

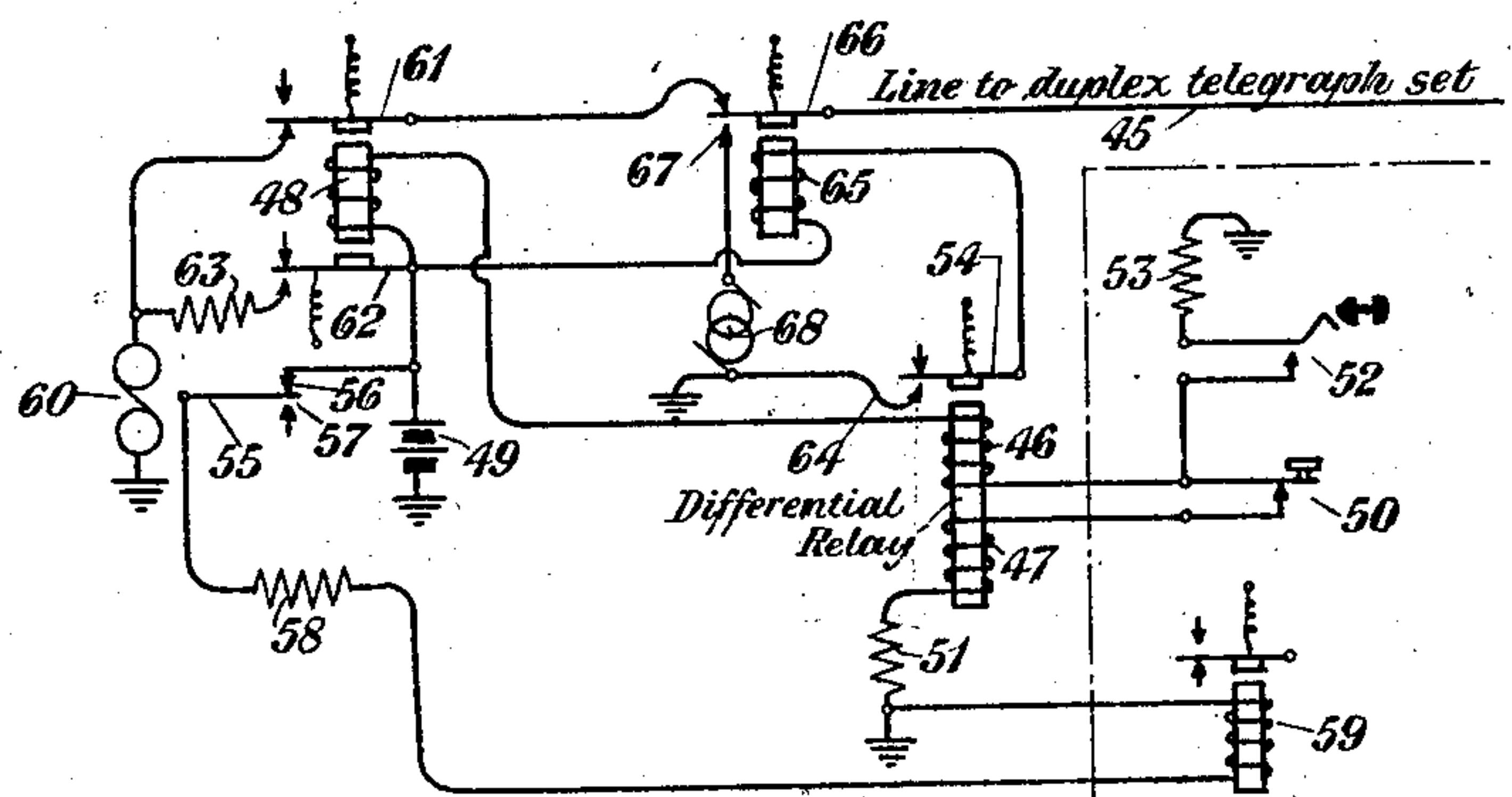
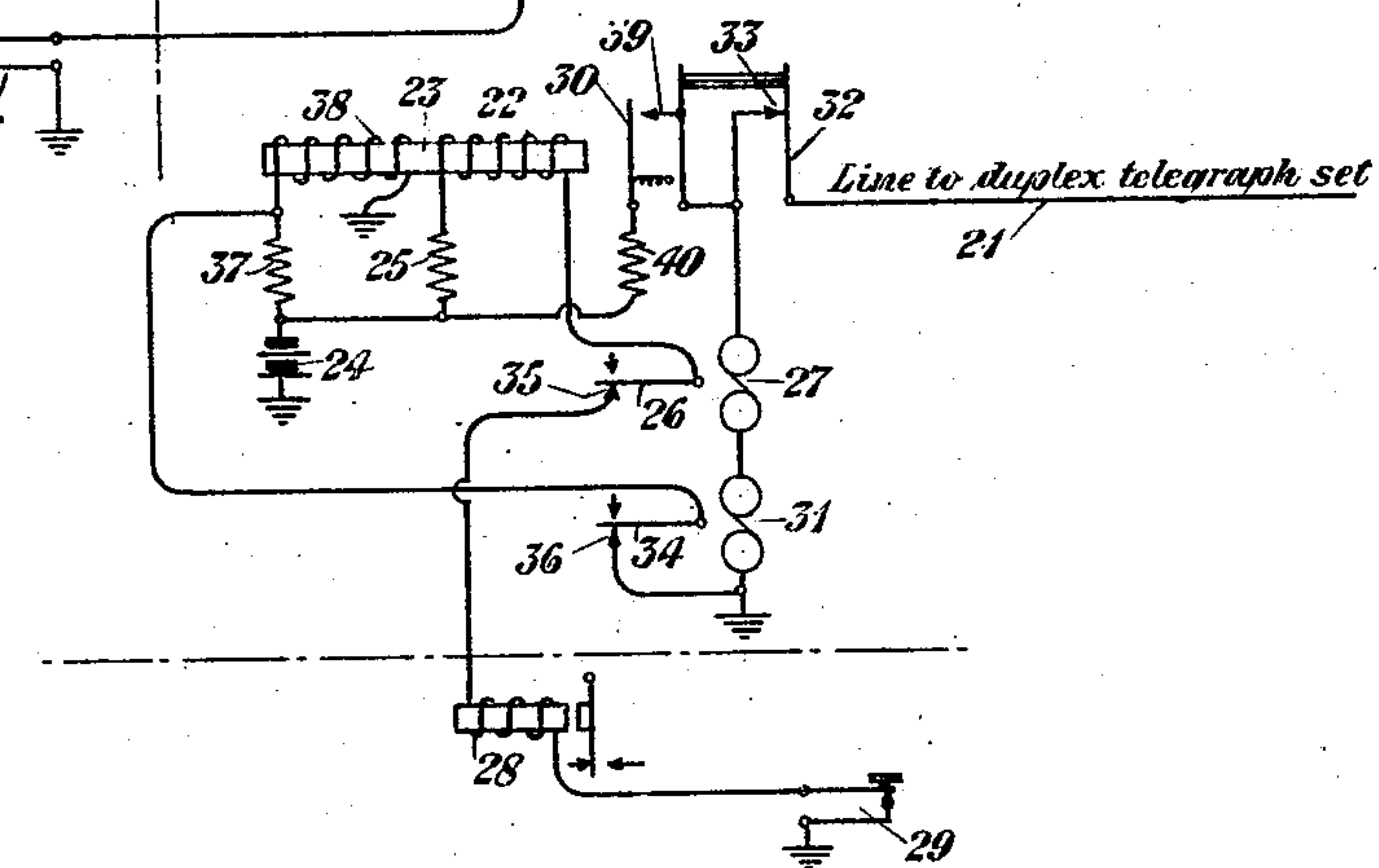
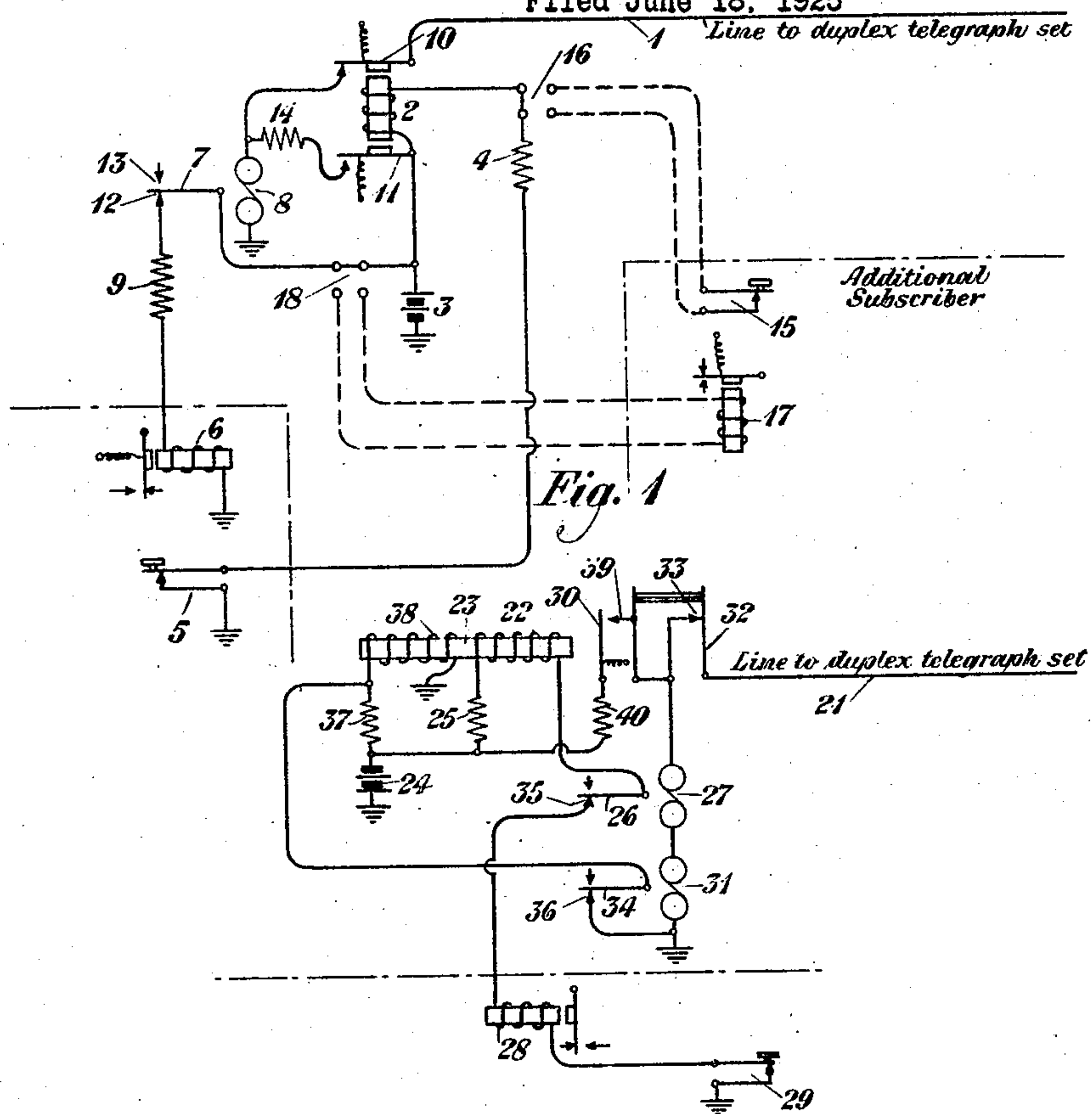
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TELEGRAPH SYSTEM

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TELEGRAPH SYSTEM.

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This invention relates to telegraph systems, and more particularly to arrangements in half duplex telegraph systems for operating one or more telegraph subscribers' stations from a side line therefrom.

A telegraph subscriber's side line has been commonly employed in connection with half duplex telegraph systems to extend service to a subscriber not located along the main line of the half duplex telegraph system when the subscriber was so far from the main line of the half duplex telegraph system as to preclude the efficient use of the usual loop connection at the repeater point in the main line circuit nearest the subscriber. A duplex telegraph set was connected to the repeater in the main line circuit nearest the subscriber, the side line being connected to the line side of the duplex telegraph set and extending directly to the subscriber's office, or a nearby local central office. It has been common practice to connect this side line through a single Morse relay and telegraph key to ground at the subscriber's office through whatever potential was available at the subscriber's office or at the nearby local central office. This arrangement was then operated by the so-called "upset duplex" method, well known to those skilled in the art. Difficulty usually arose in such an arrangement by reason of the fact that the battery potential at this outlying point was not sufficiently high for good operation against the normal potential available at the duplex telegraph set. A current override usually resulted with a consequent reduction in the margin of operation, particularly at the outlying subscriber's relay.

It is an object of the present invention to provide means for operating a telegraph subscriber's side line from a duplex telegraph set, and further to provide means for adding a plurality of subscribers' circuits to the side line as the requirements necessitate.

This invention has been illustrated diagrammatically in the accompanying drawings, in which, for the sake of simplicity, only so much of a telegraph system has been shown as is necessary to a clear understanding of the invention. Figure 1 represents arrangements for operating a telegraph subscriber's side line from a duplex telegraph set to which side line additional subscribers may be connected by providing two loops from the local central office for each of such

additional subscribers; Fig. 2 is a modification of the arrangements of Fig. 1 in which but one loop from the local central office is required for each subscriber that is added to the side line connected to the duplex telegraph set, and Fig. 3 represents arrangements for directly calling in the attendant at the duplex set which is on the main line. The arrangements of Fig. 3 may be applied to the embodiments disclosed in Fig. 1 or Fig. 2.

Referring to Fig. 1, reference character 1 represents a line which may be connected to a duplex telegraph set (not shown). The winding of relay 2 is connected in the subscriber's transmitting circuit in series relationship with battery 3, resistance 4 and key 5. The winding of the sounder 6 is arranged in the telegraph subscriber's receiving circuit in series relationship with battery 3, the armature 7 of the polar relay 8, and resistance 9.

The subscriber keeps key 5 closed during the reception of signals from the duplex set over line 1. Thus, the winding of relay 2 is energized, attracting armatures 10 and 11. Armature 10 connects one terminal of the winding of the polar relay 8 to the line 1, the other terminal of the winding of polar relay 8 being grounded. Marking and spacing signals that come in over line 1 by the reversal of battery at the duplex telegraph set move the armature 7 of the polar relay 8 between contacts 12 and 13 respectively. Thus, the receiving circuit of the subscriber's set, which comprises the winding of the sounder 6, armature 7 and battery 3, is closed and opened in accordance with the marking and spacing signals transmitted over line 1.

The subscriber closes key 5 to transmit a marking signal over line 1. Thus relay 2 is energized, armatures 10 and 11 being attracted, armature 10 connecting the winding of the polar relay 8, one terminal of which is grounded, to the line 1. Since there is no battery at this end of the side line in series with the winding of the polar relay 8, and assuming that the line at the duplex telegraph set is balanced by the artificial line at the duplex telegraph set, there will be no operating effect in the windings of the line relay at the duplex telegraph set when the key 5 is closed. The line relay of the duplex telegraph set will therefore have

to be biased to its marking position to provide a marking signal at the duplex telegraph set when the key 5 is closed. The winding of the sounder 6 is also energized, effecting a marking signal.

The subscriber opens key 5 to transmit a spacing signal over line 1. Thus, the winding of relay 2 is deenergized, releasing armatures 10 and 11, thereby upsetting the balance of the duplex telegraph set and causing the armature of the line relay at the duplex telegraph set to move to its spacing contact. Closure of the contact of armature 11 connects battery 3 to the winding of the polar relay 8 in the circuit including resistance 14 and armature 11. In order that the subscriber may properly read his own signals, the battery 3 must be so poled that when current flows from the battery 3 through the winding of the polar relay 8, armature 7 will move to its spacing contact 13. Inasmuch as the battery 3 and the line 1 are both connected on the same side of the winding of the polar relay 8, the polarity of the battery 3 at the subscriber's station must be the same as the polarity of the spacing battery at the duplex telegraph set connected to the line 1.

Additional subscribers may be connected to the arrangements represented in Fig. 1 by extending two loops to each of such additional subscribers. One of the loops, which will include a key 15, is connected in series relationship with key 5 of the sending circuit of the subscriber's set by opening the circuit at 16 and connecting the loop at that point. A sounder 17 may be provided for each of such additional subscribers by opening the circuit at 18 to permit the winding of sounder 17 to be connected in series relationship with the winding of sounder 6.

Fig. 2 represents arrangements for operating a subscriber's side line from a duplex telegraph set, in which arrangements only one loop is required for each subscriber. The operating winding 22 of the relay 23 is in series relationship with the battery 24, resistance 25, the armature 26 of the polar relay 27, the winding of the sounder 28, and the key 29. When winding 22 of the relay 23 is energized, armature 30 is attracted, and the line 21, which leads to the duplex telegraph set, is connected to the winding of the polar relay 27 and the winding of the polar relay 31, one terminal of which is grounded.

The subscriber keeps key 29 closed during the reception of signals over line 21. Thus, armature 30 is attracted and line 21 is connected to the windings of polar relays 27 and 31 through armature 32 and contact 33. A marking signal that comes in over line 21 energizes the windings of polar relays 27 and 31 and moves the armatures 26 and 34 downward to close contacts 35 and 36 re-

spectively. Closure of contact 35 completes a circuit including battery 24, winding 22, armature 26, winding of the sounder 28 and key 29. A spacing signal that comes in over line 21 effects a movement of the armatures 26 and 34 toward their upper contacts. Thus, the circuit in series with contact 35 is opened and a spacing signal is transmitted to the subscriber's station. On opening contact 36, current will therefore not flow through the circuit which includes battery 24, resistance 37 and contact 36 to ground, but an operating current will now flow from battery 24 through resistance 37 and the winding 38 of the relay 23. Thus, relay 23 will be locked when spacing signals are being received over line 21, when the winding 22 of the relay 23 is deenergized by reason of the opening of the circuit in series therewith at contact 35. This further prevents a spacing signal from being repeated back to the line.

The subscriber closes key 29 to transmit a marking signal over line 21. Thus, the winding 22 is energized and armature 30 is attracted, placing the windings of polar relays 27 and 31 in series relationship with the line 21. The line relay of the duplex telegraph set will necessarily have to be biased to its marking position, as described hereinbefore, since there will be no operating effect in the line relay at the duplex telegraph set if the duplex telegraph set is normally balanced, no battery being arranged in series with the line at the subscriber's set.

To transmit a spacing signal over line 21, the subscriber opens key 29. Thus, the winding 22 of the relay 23 becomes deenergized because of the opening of the circuit in series relationship therewith, and armature 30 is released. Armatures 39 and 32 move synchronously, being connected by a block of insulation. Before armature 32 opens contact 33, however, the armature 30 closes the contact at armature 39 and permits current to flow in the circuit including battery 24, resistance 40, armature 30, armature 39 and the windings of relays 27 and 31. Thus, the armatures 26 and 34 of the polar relays 27 and 31 close their contacts to prevent a spacing signal from being repeated back to the subscriber's circuit, and further, to prevent the relay 23 from being locked because of a flow of current through the winding 38 thereof. On the opening of contact 33, the polar relays 27 and 31 are taken off the line 21 and the balance of the line relay at the duplex telegraph set is upset, causing the armature thereof to move to its spacing contact. It will be understood that the polarity of battery 24 will be the same as the polarity of the marking battery at the duplex telegraph set.

Additional subscribers may be connected to the subscriber's circuit by extending to

the circuit in series with the key 29, a single loop, in which the sending and receiving circuits are combined. Thus, each subscriber would be provided with a key and a sounder in one local circuit, which would be in series relationship with the winding 22 of the relay 23.

Fig. 3 represents an embodiment of the invention which is adapted for directly calling in the attendant at the duplex telegraph set. In accordance with these arrangements, the subscriber would not be required to get the attention of the operator at an outlying central office. This embodiment of the invention may be applied to the arrangements of either Fig. 1 or Fig. 2.

A differential relay having windings 46 and 47, which are oppositely directed on the same core, is connected in series relationship with the winding of the relay 48 in a circuit including battery 49, winding of relay 48, winding 46 of the differential relay, key 50, winding 47 of the differential relay, and resistance 51. Another key 52 and resistance 53 are connected to ground from one side of the key 50. When key 52 is open, key 50 remaining closed, the armature 54 of the differential relay will not be attracted because the current flowing through winding 46 is equal to the current flowing through winding 47 of the differential relay but is oppositely directed with respect thereto. When key 52 is open and key 50 is also open, there will be no current in either winding of the differential relay.

Marking and spacing signals coming in over line 45 cause a movement of the armature 55 of the polar relay 60 between contacts 56 and 57 respectively, closing and opening the receiving circuit of the subscriber's set, which includes battery 49, contact 56, armature 55, resistance 58, and the winding of sounder 59. A marking signal is transmitted by closing key 50. Thus, the winding of the relay 48 is energized, attracting armature 61 to connect the winding of the polar relay 60 to the line 45. The line relay of the duplex telegraph set is biased to marking, as hereinbefore described. A spacing signal may be transmitted by opening key 50. The winding of relay 48 is thereby deenergized, releasing armatures 61 and 62. Thus, the balance at the duplex telegraph set is upset and the armature of the line relay at the duplex telegraph set moves to its spacing contact. Armature 62 closes a circuit including battery 49, armature 62, resistance 63, and the winding of polar relay 60, in order to enable the subscriber to hear the spacing signal, as described hereinbefore.

When the subscriber desires to call the attendant at the repeater station, he closes the key 52, thereby connecting resistance 53 in shunt with winding 47 of the differential

relay. Assuming that the resistance 53 is properly proportioned with respect to the resistance of winding 47 and resistance 51, more current will flow from battery 49, through the winding 46, than through the winding 47 of the differential relay. Armature 54 will therefore be attracted, closing contact 64, thereby permitting current to flow from battery 49, through the winding of relay 65, through armature 54 and contact 64. As the winding of relay 65 becomes energized, the armature 66 will be attracted and will close the contact 67, and thereby connect the ringing generator 68 to the line 45 through the armature 66. Arrangements may be provided at the duplex telegraph set for locking the circuit at that station until the attendant at that station has answered the call. Thus, the subscriber may call in the attendant at the repeater station without requiring attention at an outlying central office. By opening key 52, the arrangements are brought back to their normal operating conditions.

While this invention has been disclosed as embodied in certain particular arrangements it is to be understood that it is capable of embodiment in many 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, in combination, a line, means for signaling over said line, a subscriber's set connected to said line comprising a neutral relay having two armatures, a key, a polar relay, a sounder, and a source of potential, the winding of said neutral relay being arranged in a circuit in series relationship with said source of potential and said key, said sounder being arranged in another circuit in series relationship with said source of potential and the armature of said polar relay, one armature of said neutral relay being arranged to connect the winding of said polar relay to the line when said neutral relay becomes energized and to disconnect said polar relay from the line when said neutral relay is deenergized, the other armature of said neutral relay being arranged to connect the winding of said polar relay to said source of potential when the neutral relay becomes deenergized.

2. In a telegraph system, in combination, a line, means for signaling over said line, a subscriber's set dropped from said line to transmit and receive signals over said line, said subscriber's set having a sending circuit and a receiving circuit in which a source of potential is in common thereto, said sending circuit including a key and the winding of an electromagnetic relay, said receiving circuit including a sounder, one armature of said electromagnetic relay being arranged to connect the line to a polar relay, the other

armature of said electromagnetic relay being arranged to connect said source of potential to said polar relay, and means for signaling a plurality of additional subscribers, each of
5 such additional subscribers being provided with a sending loop and a receiving loop, said sending loop including transmitting means and being arranged in series relationship with said sending circuit, said receiving
10 loop including receiving means and being arranged in series relationship with said receiving circuit.

3. A telegraph subscriber's circuit associated with a line over which signals are
15 transmitted and received comprising a neutral relay having two armatures, a source of potential, a key, a sounder, and a polar relay, said key, the winding of said neutral relay, and said source of potential forming a transmitting circuit, said sounder, the armature
20 of said polar relay and said source of potential forming a receiving circuit, the winding of said polar relay being connected to the line by means of the first armature of said neutral relay and being also connected
25 to said source of potential by means of the second armature of said neutral relay, the armature of said polar relay being arranged in said receiving circuit to open and close
30 said circuit in accordance with spacing and marking signals.

4. In a telegraph system, in combination, a line, means for signaling over said line, a sending circuit extended to the subscriber
35 including transmitting means and a source of potential, a receiving circuit extended to the subscriber including receiving means and a source of potential, a polar relay having its winding associated with said line and its
40 armature associated with the receiving circuit, means for signaling a plurality of additional subscribers, each of such additional subscribers being provided with two
45 loops, one including a key and the other including a sounder, said key being arranged in series relationship with the transmitting means of said sending circuit, said sounder being arranged in series relationship with the receiving means of said receiving circuit.

50 5. In a telegraph system, in combination,

a line, means for signaling over said line, two subscriber's circuits including respectively transmitting means and receiving
means, a polar relay having its winding associated with said line and its armature
55 associated with the receiving means, and means for signaling a plurality of other subscribers, each of said subscribers being provided with two loops, one including a key and the other a sounder, said key being
60 arranged in series relationship with said transmitting means, said sounder being arranged in series relationship with said receiving means.

6. In a telegraph system, in combination, 65 a line, means for signaling over said line, a key, a sounder, and a polar relay, said polar relay being operated by the reversals of current arriving from the distant end of said line during the reception of signals,
70 said polar relay being disconnected from the line to permit the application of spacing potential thereto from a local source when said key is opened during the transmission of signals, said polar relay being also re-
75 connected to said line to permit the application of marking potential thereto from the distant end of said line when said key is closed during the transmission of signals.

7. In a telegraph system, in combination, 80 a main line, means for signaling over said main line, a subscriber's circuit connected to said main line including transmitting means and receiving means, means for signaling
85 one or more other subscribers, each of such other subscribers being provided with a key and a sounder to permit the transmission and reception of signals by each of such other subscribers, said key being arranged in
90 series relationship with said transmitting means, said sounder being arranged in series relationship with said receiving means, and means to permit each of such other subscribers to call in the attendant on said main
95 line.

In testimony whereof, I have signed my name to this specification this 16th day of June, 1925.

MERTON C. HALL.