

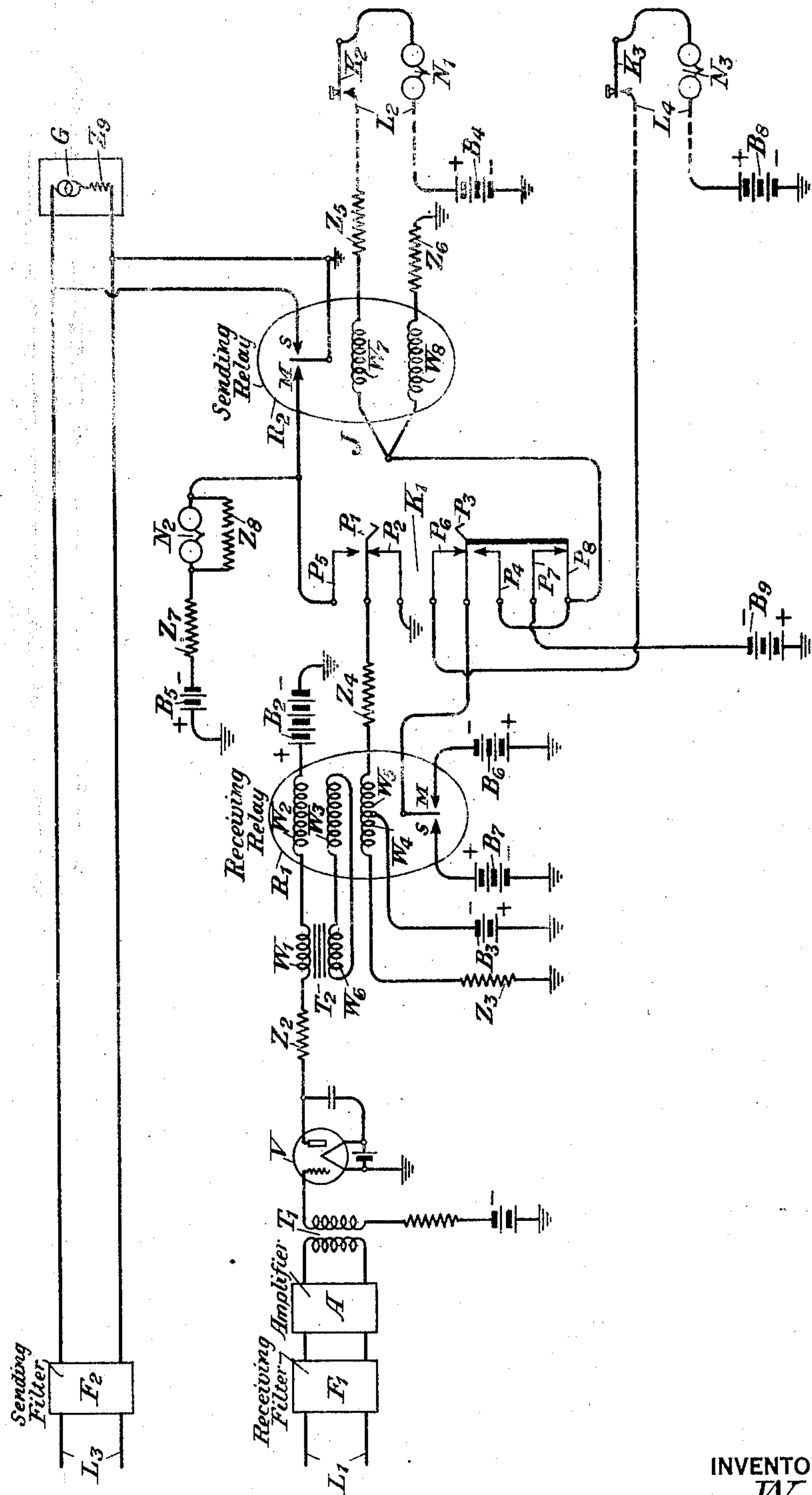
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TELEGRAPH SYSTEM

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TELEGRAPH SYSTEM

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This invention relates to telegraph systems and, particularly, to "breaking" arrangements for such systems.

In telegraph systems such as duplex systems, it is often desirable for an operator at one station to "break" in on the line or to interrupt the operator who may be sending from a distant station in order to obtain control of the circuit. 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 receiving relay is maintained continuously in the marking condition whenever the sending relay is in the spacing condition, thus rendering the incoming signals to the receiving relay ineffectual to the local circuit and allowing a spacing signal to be sent to the sending operator, the spacing signal causing like battery polarities to be connected to both ends of the loop circuit and interrupting the sending.

The breaking feature of the telegraph system is generally accomplished by a break relay which forms equipment furnished in addition to the sending and receiving relays of the telegraph repeater. Another object of this invention is to do away with this additional equipment, i. e., the break relay, and to accomplish the purpose of such a relay by means of the sending and receiving relay circuits.

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.

In the drawing there is shown one terminal of a carrier telegraph channel at which there is a line L_1 over which signals coming in from a distant station may be received and a line L_2 over which signals may be transmitted to a distant station. The pulses of carrier current incoming over line L_1 flow through a receiving filter F_1 and an amplifier A and are rectified by a detector tube V . It will be

apparent that pulses of direct current corresponding to the received pulses of alternating current will appear in the plate circuit of detector tube V , in which are included the main winding W_2 of a polar receiving relay R_1 and the primary winding W_1 of a kick transformer T_2 .

Each pulse of direct current flowing through the winding W_2 tends to move the armature of the receiving relay R_1 to its marking contact M . When ground is applied to the movable contact P_1 of the key K_1 , either through the fixed contact P_2 or through the fixed contact P_5 and the armature and marking contact M of the sending relay R_2 , current flows from the battery B_2 through the winding W_4 over the resistance Z_3 to ground, current also flowing from battery B_3 through the winding W_5 over the resistance Z_4 to ground. The current in the winding W_4 tends to move the armature toward the marking contact M with a force equal to half that produced by the winding W_2 . The current in the winding W_5 tends to move the armature toward the spacing contact S with a force equal but opposite to that produced by winding W_2 . It is thus apparent that the combined effect of windings W_4 and W_5 tends to move the armature toward the spacing contact S with a force equal to one-half the force which the current in winding W_2 exerts toward the marking contact M . It will be seen, therefore, that with normal current flowing through the winding W_5 , the armature of the receiving relay R_1 will move back and forth between the marking contact M and the spacing contact S in accordance with the telegraph signals impressed upon the winding W_2 . The effect of winding W_3 is merely to accelerate the motion of the armature. The rise and decay of current flowing through the winding W_1 of the kick transformer T_2 induces in its winding W_6 currents which, flowing through the winding W_3 , aid the signaling currents in moving the armature.

For half-duplex operation the key K_1 is operated, thereby connecting the contact P_1 to the contact P_5 , the contact P_3 to the contact P_4 and disconnecting contacts P_7 and P_8 .

In this case the armature of the receiving relay R_1 is connected to the local loop circuit L_2 , which includes the winding W_7 and W_8 of a polar sending relay R_2 , a key K_2 , a sounder N_1 , a battery B_4 and the resistances Z_5 and Z_6 . The batteries B_4 , B_6 and B_7 are of substantially equal voltages and in fact they may be the same battery. With key K_2 closed, as will normally be the case when the local operator is receiving signals and when the armature of the receiving relay R_1 is on its marking contact M , current will flow from the battery B_4 through the sounder N_1 , the key K_2 , the resistance Z_5 and the winding W_7 , to the battery B_6 and current will flow from ground through the resistance Z_6 and the winding W_8 to the battery B_6 . The current through winding W_8 will tend to move the armature of the sending relay R_2 to its spacing contact S and the current through winding W_7 will tend to move said armature to its marking contact M with twice the force exerted by winding W_8 . When the armature of the receiving relay R_1 is on its spacing contact S , current will flow from the battery B_7 through the winding W_8 and the resistance Z_6 to ground. This current will tend to move the armature of the sending relay R_2 to its marking contact M . No current will flow through the circuit including the winding W_7 , the resistance Z_5 , the key K_2 and the sounder N_1 , since batteries B_7 and B_4 are mutually opposed. It will thus be apparent that as the armature of the receiving relay R_1 alternates between its marking and spacing contacts in accordance with received telegraph signals, pulses of current will flow through the sounder N_1 , operating it in accordance with said signals. However, it is to be noted that the operation of the armature of the receiving relay will not operate the sending relay R_2 when the key K_2 is closed since the winding W_7 and W_8 are then in balanced relation with respect to the armature of the receiving relay R_1 .

When the armature of the receiving relay R_1 is at rest on its marking contact M , as will normally be the case when the operator at the local station is transmitting signals, current from the batteries B_4 and B_6 which are serially aiding, will flow through the winding W_7 of the sending relay R_2 . As stated hereinbefore, this current will tend to move the armature of said relay to its marking contact M . Current will flow from the battery B_6 through the winding W_8 and the resistance Z_6 to ground, and this current will tend to move the armature of the sending relay R_2 to its spacing contact S with half the force exerted by the current through the winding W_7 . It will be apparent that the operation of the key K_2 will interrupt the current through the winding W_7 and will cause the armature of the sending relay R_2 to alternate between its marking and spacing

contacts in accordance with the telegraph signals sent by the key K_2 . Said armature will alternately open and close a short circuit across the output of the alternating current generator G and will thus cause pulses of alternating current corresponding to said telegraph signals to flow through the sending filter F_2 and over the line L_3 to the distant station. The operation of the sending relay armature also alternately connects to ground and disconnects from ground the circuit which includes the neutral sounder N_2 , the resistance Z_7 and the battery B_5 , which is of the same voltage and polarity as the battery B_3 and may, in fact, be the same battery. A resistance Z_8 may, if desired, be used to shunt the sounder N_2 . The sounder N_2 is caused to operate in accordance with the transmitted signals, as described hereinabove. The sounder N_2 may be located at the repeater station and its purpose is to allow the repeater attendant to read the outgoing signals.

The current through the winding W_5 of the receiving relay R_1 will now be dependent upon the position of the armature of the sending relay R_2 , this current being substantially zero when said armature is not connected to its marking contact M . Hence, it will be apparent that when the armature of the sending relay R_2 is on its spacing contact S , the current through the winding W_4 will cause the armature of the receiving relay R_1 to remain on its marking contact M irrespective of the pulses of current flowing through winding W_2 . If this were not so, i. e., if the operation of receiving relay R_1 were independent of the position of the armature of the sending relay R_2 and if the operator should open the key K_2 to break the distant operator while signals were being received by relay R_1 , it would be seen that the sending relay R_1 might be operated by these incoming signals, as reversals of current would flow from the armature of the receiving relay through the winding W_8 of the sending relay R_2 to ground and the current through the winding W_7 would be substantially zero. This might cause a retransmission of signals back to the sending operator over the line L_3 for a period of time dependent upon the length of the circuit. In other words, a chattering or disturbance might take place on the line which would prevent a clean and effectual break from taking place.

However, as stated above, when the operator opens the key K_2 to break the incoming signals, the armature of the sending relay R_2 will move to its spacing contact S . The current through the winding W_5 of the receiving relay R_1 will drop to zero and hence the current through the winding W_4 will maintain the armature of the receiving relay R_1 on its marking contact M irrespective of the effect of incoming signals on the winding W_2 .

Current will then flow through ground, the resistance Z_6 , the winding W_8 , the contact P_4 , the contact P_3 , the receiving relay armature, the marking contact M and the battery B_6 , which is the energizing source, to ground. This current through the winding W_8 will maintain the armature of the sending relay R_2 on its spacing contact S as long as the key K_2 is open.

Thus, it is seen that when the key K_1 is operated, the loop L_2 and the equipment at the repeater station, including the receiving and sending relays R_1 and R_2 , respectively, are interconnected for half-duplex telegraphy as stated hereinabove. The operator at the loop L_2 may transmit signals by operating his key K_2 and pulses of alternating current will, accordingly flow over the circuit L_3 . When the operator at the loop desires to receive signals, he will close his key K_2 and pulses of alternating current received over the circuit L_1 will be registered by the sounder N_1 at his loop. The operator at the loop may obtain control of the circuit extending to the distant station, while signals are incoming, by opening his key K_2 . Irrespective of incoming signals, this will cause a spacing signal to be transmitted to the distant station which will interrupt the transmission of signals by the operator at said station by connecting like batteries to both ends of the distant loop. No break relay is required in this half-duplex telegraph system. The features of the break relay are supplied by the circuits attached to the receiving and sending relays R_1 and R_2 , respectively. Moreover, the sounder N_2 at the repeater station is continually operated and will register all signals transmitted by the local station.

The key K_1 may be placed in its normal, unoperated position to provide a full-duplex telegraph circuit. The loop L_2 will then be the sending loop and the loop L_4 the receiving loop. The key K_2 at the loop L_2 will be the essential element required for the transmission of signals over the circuit L_3 to the distant station. The sounder N_3 will be the essential element of the loop L_4 for receiving signals over the circuit L_1 from the distant station. A key K_3 may, if desired, be inserted in series with the sounder N_3 at the loop L_4 . Since the properties of a breaking arrangement are obviously not required in a full-duplex system, the circuit including the winding W_5 of the receiving relay R_1 is so arranged that current flows continuously through said winding when the key K_1 is unoperated. The resultant effect of the windings W_4 and W_5 will then be such as to tend to operate the armature of the receiving relay R_1 to its spacing contact S . Thus the combination of the windings W_4 and W_5 will serve as a biasing winding for the receiving relay.

The receiving loop L_4 extends to the arma-

ture of the relay R_1 through the contacts P_3 and P_6 of the key K_1 , and a battery B_8 , which may, if desired, be located at the repeater station, will be in series with the loop L_4 . When the armature of the relay R_1 closes its marking contact M , the batteries B_6 and B_8 will be in series with each other and their effects will be additive, thereby providing a substantial current through the sounder N_3 of the loop L_4 . This current will create an audible signal at the loop L_4 . When the armature of the relay R_1 closes its spacing contact S , the batteries B_7 and B_8 will then become connected in series relationship, and inasmuch as their voltages are substantially equal and their polarities opposite, practically no current will flow through the sounder N_3 at the loop L_4 . Consequently, the sounder N_3 will be unoperated, thus registering a spacing signal. Thus, it will be apparent that the sounder N_3 at the receiving loop L_4 will follow the signals received over the circuit L_1 .

While the key K_1 remains in its normal, unoperated condition for full-duplex signaling, the battery B_9 will be connected through contacts P_7 and P_8 to the apex J of the balanced loop L_2 . A definite current will flow unidirectionally through the winding W_7 of the relay R_2 and the effect of this current will tend to move the armature of the relay R_2 to its spacing contact S . When the key K_2 at the sending loop L_2 is closed, batteries B_4 and B_9 will be in series with each other and their effects will be additive, thereby producing a dominating magnetic effect in the winding W_7 which will move the armature of the sending relay R_2 to its marking contact M . The generator G will then transmit current over the circuit L_3 . When the key K_2 at the loop L_2 is opened, no current will flow through the winding W_7 and the magnetic effect of the winding W_8 will dominate the armature of the sending relay and this armature will close its spacing contact S . No current will then flow from the generator G over the circuit L_3 .

While this invention has been shown in certain particular arrangements merely for the purpose of illustration, it will be understood that the 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. In a telegraph system, the combination of a sending relay, a receiving relay, a loop connected to the winding of the sending relay, a key being included in the loop, means responsive to the opening of the key to bring the armature of said 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 to maintain

these armatures in said positions while the key remains open, and a sounder connected in series with the armature and one of the contacts of the sending relay.

2. In a telegraph system, the combination of a sending relay, a receiving relay, a loop connected to the winding of the sending relay, a key being included in said loop, means responsive to the opening of the key to bring the armature of the sending relay into a predetermined position, means to subsequently bring the armature of the receiving relay into a predetermined position and to maintain the armatures of the sending and receiving relays in these positions while the key remains open, and a sounder connected in series with the armature and one of the contacts of the sending relay.

3. In a telegraph system having sending and receiving relays arranged for half-duplex operation, the combination of means to produce a break signal, said means comprising means to bring the armatures of the sending and receiving relays successively into predetermined positions and to maintain these positions for an appreciable period of time, and a sounder controlled by the armature of the sending relay.

4. In a half-duplex telegraph system, the combination of a receiving relay having a main winding through which pulses of direct current flow and two auxiliary windings having a common terminal, one of the terminals of one of the auxiliary windings being grounded, a grounded battery connected to the terminal common to said auxiliary windings, a sending relay having a grounded armature, the contact of said sending relay being connected to the ungrounded terminal of the other of the auxiliary windings, a sounder, and a second grounded battery connected to the contact of the sending relay through said sounder.

5. In a carrier telegraph system having sending and receiving relays arranged for half-duplex operation, the sending relay including an armature and two contacts, the combination of means to produce a clean-cut break signal, said means comprising means to bring the armatures of the sending and receiving relays successively into predetermined positions and to maintain these armatures in these positions for an appreciable period of time, a sounder connected in series with the armature and one of the contacts of the sending relay, and a source of alternating current connected in series with the armature and the other of the contacts of the sending relay.

6. In a half-duplex telegraph system the combination of a receiving relay having a main winding receiving pulses of direct current and an auxiliary winding, first and second batteries, a sending relay, the armature and one contact of the sending relay be-

ing connected in series with the first battery through a part of the auxiliary winding, the remaining part of the auxiliary winding being connected in series with the said first battery, and a sounder connected in series with the said second battery and the armature and other contact of the sending relay.

In testimony whereof, I have signed my name to this specification this 22nd day of April 1931.

WILTON T. REA.