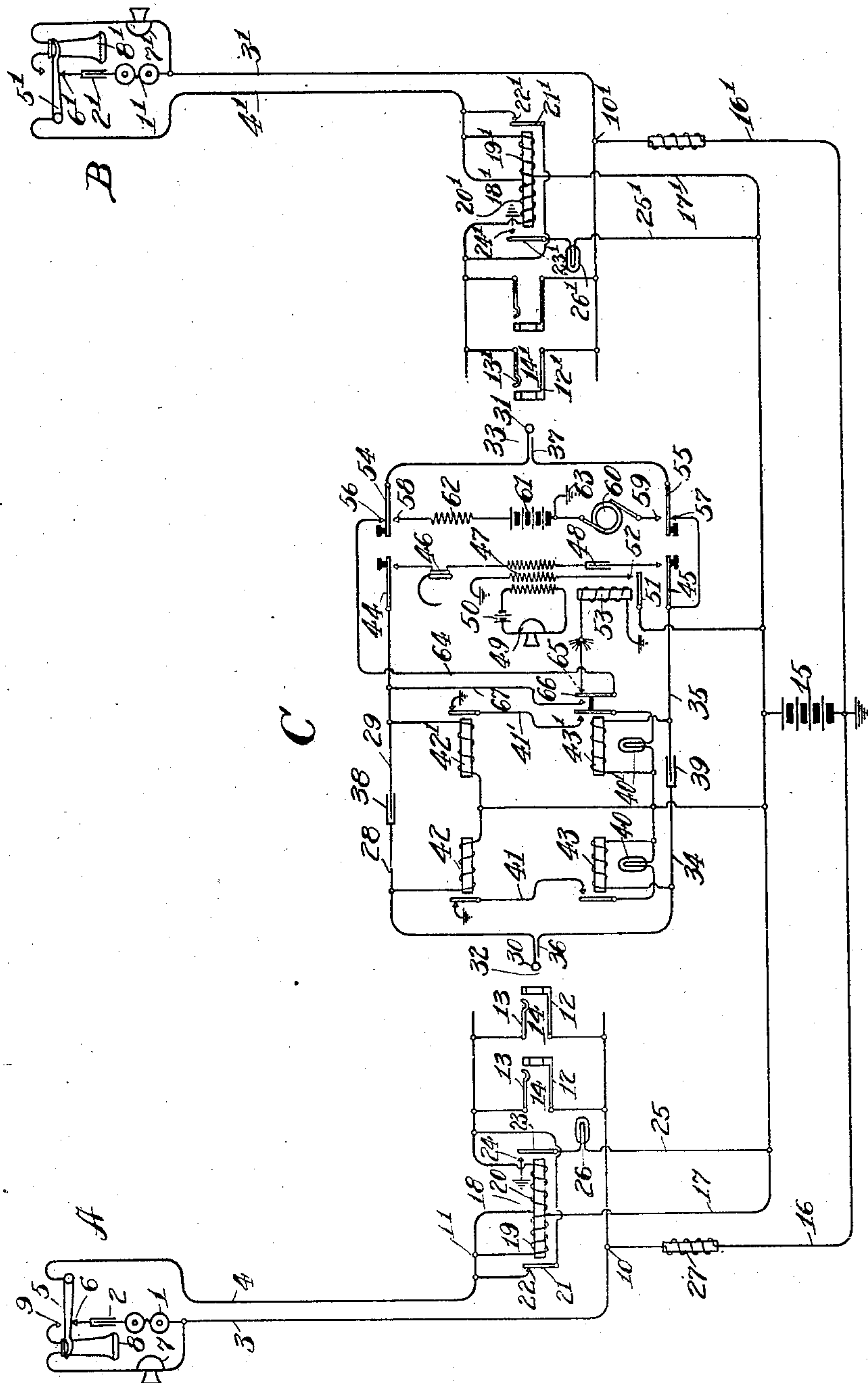


H. G. WEBSTER.
TELEPHONE SYSTEM,
APPLICATION FILED FEB. 12, 1906.

907,660.

Patented Dec. 22, 1908.



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TELEPHONE SYSTEM.

No. 907,660.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a specification.

The present invention relates to telephone systems generally and more particularly to the arrangement of circuits and apparatus by which the operator and subscriber may call each other and by which the operator may be informed of the operative condition of a connected telephone line, and consists in a novel organization of circuits and apparatus associated with the line circuit which is utilized, together with the link-circuit and subscriber's equipment, in performing these functions.

In carrying out my invention, I employ a relay for the control of the usual line signal, which is provided with two differentially arranged energizing windings. One of these windings, under the control of the subscriber, is employed in energizing the relay to cause a display of the line signal; while the other, under the control of the operator, coöperates with a path in shunt to the first winding in overcoming the initial energization of the relay to cause the effacement of said signal. In operation, the latter winding, which is only momentarily included in circuit, deenergizes the relay sufficiently to allow its contacts to return to their normal position; and the shunt path, which includes a supervisory relay, then diverts a sufficient amount of current from the first winding of the line relay to prevent a second attraction of its contacts.

The character of the invention will be more fully understood upon reference to the following description taken in connection with the accompanying drawing, and its scope will be more particularly pointed out in the appended claims.

In the drawing, which is a diagram of a telephone system constructed in accordance with the present invention, A and B designate substations which are united to a central office C by suitable telephone lines. The equipment at substation A, which may be of any preferred type, is here shown as embodying a call-bell 1 in series with a condenser 2, normally maintained in bridge of

the telephone line limbs 3—4 by the engagement of the switch-hook 5 with the fixed contact 6. The transmitter 7 and the receiver 8 are connected between the line limbs 3 and 4 in a normally open bridge, which may be closed by the engagement of the switch-hook 5 with the fixed contact 9 whenever the receiver 8 is removed from the switch hook 5. While the receiver remains in place, a path is provided, through the call bell 1 and condenser 2, for incoming ringing current, while its removal completes a path for battery current from a suitable central office source, through the transmitter and receiver. At the central office, the telephone line limbs 3 and 4 are extended from the points 10 and 11 to the contacts 12 and 13 of the usual spring jacks 14, and to the terminals of a suitable source of current 15 by the conductors 16 and 17. The line relay 18 is provided with two differentially arranged energizing windings 19 and 20, the former being included in the conductor 17 which extends the line limb 4 to the live pole of the battery 15, and the latter being included in the extension of said line limb to the jack contacts 13. The normally closed relay contacts 21—22 control a short circuit about the winding 20 while the normally open relay contacts 23—24 control a bridge leading from the live pole of the battery 15 to ground through the line signal lamp 26. In order to balance the impedance of the relay winding 19, an impedance 27 is included in circuit with the conductor 16.

The circuit and apparatus thus far described in connection with substation A are duplicated at substation B and are designated by similar primed characters.

At the central office, connection is established between the desired telephone lines by means of link-circuits each comprising the strands 28 and 29 which unite tip contacts 30 and 31 of the answering and calling plugs 32 and 33 respectively, and the strands 34 and 35 which unite the sleeve contacts 36 and 37 of said plugs. These strands are provided with the usual condensers 38 and 39, which permit the passage of voice currents and, by refusing the passage of battery currents, maintain the signaling apparatus at the opposite ends of the link-circuit independent. At the answering end of the link-circuit, the supervisory signal lamp 40, which is included

in a branch 41 between the live pole of the battery 15 and ground, is controlled by the supervisory relays 42 and 43, whose windings are connected between the live pole of the battery 15 and the link-circuit strands 28 and 34, respectively. The contacts of the relay 42 are normally closed, while the contacts of the relay 43 are normally open. From this, it will be seen that upon the energization of the relay 43 only, the branch 41 through the lamp 40 will be closed, while the energization of the relay 42 will open said branch whether the relay 43 be energized or not. A similar supervisory signal lamp 40', similarly included in a branch 41' and controlled by the relays 42' and 43', is associated with the calling end of the link-circuit. The link-circuit is provided with the usual listening key whose levers 44 and 45, directly connected to the strands 29 and 35, are adapted to close a bridge between said strands including the operator's receiver 46, the secondary of an induction coil 47, and a condenser 48. The primary winding of the induction coil 47 is included in a local circuit with the operator's transmitter 49 and a battery 50. The induction coil 47 is provided with a tertiary winding which may be included directly between the live pole of the battery 15 and ground by the engagement of the contacts 51 and 52 of the test relay 53, which is common to the link-circuits at an operator's position. The link-circuit is also provided with the usual ringing key whose levers 54 and 55 normally engage fixed contacts 56 and 57 to maintain the continuity of the strands 29 and 35, but may be depressed into engagement with the contacts 58 and 59 to include, in circuit with the plug contacts 31 and 37, the ringing generator 60, battery 61 and a resistance 62, one pole of both the battery and generator being connected to ground at 63. The circuit of the test relay 53 is normally completed from the tip contact 31 of the plug 33 to ground by way of the tip strand 29, ringing key contacts 54-56 and branch 64, which may be made and broken at the relay contacts 65 and 66, added to the usual contacts of the supervisory relay 43'. In the alternate position of the contact 66, the conductor 64 is connected to the strand 29 by way of the conductor 67, thus completing the tip strand.

In the operation of the system, in case a party at substation A desires to converse with a party at substation B, he will remove his receiver 8 from its switch-hook, thereby completing a circuit for battery current which will sufficiently energize the line relay 18 to cause the display of the line lamp 26. This circuit extends from the live pole of the battery 15, through the conductor 17 including the line relay winding 19, line limbs 4 and 3 including the closed bridge at the substation, and conductor 16 to the grounded

side of the battery. This will permit a flow of current through the relay winding 19, which will sufficiently energize the said relay to draw up both contacts 21 and 23—by the former breaking the normal short circuit about the relay winding 20, and by the latter closing the bridge 25 through the line lamp 26 to cause it to light, as a signal to the operator that connection is desired. Upon observing this signal, the operator will insert the answering plug 32 into one of the jacks associated with the line 3-4, thereby completing two additional paths for the flow of battery current. One of these includes the winding of the supervisory relay 43 and extends from the live pole of the battery 15 through said winding, strand 34, plug and jack contacts 36-12, line limb 4 to the point 10, and conductor 16 to the grounded side of the battery. The other includes the winding of the supervisory relay 42 and extends from the live pole of the battery through said winding, strand 28, plug and jack contacts 30, 13, line limb 4 including the line relay winding 20, to the point 11, there uniting with the path through the conductor 17 including the relay winding 19 and extending over the line limbs 4 and 3 and the conductor 16 to the grounded side of the battery. The flow of current over this latter path, through the winding of the supervisory relay 42, will sufficiently energize it to break the branch 41 including the supervisory lamp 40 and thus prevent the lighting of said lamp and will also, through the agency of the line relay winding 20 sufficiently overcome the initial energization of the line relay, produced by the winding 19, to allow the contacts 21 and 23 to return to their normal positions, thereby closing the short circuit about the winding 20 and extinguishing the line lamp 26. As soon as the short circuit is closed, the line relay contacts do not return to their attracted positions, since the flow of current through the winding 19, by reason of the shunt path through the supervisory relay 42, is insufficient to move them. From the above, it will be seen that, by the use of the winding 20 to cause the return of the relay contacts to their normal positions, it is possible to employ a relay of much higher resistance in the path in shunt to the winding 19, than would be possible were this path alone relied upon to return the relay contacts.

Upon establishing connection with the line 3-4, the operator will depress her listening key levers 44-45 to close the bridge through her receiver 46 to place herself in communication with the calling party. After learning his wishes, she will touch the tip contact 31 of the calling plug 33 against one of the jack contacts 12' to determine the idle or busy condition of the line 3'-4'. If this line is connected with another link-circuit, contact 12', touched by the tip contact

31, will have a potential above that of ground, due to a flow of current from the live pole of the battery 15 over the sleeve strand 35 of the connected link-circuit.

5 Therefore, upon touching the tip contact 31 while the listening key levers 44 and 45 remain depressed, a flow of current will result over the tip strand 29 and the conductor 64 through the winding of the test relay 53 to
10 ground, thereby actuating said relay to close the branch through the tertiary winding of the induction coil 47, thus producing a flow of current through said branch and a resultant "click" in the operator's receiver, as an in-
15 dication to her that the line is busy.

If the operator finds that the line is idle, she will insert the calling plug 33 into the jack 14'. This will close a circuit from the live pole of the battery 15 through the winding of a
20 supervisory relay 43', the link-circuit strand 35, plug and jack contacts 37—12', line limb 3' to point 10' and conductor 16' to the grounded side of the battery. The supervisory relay 43' will be sufficiently energized
25 by the closing of this circuit to close its contacts, thereby completing the grounded branch through the supervisory lamp 40', causing it to light. The insertion of the plug 33 into the jack 14' will also complete a
30 circuit from the live pole of the battery 15, through the winding of the supervisory relay 42', over the strand 29, plug and jack contacts 31—13', line limb 4' to the normally open bridge at the substation, thence over
35 the line limb 3' and conductor 16' to the grounded side of the battery. With the parts thus related, the operator will depress the ringing key levers 54—55, thereby supplying ringing current over a metallic circuit
40 including portions of the strands 29 and 35 and the line limbs 3'—4'. Upon closing this ringing circuit, the active poles of both batteries 15 and 61 are connected together through the line relay winding 19', jack and
45 plug contacts 13'—31, ringing key contacts 54—58 and the resistance 62; thus the battery 61 prevents a flow of current through the line relay winding 19' to the grounded side of the generator 60, which would occur
50 if such battery were omitted and thereby cause undesired operation of the line relay. As soon as the call at substation B is responded to by the removal of the receiver 8' from its hook 5', the circuit through the
55 winding of the supervisory relay 42' will be completed and its contents separated, thereby interrupting the circuit of the lamp 40' and causing its extinguishment. It will be noted that upon the insertion of the calling
60 plug 33 into the jack 14', the circuit over the line limbs 3'—4' included the short circuit about the line relay winding 20' and that the subsequent closing of the bridge at the substation B, although closing a circuit through
65 the winding 19' of said relay, did not cause

the actuation of the relay contacts, since the current shunted from said winding, over the path including the winding of the supervisory relay 42', was sufficient to prevent a flow through the winding 19' large enough to
70 attract the relay contacts. With the parties thus connected, the supervisory lamps 40 and 40' will remain dark during conversation; but as soon as either party hangs up his receiver, the associated supervisory lamp
75 will light, and the lighting of both lamps will be a signal to the operator to disconnect.

Obviously, in practice, the batteries 15 and 61 may be one and the same, and the ground indications should be understood as connec-
80 tions either to ground or the usual central office common return. It will be apparent that, in practicing the invention, other alterations and modifications may be made without departing from its scope; I, therefore, do
85 not wish to be limited to the specific matter herein disclosed, but aim to cover, by the terms of the appended claims, all such alterations and modifications.

What I claim as new and desire to secure
90 by Letters Patent of the United States is:—

1. A telephone system comprising a relay, means for closing a circuit through an energizing winding of said relay to energize it sufficiently to change the normal relative
95 position of its contacts, means for shunting current from said winding to reduce said energization to an amount insufficient to cause such change, means for decreasing for
100 a moment only said energization sufficiently to allow the return of the contacts to their normal position, a signal, and means for utilizing the current in the shunt path in the control of said signal.

2. A telephone system comprising a relay,
105 means for closing a circuit through an energizing winding of said relay to energize it sufficiently to change the normal relative position of its contacts, means for shunting current from said winding to reduce said
110 energization to an amount insufficient to cause such change, means for decreasing for a moment only said energization sufficiently to allow the return of the contacts to their normal position, a signal, and a controlling
115 electro-magnet having its winding included in said shunt path.

3. A telephone system comprising a circuit extending between two stations, a relay associated with said circuit, means under the
120 control of one station for closing a circuit through an energizing winding of said relay to energize it sufficiently to change the normal relative position of its contacts, means under the control of the other station for
125 shunting current from said winding to reduce said energization to an amount insufficient to cause such change, means for decreasing for a moment only said energization sufficiently to allow the return of the contacts to
130

their normal position, a signal, and means for utilizing the current in the shunt path in the control of said signal.

4. A telephone system comprising a circuit
 5 extending between two stations, a relay associated with said circuit, means under the control of one station for closing a circuit through an energizing winding of said relay to energize it sufficiently to change the normal relative position of its contacts, means
 10 under the control of the other station for shunting current from said winding to reduce said energization to an amount insufficient to cause such change, means for decreasing for a moment only said energization sufficiently to allow the return of the contacts to their normal position, a signal, and a controlling electro-magnet having its winding included in said shunt path.
- 20 5. A telephone system comprising a circuit extending between two stations, a relay associated with said circuit, means under the control of one station for closing a circuit through an energizing winding of said relay
 25 to energize it sufficiently to change the normal relative position of its contacts, means under the control of the other station for shunting current from said winding to reduce said energization to an amount insufficient
 30 to cause such change, means also under the control of the last mentioned station for decreasing for a moment only said energization sufficiently to allow the return of the contacts to their normal position, a signal, and means
 35 for utilizing the current in the shunt path in the control of said signal.

6. A telephone system comprising a circuit extending between two stations, a relay associated with said circuit, means under the
 40 control of one station for closing a circuit through an energizing winding of said relay to energize it sufficiently to change the normal relative position of its contacts, means under the control of the other station for
 45 shunting current from said winding to reduce said energization to an amount insufficient to cause such change, means also under the control of the last mentioned station for decreasing for a moment only said energization
 50 sufficiently to allow the return of the contacts to their normal position, a signal, and a controlling electro-magnet having its winding included in said shunt path.

7. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a
 55 line relay, means under the control of the subscriber for closing a circuit through an energizing winding of said line relay to energize it sufficiently to change the normal relative position of its contacts, means under the control of the operator for shunting current from
 60 said winding to reduce said energization to an

amount insufficient to cause such change, means also under the control of the operator for decreasing for a moment only said energization sufficiently to allow the return of the contacts to their normal position, a line signal controlled by the line relay contacts, a relay associated with said link-circuit having its winding included in said shunt path, and a supervisory signal controlled by said link-circuit relay contacts. 75

8. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a
 80 line relay having two differentially arranged energizing windings, means under the control of the subscriber for closing a circuit through one of said windings to energize said relay sufficiently to change the normal relative position of its contacts, means operative upon the subsequent connection of said link-circuit to said line both to shunt current from said winding to reduce said energization to
 90 an amount insufficient to cause such change and to close a circuit through said second winding to decrease said energization sufficiently to allow the return of the contacts to their normal position, means for closing a short circuit about said second mentioned
 95 winding upon the return of said contacts to their normal position, a relay associated with said link-circuit having its winding included in said shunt path, and a supervisory signal controlled by said link-circuit relay contacts. 100

9. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a
 105 line relay having an energizing winding included in the telephone line, means under the control of the subscriber for energizing said relay, means under the control of the operator for modifying said energization, and means responsive to said initial energization to display a signal and to said modified energization to efface said signal and short circuit the said winding included in said telephone line. 115

10. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a
 120 line relay having two differentially arranged energizing windings, one of said windings being included in the telephone line, means under the control of the subscriber for energizing said relay by supplying current to the other of said windings, means under the control of the operator for decreasing said energization by supplying current to the winding included in said telephone line and decreasing the current supplied to the other wind- 130

ing, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal and to short circuit the relay winding included in the telephone line.

11. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, one of said windings being included in the telephone line, means under the control of the subscriber for energizing said relay by supplying current to the other of said windings, means under the control of the operator for decreasing the said energization by supplying current to the winding included in said telephone line and shunting current from the other winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal and to short circuit the relay winding included in the telephone line.

12. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, one of said windings being included in the telephone line, a normally closed short circuit about said winding, means under the control of the subscriber for energizing said relay by supplying current to the other of said windings, means under the control of the operator for decreasing said energization by supplying current to the winding included in said telephone line and decreasing the current supplied to the other winding, and means responsive to said initial energization to display a signal and to open said short circuit, and to said decreased energization to efface said signal and to close said short circuit.

13. A telephone system comprising a telephone line extending from a substation to a central office, a link-circuit for making connection to said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, one of said windings being included in the telephone line, a normally closed short circuit about said winding, means under the control of the subscriber for energizing said relay by supplying current to the other of said windings, means under the control of the operator for decreasing said energization by supplying current to the winding included in said telephone line and shunting current from the other winding, and means responsive to said initial energization to display said signal and to open said short circuit, and to said de-

creased energization to efface said signal and to close said short circuit.

14. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two energizing windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization by decreasing the current supplied to said winding and by supplying current to said second winding, and means responsive to said initial energization to establish a certain signaling condition and to said modified energization to change said condition.

15. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two energizing windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization by decreasing the current supplied to said winding and by supplying current to said second winding, means responsive to said initial energization to display a signal and to said modified energization to efface said signal.

16. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two differentially arranged energizing windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization by decreasing the current supplied to said winding and by supplying current to said second winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

17. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two differentially arranged windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization by shunting current from said winding and supplying current to said second winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

18. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connec-

tion with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit over the line limbs in series and through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to modify said energization by closing a path for current through said second winding, and means responsive to said initial energization to establish a certain signaling condition, and to said modified energization to change said condition.

19. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit over the line limbs in series and through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to modify said energization by closing a path for current through said second winding, and means responsive to said initial energization to display a signal, and to said modified energization to efface said signal.

20. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit over the line limbs in series and through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by closing a path for current through said second winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

21. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially ar-

65 ranged energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by decreasing the current supplied to said winding and by closing a path for current through said second winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal. 70 75

22. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by shunting current from said winding and by closing a path for current through said second winding, and means responsive to said initial energization to establish a certain signaling condition, and to said modified energization to change said condition. 80 85 90 95

23. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by shunting current from said winding and by closing a path for current through said second winding, and means responsive to said initial energization to display a signal, and to said modified energization to efface said signal. 100 105 110 115

24. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, a source of current, means under the control of the sub- 120 125

scriber for energizing said relay by completing a circuit through said source of current and one of said relay windings only, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by shunting current from said winding and by closing a path for current through said second winding, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

25. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection to said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, means under the control of the subscriber for energizing said relay by supplying current to one of said windings only, two relays associated with said link-circuit, means for displaying a signal in response to the energization of one of said relays only and for effacing said signal in response to the energization of the other, means operative upon the connection of said link-circuit to said line, while said line relay is thus energized, to decrease said line relay energization by shunting current from the then active line relay winding through one of said link-circuit relays and supplying current to the other line relay winding, and means responsive to the initial energization of said line relay to display a signal and to said decreased energization to efface said signal.

26. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection to said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, means under the control of the subscriber for energizing said line relay by supplying current to one of said windings only, two relays associated with said link-circuit, means for displaying a signal in response to the energization of one of said relays only and for effacing said signal in response to the energization of the other, means operative upon the connection of said link-circuit to said line, while said line relay is thus energized, to decrease said line relay energization by shunting current from the then active line relay winding through one of said link-circuit relays and supplying current to the other line relay winding and to supply current to said other link-circuit relay, and means responsive to the initial energization of said line relay to display a signal and to said decreased energization to efface said signal.

27. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection to said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, means under the control of the subscriber for energizing said relay by supplying current to one of said windings only, two relays associated with said link-circuit, means for displaying a signal in response to the energization of one of said relays only and for effacing said signal in response to the energization of the other, means operative upon the connection of said link-circuit to said line, while said line relay is thus energized, to decrease said line relay energization by closing a path for current through one of said link-circuit relays and through the second winding of said line relay, and means responsive to the initial energization of said line relay to display a signal and to said decreased energization to efface said signal.

28. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection to said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, means under the control of the subscriber for energizing said relay by supplying current to one of said windings only, two relays associated with said link-circuit, means for displaying a signal in response to the energization of one of said relays only and for effacing said signal in response to the energization of the other, means operative upon the connection of said link-circuit to said line, while said line relay is thus energized, to decrease said line relay energization by closing a path for current through one of said link-circuit relays and through the second winding of said line relay and further operative to supply current to said other link-circuit relay, and means responsive to the initial energization of said line relay to display a signal and to said decreased energization to efface said signal.

29. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection to said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, means under the control of the subscriber for energizing said relay by supplying current to one of said windings, two relays associated with said link-circuit, means for

displaying a signal in response to the energization of one of said relays only and for effacing said signal in response to the energization of the other, means operative upon
 5 the connection of said link-circuit to said line, while said line relay is thus energized, to decrease said line relay energization by closing a path for current through one of the link-circuit relays and the second wind-
 10 ing of the second line relay winding in shunt to the first line relay winding and subsequently short circuiting said second winding, and means responsive to the initial energization of said line relay to display a
 15 signal and to said decreased energization to efface said signal.

30. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two energizing
 20 windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization
 25 by decreasing the current supplied to said winding and by supplying current to said second winding, and means responsive to said initial energization to establish a certain signaling condition and to said modified
 30 energization to change of said condition.

31. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two energizing
 35 windings, means under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization
 40 by decreasing the current supplied to said winding and by supplying current to said second winding, means responsive to said initial energization to display a signal and to
 45 said modified energization to efface said signal.

32. A telephone system comprising a telephone line extending in two limbs only from a substation to a central office, a relay associated with said line having two differentially arranged energizing windings, means
 50 under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings only, means under the control of the operator for decreasing the said energization by decreasing the current supplied to said winding and by supplying current to said second winding, and means responsive to said initial energization
 55 to display a signal and to said decreased energization to efface said signal.

33. A telephone system comprising a telephone line extending from a substation to a central office, a relay associated with said

line having two energizing windings, means
 65 under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings, means under the control of the operator for decreasing the said energization by decreasing the current
 70 supplied to said winding and by supplying current to said second winding for a moment only, and means responsive to said initial energization to establish a certain signaling condition and to said modified en-
 75 ergization to change said condition.

34. A telephone system comprising a telephone line extending from a substation to a central office, a relay associated with said line having two energizing windings, means
 80 under the control of the subscriber for energizing the relay magnet by supplying current to one of said windings, means under the control of the operator for decreasing the said energization by decreasing the current
 85 supplied to said winding and by supplying current to said second winding for a moment only, means responsive to said initial energization to display a signal and to said modified energization to efface said signal.
 90

35. A telephone system comprising a telephone line extending from a substation to a central office, a relay associated with said line having two differentially arranged energizing windings, means under the control of
 95 the subscriber for energizing the relay magnet by supplying current to one of said windings, means under the control of the operator for decreasing the said energization by decreasing the current supplied to said winding
 100 and by supplying current to said second winding for a moment only, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.
 105

36. A telephone system comprising a telephone line extending from a substation to a central office, a relay associated with said line having two differentially arranged windings, means under the control of the sub-
 110 scriber for energizing the relay magnet by supplying current to one of said windings, means under the control of the operator for decreasing the said energization by shunting current from said winding and supplying
 115 current to said second winding for a moment only, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.
 120

37. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connec-
 125 tion with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a

source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to modify said energization by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to establish a certain signaling condition, and to said modified energization to change said condition.

38. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to modify said energization by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to display a signal, and to said modified energization to efface said signal.

39. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

40. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit

through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by decreasing the current supplied to said winding and by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to display a signal and to said decreased energization to efface said signal.

41. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by shunting current from said winding and by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to establish a certain signaling condition, and to said modified energization to change said condition.

42. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit through said source of current and one of said relay windings, means operative upon the subsequent connection of said link-circuit to said line to decrease said energization by shunting current from said winding and by closing a path for current through said second winding for a moment only, and means responsive to said initial energization to display a signal, and to said modified energization to efface said signal.

43. A telephone system comprising a telephone line extending in two limbs from a substation to a central office, a connection terminal therefor, a two strand link-circuit and connecting plug for establishing connection with said line, means for holding conversation over said line and link-circuit, a line relay having two differentially arranged energizing windings, a source of current, means under the control of the subscriber for energizing said relay by completing a circuit

cuit through said source of current and one
of said relay windings, means operative upon
the subsequent connection of said link-cir-
cuit to said line to decrease said energization
5 by shunting current from said winding and
by closing a path for current through said
second winding for a moment only, and
means responsive to said initial energization

to display a signal and to said decreased
energization to efface said signal. 10

In witness whereof, I hereunto subscribe
my name this 8th day of Feby. 1906.

HARRY G. WEBSTER.

Witnesses:

A. H. DYSON,
CAROLYN WEBER.