April 28, 1925.

H. S. PERCIVAL

1,535,244

TELEGRAPHY

Filed May 20, 1920

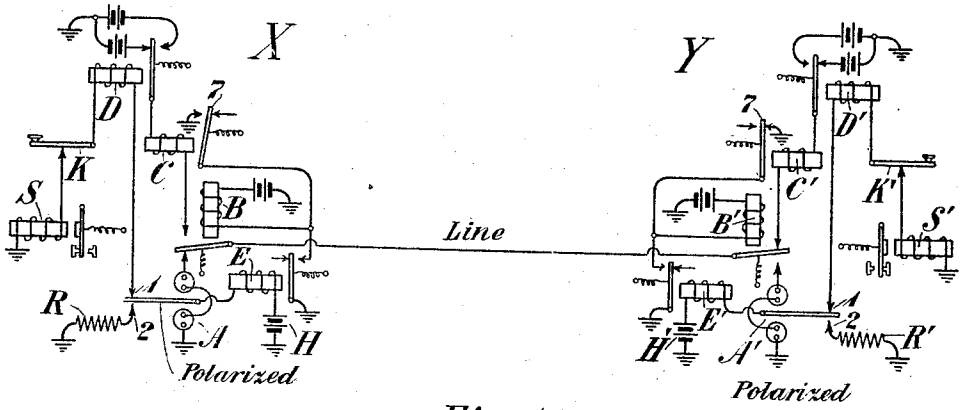


Fig. 1

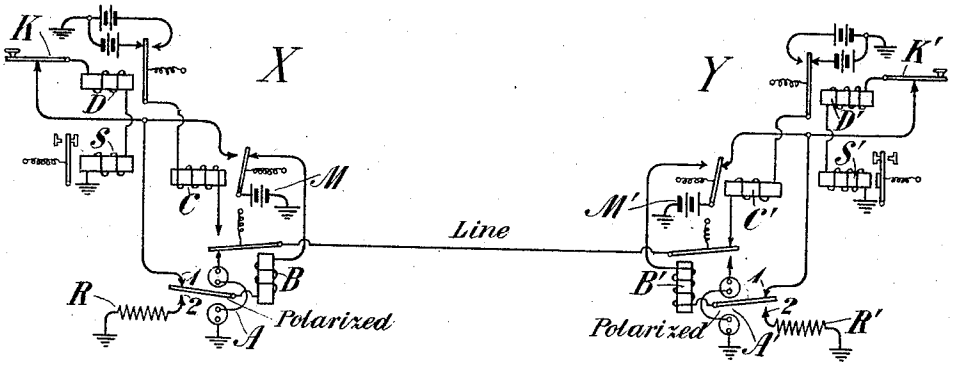


Fig. 2

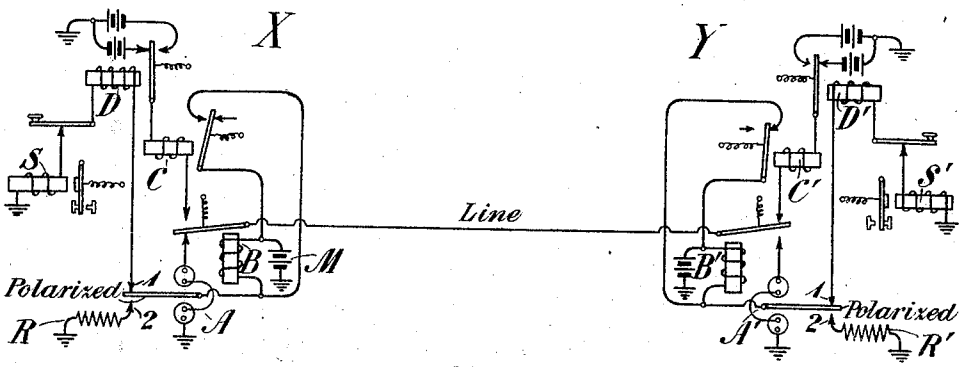


Fig. 3

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UNITED STATES PATENT OFFICE.

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TELEGRAPHY.

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To all whom it may concern:

Be it known that I, HARRY S. PERCIVAL, residing at Bloomfield, in the county of Essex and State of New Jersey, have invented certain Improvements in Telegraphy, of which the following is a specification.

This invention relates to telegraphy, and it is concerned particularly with telegraph systems in which transmission is limited to one direction or the other at a time, which systems are generally designated in the art as "single" telegraph systems.

In the single telegraph systems now in common use the line relays are of the type which is responsive to the presence or absence of line current irrespective of the direction thereof. Systems of this character are troublesome, when used on long lines, due to leakage and capacity. In such instances it is not uncommon to employ a duplex telegraph system modified for one-way operation, the advantage of this system being that it employs relays responsive to the direction of current, as for example, relays with polarized armatures. The duplex systems, however, necessitate the use of balancing artificial lines and other equipment which is expensive to install and troublesome to keep in adjustment.

The object of the present invention is to provide a single telegraph system which employs relays of the type responsive to current reversals, thus securing the operating advantages of these relays for the single systems without the use of balancing artificial lines and similar equipment.

The invention proposes, furthermore, to provide the line circuit with two branches at each station, one being employed for the transmission, the other for the reception of signals. A translating device is provided at each station to connect one or the other branch to the line according as the operator thereat is transmitting or receiving. This translating device is arranged to disconnect the transmitting branch from the line when the operator at the distant end is "breaking" the message.

A good understanding of the invention may now be had from the following description thereof having reference to the accompanying drawing in which:

Figure 1 is a diagrammatic view of one form and arrangement of apparatus embodying the invention, and

Figs. 2 and 3 are views showing modifications of the apparatus of Fig. 1.

Similar characters of reference designate similar parts in each of the several views.

In Fig. 1, I have shown a telegraph line with which are associated stations X and Y, the former of which comprises a relay B, the armature of which is connected to the line, the front contact of which is associated with a transmitting branch circuit, and the back contact of which is connected with a receiving branch circuit. The transmitting branch circuit comprises positive and negative battery governed by the armature of the transmitting relay D, and a relay C, the winding of which is in series with the branch circuit so that the relay is energized when current of either positive or negative polarity flows from the transmitting branch into the line. The receiving branch of the line circuit extends from the back contact of the relay B, through the winding of a polarized relay A to ground. The armature of this relay governs a local circuit which comprises battery H, the relay E, the contact 1 of the polar relay A, the transmitting relay D, the key K and the sounder S. The station Y is provided with similar apparatus designated by like reference characters, a prime mark (′) being used to distinguish the apparatus of Y from that of X.

The interrelations of the various relays and circuits of this system may be readily understood from the following description of the operation thereof, in which description the operator at Y is assumed, first, to be sending to X. In the course of such sending, relay B′ will have its armature against its front contact and relay B will have its armature against its back contact, all as shown in the drawing. If for any reason these armatures should be in any other position when the operator at Y begins to send, they will at once be thrown to the positions shown upon first opening the key K′ to spacing position. This will appear in the course of the description of the operation that follows. With the key at Y closed, current flows from the battery H′, through the local circuit, so that relays E′ and D′ and the sounder S′ are energized.

The armature of the relay D′ is therefore in engagement with the front contact, so that current from negative battery flows in the circuit which extends through the relay C′, the armature of relay B′, the line, the armature of relay B and the receiving relay A to ground. This current energizes the relay C′ and causes the same to hold closed at contact 7 the circuit of the relay B′ so that the armature of this relay remains in engagement with its front contact. The negative current through the receiving relay A causes this relay to close the contact 1 so that current flows through the local circuit at this station and energizes the sounder thereat. It is thus seen that when the key at Y is closed, the sounders at both stations are energized, denoting a marking signal.

To send a spacing signal the operator at Y opens his key and causes, thus, the release of his sounder and the deenergization of his transmitting relay D′. This causes the flow of current from positive battery through the main line circuit, so that relays C′ and A are energized by current of opposite direction. The relay C′ is so constructed with slow release that it does not open its front contact during the reversal of current in its winding; it therefore retains the relay B′ energized so that the same does not open the connection between the main line and the transmitting branch thereof at station Y. The polarized receiving relay A responds to the reversal of current by opening its contact 1 and closing contact 2. This takes battery H off the sounder S so that the same is released, thus causing a spacing signal at station X. When the operator at Y recloses his key, he causes another reversal of current in the main line, and a renewed response of the sounders at both stations. Messages may therefore be transmitted from Y to X by operations of the key at Y in the usual manner.

If now, the operator at X desires to "break" the message from Y for the purpose of sending in the opposite direction, he opens his key so that during the interval in which the operator at Y holds his key depressed, current is taken off the relays D and E, and from the sounder S. The deenergization of E brings about the closure of the circuit of B through the back contact of E, so that relay B opens the connection of the receiving relay A to the line, and closes that of the transmitting branch circuit. The transmitting relay D, having been de-energized, connects negative battery through relay C to the line. Battery of like polarity, however, is applied to the opposite end of the line so that current ceases to flow therein. The relay C′ at Y is thus de-energized and opens its contact so that relay B′ opens the connection between the line and the transmitting branch circuit of Y and closes that to the receiving branch. As this connection is made, current from the negative battery at X flows through the relay C, the armature of the relay B, and through the line to station Y, where it flows through the armature of relay B′ and the winding of the polarized receiving relay A′, to ground. The current in this circuit energizes the relay C so that the same operates its armature into engagement with its front contact and maintains the circuit of B closed. The negative current through relay A′ causes the same to close its contact 2, thus taking the battery H′ off the transmitting relay D′ and the sounder S′, which thus notifies the operator at Y that X is "breaking" his message. Moreover, if the operator at Y continues to operate his key he will fail to note a response in his sounder because battery is off the key. Having thus become aware that X is interrupting him, he closes his key and takes the message from X, which is transmitted to Y in the same manner as hereinefore explained for transmission in the opposite direction.

The foregoing explanation of "breaking" by the operator at X shows how an operator gets control of the line by opening his key. If for any reason the armatures of relays B and B′ should both be on their back contacts when the line was idle, or if these armatures were reversed from the positions shown in Figure 1, in either case they would go to the positions there shown upon first opening the key at K′. Thereafter the operation of sending would be as heretofore described.

It will have been noted that the relay E is included in the local circuit at each station, so that this relay closes and opens its contact when the operator thereat is transmitting. These operations of the contact have no effect, however, on relay B for the reason that the circuit thereof is maintained closed by the relay C while the circuit thereof is connected to the line. The purpose for which the relay E is provided is to close the circuit of the adjacent relay B when the operator at the same station is "breaking," as hereinbefore explained. To prevent an operation of E when the operator is receiving, the contact 2 of the receiving relay is connected through a resistance R to the ground, (reference being had to station X) so that the current from battery H energizes the relay E in either position of the armature of relay A, relay E being slow enough in release to hold during the change from one of said positions to the other. A similar circuit is provided for relay E′ of station Y.

In the modification illustrated in Fig. 2, I eliminate one of the relays employed in the preceding form of embodiment of the invention. The relay B governs, as before,

the connection of the line to the transmitting or the receiving branch circuit, and the relays C, D and A are used for similar purposes as in Fig. 1. The local circuit in this modification consists, however, of two paths. One of these, the path used during transmission, extends from the battery M through the front contact of relay C, the key K, the transmitting relay D and the sounder to ground. The other of these paths—employed during reception—consists of the battery M, back contact of relay C, the winding of relay B, the armature of relay A, the key K, relay D and the sounder, to ground.

The operation of this modification with X receiving and Y sending is as follows: It is assumed that the armatures of relays B and B′ are in the positions shown in Figure 2; if not, they will be brought to those positions by first opening the key at Y, as will appear in the course of the following description. When the key at Y is closed, relay D′ and the sounder are energized by current from battery M. The front contact of relay D associates negative battery with the transmitting branch circuit so that current of this polarity flows over the line and operates the armature of the receiving relay A at station X to the position shown in the drawing. Current therefore flows through the receiving path of the local circuit at station X, which current energizes the relay B and the relay D as well as the sounder, the position of which thus corresponds to the position of that at Y. When the key at Y is opened to send a spacing signal, the sounder S′ is de-energized and the current in the line is reversed. This causes the receiving relay A to close its contact 2, thus opening the sounder circuit to give the spacing signal. The relay B remains energized by current which flows through the resistance R to ground. This relay serves, thus, to hold to the receiving branch circuit connected to the line at station X. The relay B′ at station Y remains de-energized during the transmission of the message because the circuit of this relay is held open at the back contact of relay C′.

If the operator at X wants to "break" the message from Y, he opens his key so that during the interval in which the operator at Y holds his key depressed the relay B is de-energized and closes its back contact and the relay D is de-energized and associates negative battery with the line circuit. Current therefore ceases to flow in the main line and the relay C′, in closing its back contact, causes the energization of relay B so that the same connects the receiving branch circuit to the line. Negative current now flows from station X through the relay C, over the line, and through the receiving relay A′ to ground. Relay C is thus energized and in closing its front contact establishes the transmission path of the local circuit at X. The relay A′ of Y reverses its armature and opens the circuit of the sounder. Current is thus taken off the key at station Y, and the operator is thus notified that he is being interrupted by station X. He closes his key and the operator at X is free to send to Y.

In the modification of the invention shown in Fig. 3, the number of relays is the same as in the preceding modification, and the local circuit at each station is again made up of two paths, the transmission path extending from the battery M through the front contact of the relay C, the armature of the receiving relay A, the winding of the transmitting relay D and the sounder to ground; and the receiving path extending from the same battery, through the winding of the relay B, armature of the receiving relay A, transmitting relay D and the sounder, to ground. The operation of this arrangement with Y sending to X is as follows: It is assumed that the armatures of relays B and B′ are in the positions shown in Figure 3; if not, they will be brought to those positions by first opening the key at Y, as will appear in the course of the following description. With the key at Y closed, negative current flows through the relay C′ and over the line to station X, where it causes the receiving relay A to close its upper contact, so that current from battery M flows through the receiving path of the local circuit at X. Opening the key at Y reverses the direction of the current in the line circuit, so that the receiving relay A opens the sounder circuit, but retains the relay B energized by current flowing through the contact 2 and resistance R to ground. Relay B thus maintains its lower contact closed while signals are being received at the station X. The relay C′ at Y, being energized by the line current, holds the transmitting path of the local circuit closed. The front contact of C′ is in shunt to the relay B′, which is therefore de-energized while current continues to flow in the transmitting branch circuit.

When the operator at X, in order to "break" the message from Y, opens his key so that the relays B and D are de-energized, he causes negative battery to be applied to the line so that current ceases to flow therein. This brings about the de-energization of the relay C′ at station Y, which in turn causes the removal of the short circuit from the winding of relay B′, so that the same is energized and connects the line to the receiving relay A′ of station Y. Negative current now flows over the line circuit and causes

the receiving relay A′ to open contact 1 and close contact 2. This takes battery off the key at Y and serves to notify the operator at this station that X is "breaking" his message. He, therefore, leaves the key in its closed position and receives the message in the regular manner.

Although I have shown and described herein only a few forms of embodiment of the invention, it is readily understood that various other changes and modifications may be made therein within the scope of the following claims, without departing from the spirit and scope of the invention.

What I claim is:

1. In a telegraph system, a main line, a station associated therewith, a transmitting branch circuit for said main line at said station, a device for at times associating said main line with said branch circuit, a transmitting device at said station, means governed by said transmitting device for causing said first mentioned device to assume its operative position and means associated with said transmitting branch circuit for retaining said device in its operative position.

2. In a telegraph system, a main line, a plurality of stations associated therewith, a transmitting and a receiving branch circuit for said main line at each of said stations, a translating device at each station for associating one or the other branch circuits with said main line, a key for transmitting and a sounder for receiving, both in series in a single circuit with respect to one and the same battery at each station, means controlled by said key for causing the adjacent translating device to assume one or the other of its positions according to the position of the key, and means effective when the keys at said stations are in predetermined relative positions for rendering the translating device of one station non-responsive to its key.

3. In a telegraph system, a line, a plurality of stations associated therewith, a set of receiving and a set of transmitting device for said line at each station, means at each station for connecting one or the other of said sets with said line, and means operable at each station for rendering the said connecting means ineffective at the other station when said other station is transmitting and a transmitter and a receiver in series in one circuit at each station and acted on respectively by said transmitting and receiving devices.

4. In a telegraph system, a main line, a station associated therewith, a transmitting and a receiving branch for said line at said station, and means selectively actuated when said station is transmitting or receiving for associating said transmitting or receiving branch, respectively, with said line and a transmitter and a receiver in series in one circuit at each station and acted on respectively by said transmitting and receiving branches.

5. In a telegraph system, a main line, a plurality of stations associated therewith, a receiving branch and a transmitting branch for said main line at each of said stations, a relay for each station arranged to associate one or the other of said branch circuits with the main line according to its operated or non-operated position, a key and sounder at each station, a polarized receiving relay associated with said receiving branch circuit for causing operations of said sounder in accordance with the direction of current in the main line, a source of current, a transmitting relay responsive to said key for associating positive or negative potential with said transmitting branch circuit according to the position of said key, a relay at each station responsive to the transmitting key thereat for causing an initial operation of said first mentioned relay, and a device associated with the transmitting branch circuit at each station for retaining said first mentioned relay in operated position when current flows through said branch circuit.

6. In combination, a main line, a station associated therewith, a local circuit at said station, said circuit comprising a transmitting and a receiving path, a transmitting device and a sounder associated with both of said paths, a transmitting branch and a receiving branch for said main line, a relay associated with the receiving path of the local circuit for associating one or the other of said branches with said main line, a receiving relay associated with said receiving branch circuit for governing said receiving path of the local circuit, and a relay associated with said transmitting branch of the main line circuit for governing both of said paths of the local circuit.

7. In a telegraph system, a line, a plurality of stations associated therewith, a transmitting and a receiving branch for said line at each station, a translating device at each station for associating one or the other of said branches with said line, a key at each station, a relay responsive to flow of current in said transmitting branch, a circuit for said translating device governed by said key and said relay, a receiving relay associated with said receiving branch, and a circuit governed thereby for at times rendering said translating device non-responsive to said key.

8. In a telegraph system, a line, a plurality of stations associated therewith, a transmitting and a receiving branch for said line at each station, a translating device at each station for associating one or

the other of said branches with said line, a key at each station, a relay responsive to flow of current in said transmitting branch, a circuit for said translating device governed by said key, a shunt for said device governed by said relay, a receiving relay associated with said receiving branch, and a circuit governed thereby for at times rendering said relay non-responsive to said key.

In testimony whereof, I have signed my name to this specification this 14th day of May 1920.

HARRY S. PERCIVAL.