 1 from stations B to A, armature and spacing contact of sending relay SR_1, resistance 5 to ground potential 6. This will result in a current flow of approximately 10 mils

$$\left(\frac{+30 \text{ volts}}{3270 \text{ ohms}}\right)$$

from stations B to A and through the winding of receiving relay RR_2 in direction indicated which is now the reverse of that resulting when the armature of sending relay SR_1 was in marking condition. This reversal of the direction of current flow in the winding of receiving relay RR_2 at station B will cause it to operate to spacing. When a spacing signal is sent at station A the receiving relay RR_1 thereat will remain in a marking condition. This will be due to holding current flowing from 60 volt battery **7**, through winding of receiving relay RR_1 from right to left (which is the marking direction) and through resistance **4**. When the armature of sending relay SR_1 is in mid-air this holding current is approximately 5 mils and flows from 60 volt battery **7**, through the receiving relay RR_1, resistance **4** and over line **1** to 30 volt battery **10** at station B. When the armature of sending relay SR_1 reaches its spacing contact this holding current will be approximately 20 mils as a result of current flow from 60 volt battery **7**, through receiving relay RR_1, resistances **4** and **5** to ground **6**. Transmission from station B to station A is accomplished in a similar manner. As heretofore pointed out when the sending relays SR_1 and SR_2 are in marking condition the armatures of the receiving relays RR_1 and RR_2 will be on their marking contact. Let it be assumed that a spacing signal is now sent at station B. This will cause the armature of sending relay SR_2 to move to its spacing contact. This will connect the 90 volt battery **13** to the line **1**. This will cause current to flow from 90 volt battery **13** over resistance **12**, armature of sending relay SR_2, line **1**, armature and marking contact of sending relay SR_1, winding of receiving relay RR_1 (from left to right) to 60 volt battery **7**. This will result in a current flow of approximately 10 mils

$$\left(\frac{+90 \text{ volts minus } +60 \text{ volts}}{3270 \text{ ohms}}\right)$$

from stations B to A and will reverse the direction of current flow in the winding of receiving relay RR_1 and cause it to operate to spacing. When a spacing signal is sent at station B the receiving relay RR_2 will remain in a marking condition. This will be due to holding current flowing (when the armature of sending relay SR_2 is in mid-air) from 60 volt battery **7**, through resistance **11** and winding of receiving relay RR_2 to 30 volt battery **10**. This holding current will be approximately 5 mils under such a condition. When the armature of sending relay SR_2 reaches its spacing contact current will flow from 90 volt battery **13** through resistance **12**, armature of sending relay SR_2, resistance **11**, winding of receiving relay RR_2 (from left to right) to 30 volt battery **10**. This will result in a holding current of approximately 20 mils

$$\left(\frac{+90 \text{ volts minus } +30 \text{ volts}}{3270 \text{ ohms}}\right)$$

through the winding of receiving relay RR_2 in such a direction as to hold it in marking condition.

As heretofore pointed out the values of the sources of potential at each end of the line are merely illustrative and other values of potential might be utilized. If the value of the source of potential connected to the marking contact of the sending relay at station A is greater than the value of the source of potential connected to the marking contact of the sending relay at station B, then the potential connected to the spacing contact of the sending relay at station A should be smaller than the smallest of said other potentials and the value of the potential connected to the spacing contact of the sending relay at station B should be greater than the largest of said other potentials. Accordingly while the invention has been disclosed as embodied in certain specific forms which are deemed desirable it is understood that it is capable of embodiment in many and other widely varied forms without departing from the spirit of the invention as defined in the appended claims.

What is claimed is:

1. A telegraph system including a line interconnecting two stations, a sending relay and a receiving relay at each of said stations, each of said sending relays having its armature connected to different ends of said line, receiving circuits each including one of said receiving relays connected to different ends of said line, sources of potential connected to each of said receiving circuits, said sources being of different values and so poled as to oppose each other whereby the resultant current through said receiving relays will be in such a direction as to maintain them in marking condition, sources of potential connected to the spacing contacts of each of said sending relays, said sources of potential being so poled as to oppose said first mentioned sources and having such values that when one of said last mentioned sources is connected to one end of said line by the operation of the sending relay thereat the resultant current through the receiving relay at that end of the line will be in such a direction as to maintain said relay in marking condition and the resultant current through the receiving relay at the other end of the line will be reversed and will be in a direction to shift said relay to a spacing condition.

2. A telegraph system including a line interconnecting two stations, a sending relay and a receiving relay at each of said stations, each of said sending relays having its armature connected to different ends of said line, receiving circuits each including one of said receiving relays connected to different ends of said line, sources of potential connected to each of said receiving circuits, the source at the first of said stations being of greater value than the source at the second of said stations, said sources being so poled as to oppose each other whereby the resultant current through said receiving relays will be in such a direction as to maintain them in a marking condition, and a source of potential at the first of said stations connected to the spacing contact of the sending relay thereat, said last mentioned source being so poled as to oppose said first mentioned sources and having a value sufficiently smaller than the smaller of said two first mentioned sources whereby when said last mentioned source is connected to the line the resultant current through the receiving relay at the first of said stations will be in such a direction as to maintain it in a marking condition and the resultant current through the receiving relay at the second of said stations will be reversed and will be in a direction to shift said relay to a spacing condition.

3. A telegraph system including a line interconnecting two stations, a sending relay and a receiving relay at each of said stations, each of said sending relays having its armature connect-

ed to different ends of said line, receiving circuits each including one of said receiving relays connected to different ends of said line, sources of potential connected to each of said receiving circuits, the source at the first of said stations being of greater value than the source at the second of said stations, said sources being so poled as to oppose each other whereby the resultant current through said receiving relays will be in such a direction as to maintain them in marking condition, and a source of potential at the second of said stations connected to the spacing contact of the sending relay thereat, said last mentioned source being so poled as to oppose said first mentioned sources and having a value sufficiently greater than the greater of said two first mentioned sources whereby when said last mentioned source is connected to the line the resultant current through the receiving relay at the second station will be in such a condition as to maintain it in a marking condition and the resultant current through the receiving relay at the first station will be reversed and will be in a direction to shift said relay to a spacing condition.

4. A telegraph system including a conductor, receiving circuits each including a receiving relay connected to each end of said conductor, each of said receiving circuits being normally connected to potentials of different values and so poled as to tend to cause current to flow in opposite directions over said conductor whereby the resultant current is in such direction to actuate both of said receiving relays to marking condition, a pair of sending relays, one having its armature connected to one end of said line and the other having its armature connected to the opposite end, marking and spacing contacts for said armatures, the spacing contacts of each sending relay being connected to potentials so related to the potentials normally applied to said receiving circuits that when the armature of the sending relay at either end is shifted to its spacing contact a current flow will be maintained over the receiving circuit at that end in the same direction as when said armature was on its marking contact but the direction of current flow through the receiving circuit at the opposite end will be reversed, thereby causing current to flow through the receiving relay therein in spacing direction.

5. A telegraph system including a conductor, receiving circuits each including a receiving relay connected to each end of said conductor, each of said receiving circuits being normally connected to potentials of different values and so poled as to tend to cause current to flow in opposite directions over said conductor whereby the resultant current is in such direction to actuate both of said receiving relays to marking condition, a pair of sending relays, one having its armature connected to one end of said line and the other having its armature connected to the opposite end, marking and spacing contacts for said armatures, the spacing contacts of said sending relay armatures being connected to different potentials, said spacing contact potentials and said receiving circuit potentials being so related to each other that the receiving circuit potential normally applied at one end will lie between the spacing contact potential and the receiving circuit potential normally applied at the opposite end, whereby if the armature of the sending relay is shifted to its spacing contact a current flow will be maintained through the receiving relay at that end in the normal direction but the resultant current over said conductor and the receiving circuit at the opposite end will be reversed to actuate the receiving relay at the opposite end to a spacing condition.

6. A telegraph system including a line interconnecting two stations, a receiving relay and a sending relay at each of said stations, a circuit for the receiving relay at the first station including a source of potential and the winding of said relay, said circuit being connected to said line over the marking contact and armature of the sending relay at the first station when it is in marking condition, a circuit for the receiving relay at the second station including a source of potential and the winding of said relay, said circuit being connected to said line over the marking contact and armature of the sending relay at the second station when it is in marking condition, said sources of potential being so poled as to oppose each other and the one at the second station being of smaller voltage than the other, and means at said first station operative when the sending relay thereat is in spacing condition for completing both of said circuits to a source of potential smaller in voltage than said last mentioned source and so poled as to oppose it.

7. A telegraph system including a line interconnecting two stations, a receiving relay and a sending relay at each of said stations, a circuit for the receiving relay at the first station including a source of potential and the winding of said relay, said circuit being connected to said line over the marking contact and armature of the sending relay at the first station when it is in marking condition, a circuit for the receiving relay at the second station including a source of potential and the winding of said relay, said circuit being connected to said line over the marking contact and armature of the sending relay at the second station when it is in marking condition, said sources of potential being so poled as to oppose each other and the one of the second station being of smaller voltage than the other, and means at said second station operative when the sending relay thereat is in spacing condition for completing both of said circuits to a third source of potential said third source of potential being so poled as to oppose said other source of potential and having a voltage greater than the voltage of the source of potential at the first station.

8. A telegraph system including a line interconnecting two stations, a sending relay at each of said stations, each of said sending relays having an armature and marking and spacing contacts, a source of current individual to each of said stations, each of said sources of current being adapted to be connected to said line at each of said stations and to the armature of the sending relay thereat, receiving relays at each of said stations, each of said receiving relays having its winding connected between the source of current individual to its station and the armature of its respective sending relay, each of said sources of current being so poled as t oppose each other and one being of greater voltage than the other whereby the direction of current flow through said receiving relays will be controlled by the source of current of greater voltage when said sending relay armatures are on their marking contacts, and means controlled by either of the armatures of said sending relays for completing individual circuits over its spacing contact for said sources of current whereby the direction of current flow through the receiving relay at the other end of the line may be reversed.

9. A telegraph circuit including a receiving relay and a source of potential connected at each end thereof, a sending relay associated with each end of said circuit, two other sources of potential each associated with different ones of said sending relays, said first two sources being so poled as to oppose each other and one being of greater value than the other, either of said second two sources being adapted to be connected to said circuit in opposing relationship to said first two sources by its associated sending relay, said second two sources being of different values, one having a value greater than the largest of said first two sources and the other having a value smaller than the smallest of said first two sources, the greater of said second two sources being located at the same end of the circuit as the smaller of said first two sources.

10. A telegraph circuit including a receiving relay and a source of potential connected at each end thereof, a sending relay associated with each end of said circuit, two other sources of potential each associated with different ones of said sending relays, said first two sources being so poled as to oppose each other and one being approximately twice the value of the other, either of said second two sources being adapted to be connected to said circuit in opposing relationship to said first sources by its associated sending relay, said second two sources having a value approximately half way between the values of the sources at the opposite end of the circuit.

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