

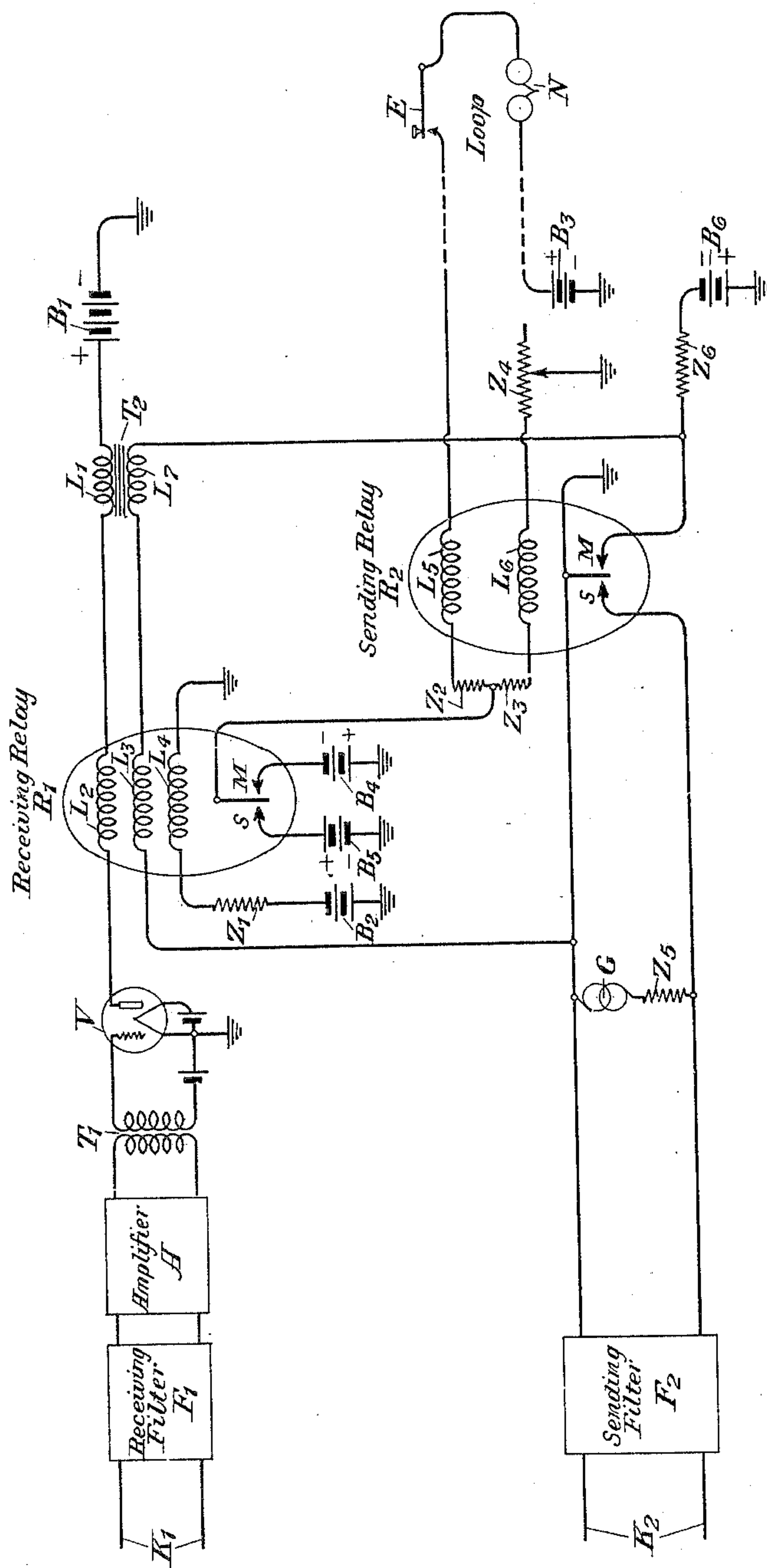
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TELEGRAPH SYSTEM

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TELEGRAPH SYSTEM

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This invention relates to signaling systems. More particularly, this invention relates to telegraph systems, and furthermore, it relates to "breaking" arrangements for such systems.

In telegraph systems, the circuits are generally so arranged that an operator may interrupt or "break" another operator sending signals from some distant point in the telegraph circuit and thereby himself gain control of the circuit. The usual method of "breaking" the circuit is for the operator to open his key for a short interval of time. It is essential that the circuits be so arranged that the first opening of the operator's key will cause a clean-cut spacing signal to be transmitted to the sending operator, thereby interrupting his sending of signals. When this occurs, there will be no current in the sending operator's loop even when his own key is closed.

The breaking feature of the telegraph system is generally accomplished by a break relay which is equipment furnished in addition to the sending and receiving relays of the telegraph set. This break relay has been found to be undesirable for a number of reasons and this invention has been made to do away with this additional equipment, i. e., the break relay, and has retained the properties and features of such a relay.

It is in general the object of this invention to provide improved arrangements for this purpose by providing at a telegraph station arrangements whereby the armature of the receiving relay is maintained on its marking contact whenever the armature of the sending relay is on its spacing contact, thereby rendering the incoming signals to the receiving relay ineffectual to the loop circuit and allowing a spacing signal to be transmitted to the sending operator, which will cause like polarities of battery to be connected to both ends of his loop circuit and will interrupt his sending of signals.

Another of the objects of this invention is to provide a telegraph system which shall accomplish the well known breaking feature with the ordinary sending and receiving re-

lays of the telegraph set, thereby obviating the necessity for a break relay.

While this invention will be pointed out with particularity in the appended claims, the invention itself, both as to its further objects and features, will be better understood from the detailed description hereinafter following, when read in connection with the accompanying drawing which shows one embodiment of the invention given merely for the purpose of illustration.

Referring to the drawing, the reference character K_1 designates a pair of wires forming a line suitable for receiving carrier waves interrupted in accordance with telegraph signals. These currents flow through a receiving filter F_1 , then through an amplifier A , and become impressed upon the input circuit of a vacuum tube V by means of a transformer T_1 located between the amplifier A and the tube V . It will be apparent that pulses of alternating current corresponding to telegraph signals will appear in the input circuit of the tube V .

The output circuit of the tube V includes the battery B_1 , the winding L_1 of a kick transformer T_2 , the winding L_2 of a polar receiving relay R_1 and the plate and filament electrodes of the tube V and ground. The tube V is employed to act as a rectifier, and by virtue of its rectifying properties the current flowing in its output circuit will be a direct current interrupted in accordance with the telegraph signals. Each pulse of alternating current in the input circuit of the tube V will produce a corresponding direct current pulse in the output circuit of the tube V .

The winding L_2 is the main winding of the receiving relay R_1 . This relay also includes a kick winding L_3 and a biasing winding L_4 . The circuit formed by the winding L_3 will be considered in some detail hereinafter. The winding L_4 is permanently connected in a series circuit which includes a battery B_2 , a resistance Z_1 , the winding L_4 itself, and ground. Current flows continuously through the latter circuit and the effect produced by winding L_4 tends to move the armature of the relay R_1 toward its spacing contact S , and if this armature is already on

the spacing contact S, the magnetic effect of winding L_4 will tend to hold it on this contact. The magnitude of the biasing effect of winding L_4 is generally about one-half of the magnetic effect which may be produced by the winding L_2 , and moreover, the effects of windings L_2 and L_4 are mutually opposite.

The armature of relay R_1 is connected to the junction of a pair of resistances designated Z_2 and Z_3 . The resistance Z_2 is in series with the winding L_5 of a sending relay R_2 and a loop circuit which includes a key E and a sounder N and a battery B_3 as well as ground. The resistance Z_3 is in series with a circuit which includes a winding L_6 of the sending relay R_2 and a variable resistance Z_4 as well as ground. The resistance Z_4 is simply used for balancing purposes. The key E and the sounder N may be considered the equipment at a local station and its circuit is generally known as a loop. The resistance Z_4 is intended to equalize the resistance of the conductors of this loop as well as the resistance of the sounder N. A longer loop will, of course, require a greater resistance at Z_4 .

The contacts of the armature of relay R_1 are designated M and S and these are generally known as the marking and spacing contacts respectively. These contacts are connected to oppositely poled batteries B_4 and B_5 , both of which are grounded. When the armature of the relay R_1 is in its mid-position and free from its contacts M and S and key E is open, no current will flow through the windings L_5 or L_6 of the sending relay R_2 . When the contact M of the relay R_1 becomes closed and the key E at the loop is also closed, current will then flow through the winding L_5 of the relay R_2 and its magnitude will be about twice as great as that flowing through the winding L_6 . Since the magnetic effects of windings L_5 and L_6 are arranged to be mutually opposite and since the magnetic effect of the winding L_5 is the greater, it will tend to move the armature of the relay R_2 towards its marking contact M, or to hold it on contact M if it is already there. When the armature of the relay R_1 closes its spacing contact S, the magnetic effect of the winding L_6 will be reversed, tending to maintain the armature of the relay R_2 closed against its marking contact M. While this condition exists, the battery B_5 which is connected to the spacing contact S of the relay R_1 , will oppose the battery B_3 . If key E is closed, and since the voltages of these batteries are practically equal to each other, no current will flow through the winding L_5 . If the key E is open, no current will flow through the winding L_5 of the relay R_2 as was the case when the key E was closed.

It will be seen that as long as the key E is open, there will be no magnetic effect whatever in the winding L_5 of the sending re-

lay R_2 . Under this condition the magnetic effect of the winding L_6 of the relay R_2 will be dependent upon the position of the armature of the relay R_1 . If the armature of the relay R_1 is on its marking contact M, the armature of the relay R_2 will go to its spacing contact. However, if the armature of the relay R_1 is on its spacing contact, the armature of the relay R_2 will go to its marking contact. Thus, when the winding L_5 of the relay R_2 becomes effectively deenergized, the armature of the relay R_2 will close its spacing contact S when the armature of the relay R_1 closes its marking contact, and conversely, the armature of relay R_2 will close its marking contact M when the armature of relay R_1 closes its spacing contact S.

Under these conditions, if a "break" feature, which will be described hereinafter, were not incorporated in the system, signals received over the circuit K_1 would be retransmitted over the circuit K_2 in reversed form and this would occur for a period of time which depends upon the length and characteristics of the line circuit.

The armature of the relay R_2 and its spacing contact S lead to an alternating current generator G which is connected in series with a resistance Z_5 . The generator G and its series resistance Z_5 are also connected to a sending filter F_2 which extends to an output circuit K_2 , and the circuit K_2 leads to a distant station. Just as the circuit K_1 receives alternating current signaling pulses from a distant station, so the circuit K_2 sends alternating current signaling pulses to a distant station which may be, and preferably is, the same station connected or coupled to the circuit K_1 . Thus, it will be seen that the circuits K_1 and K_2 form a four-wire arrangement suitable for the transmission of pulses of alternating current in opposite directions between a pair of stations.

It is to be noted that when the spacing contact S of the relay R_2 is closed by its armature, the generator G will be short-circuited through the resistance Z_5 and practically no current will flow from the generator G through the filter F_2 over the circuit K_2 . When the contact S of the relay R_2 is open, alternating current will be transmitted from generator G through filter F_2 and over the circuit K_2 . Thus, signals composed of pulses of alternating current may be transmitted over the circuit K_2 in accordance with the operation of the armature of the relay R_2 .

The armature of the relay R_2 is grounded. The contact M of the relay R_2 is connected in series with a resistance Z_6 , a battery B_6 and ground. When the armature of the sending relay R_2 is not on its marking contact M, current will flow from battery B_6 through the winding L_3 of the receiving relay R_1 , the circuit including battery B_6 , resistance Z_6 , the secondary winding L_7 of the kick transformer

T₂, winding L₃ of relay R₁ and ground. The portion of the latter circuit including the windings L₃ and L₇ will be shunted by the armature of the relay R₂ when this armature closes its marking contact M. Consequently, current will flow from battery B₆ through the winding L₂ of the relay R₁ and this current will be effective in moving the armature of the relay R₁ toward its marking contact M if this armature is not already on this contact, and this will occur only when the armature of the relay K₂ is not on its marking contact M.

The operator at the loop may desire to send signals over the circuit K₂ to the distant station. This he may do by opening his key E in order to gain control of the circuit and "break" the transmission signals from the distance station over the circuit K₁. If the armature of the relay R₁ is on its spacing contact S, the armature of the relay R₂ will remain on its marking contact M, and generator G will continue to send current through filter F₂ over the circuit K₂. Still there will be no "break" in the circuit. When, under the control of incoming signals, the armature of the relay R₁ goes to its marking contact M, the armature of the relay R₂ will reach its spacing contact S and the generator G will be short-circuited through the resistance Z₅. No current will then be transmitted by the generator G over the circuit K₂. If no break feature were provided and a spacing signal were to be received before the breaking signal had reached the operator at the distant station, the armature of relay K₁ would be operated to its spacing contact S, thereby causing the armature of sending relay R₂ to move to its marking contact. This would interrupt the breaking signal.

A special feature of this invention lies in the prevention of the armature of the relay R₁ from leaving its marking contact M after it has reached this contact and after the key E has been opened by the operator at the loop for the purpose of "breaking" the circuit. Since the armature of the sending relay R₂ will thereby be operated to its spacing contact S, the battery B₆ will supply current through the resistance Z₆ and through the windings L₇ and L₃, and the current through the winding L₃ will of itself be sufficient to cause the armature of the relay R₁ to close its marking contact M. Contact M of relay R₁ will remain closed even during the absence of current through winding L₂ of the relay R₁ which, of course, is in the output circuit of the tube V. If, as here shown, the marking contact of the relay R₁ is maintained closed, the spacing contact of the relay R₂ will also remain closed and no current will flow from the generator G over the circuit K₂. It is essential to maintain the spacing contact of the relay R₂ closed for a sufficient interval of time so that the spacing or

breaking signal to the distant station located at the distant end of the circuit K₂ will be completed and registered.

While this invention has been shown and described in certain particular arrangements merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of a receiving relay for receiving pulses of direct current corresponding to telegraph signals, a loop including a key, a sending relay connected between the receiving relay and the loop, a circuit controlled by the armature of the sending relay, and means controlled by the sending relay and responsive to the opening of the key included within the loop to break said circuit and to bring the armatures of the sending and receiving relays into predetermined positions and to maintain these armatures in these positions while the key remains open.
2. In a telegraph system, the combination of a receiving relay having a main winding which may receive signals from one line and a kick winding, a sending relay which may send signals over another line, and means to break the circuit extending to the sending relay, said breaking means comprising means to transmit current through the kick winding of the receiving relay to simultaneously hold the armatures of said sending and receiving relays in predetermined positions.
3. The combination of a receiving relay having a first winding through which direct current pulses will flow and a second winding, a loop, a sending relay interconnecting the armature of the receiving relay with the loop, an alternating current generator connected between the armature and one of the contacts of the sending relay, and a source of direct current potential which is connected in series with the second winding of the receiving relay, said source of direct current potential being also connected in series with the armature and the other of the contacts of the sending relay.
4. The combination of a receiving relay having a main winding and an auxiliary winding, a first circuit connected to the receiving relay for energizing its main winding with pulses of direct current corresponding to signals, a loop, a sending relay interconnecting the armature of the receiving relay with the loop, a second circuit connected between the armature of the sending relay and one of its contacts, a source of potential controlled by the second circuit, and a source of direct current potential connected in series with the auxiliary winding of the receiving relay, said source of direct current potential

being also connected between the armature of the sending relay and its other contact.

5. In a telegraph system, the combination of a receiving relay for receiving pulses of direct current, said receiving relay having a main winding through which said pulses may flow and an auxiliary winding, a sending relay, a source of direct current potential, and a resistance, said source of direct current potential being connected in a permanently closed circuit in series with the auxiliary winding of the receiving relay and with said resistance, the armature and one of the contacts of the sending relay being connected in a circuit in series with the source of direct current potential and the resistance.

6. In a telegraph system having sending and receiving relays, means to break the transmission of signals, said means comprising means to bring the armature of the sending relay into a predetermined position and means responsive to the operation of the armature of said sending relay to bring the armature of the receiving relay into a predetermined position and to maintain the armatures of both relays in these predetermined positions for an appreciable period of time.

7. In a telegraph system having sending and receiving relays suitable for receiving signals from a distant station, means to break the transmission of signals from said distant station, said breaking means comprising electromagnetic means to bring the armature of the sending relay into a predetermined position and electromagnetic means controlled by the armature of the sending relay to bring the armature of the receiving relay into a predetermined position, and means to maintain the armatures of both relays in said positions for an appreciable period of time.

8. Breaking apparatus for a telegraph system having polar sending and receiving relays and a key, comprising means responsive to the opening of said key to bring the armature of the sending relay into a predetermined position, means responsive to the operation of said sending relay to bring the armature of the receiving relay into a predetermined position, and means to maintain these armatures in said positions until the key subsequently becomes closed.

9. In a telegraph system, the combination of a sending relay, a receiving relay, a loop connected to the sending and receiving relays, a key being included in said loop, and means responsive to the opening of said key to produce a breaking signal, said means comprising means to bring the armature of the sending relay into a predetermined position and means responsive to the operation of said sending relay to bring the armature of the receiving relay into a predetermined posi-

tion and to maintain both armatures in said positions while the key remains open.

In testimony whereof, I have signed my name to this specification this 23rd day of December 1930.

FRANK H. HANLEY.

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