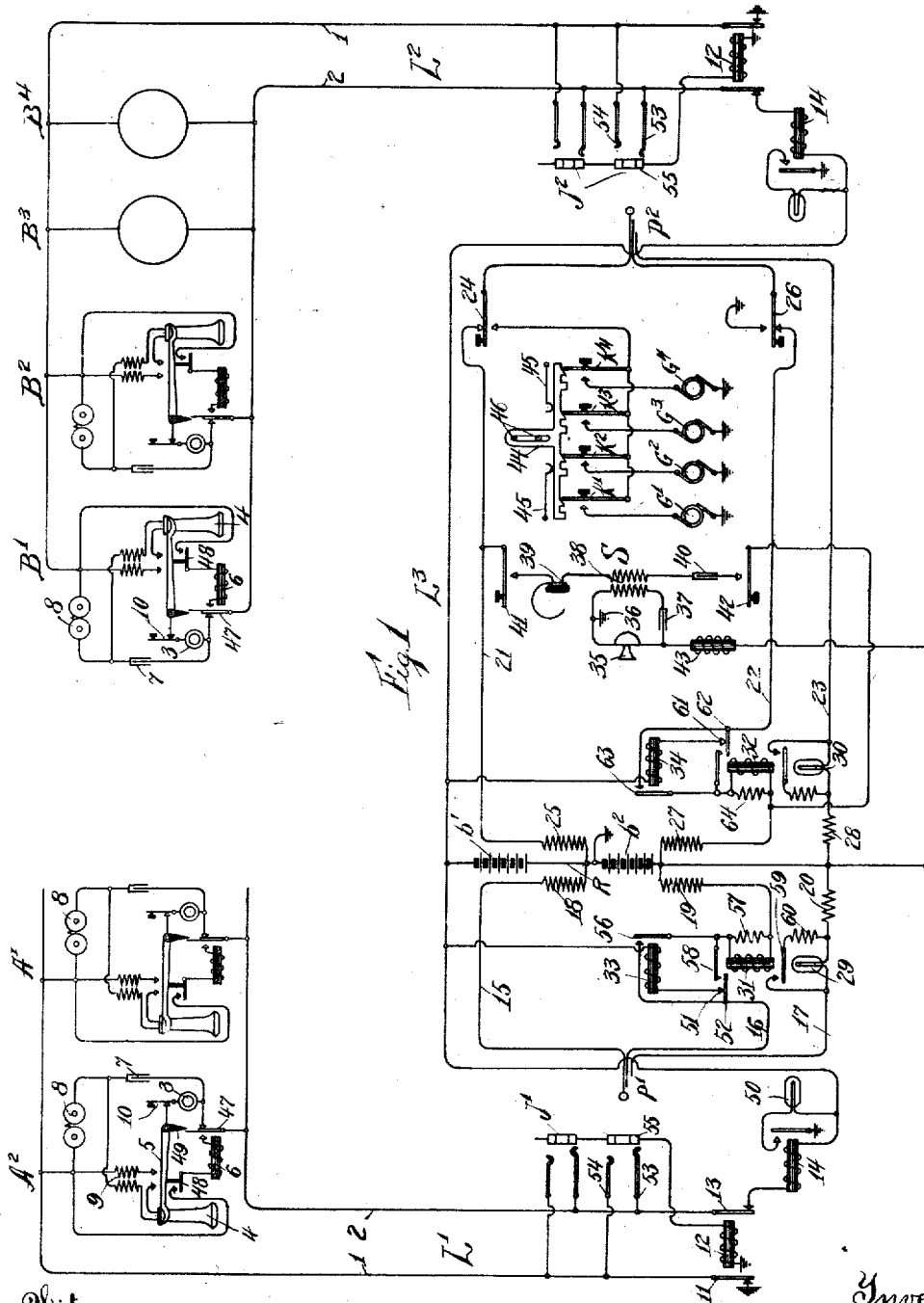


H. G. WEBSTER.
TELEPHONE SYSTEM.
APPLICATION FILED MAR. 7, 1907

1,009,813.

Patented Nov. 28, 1911

2 SHEETS—SHEET 1.



Witnesses

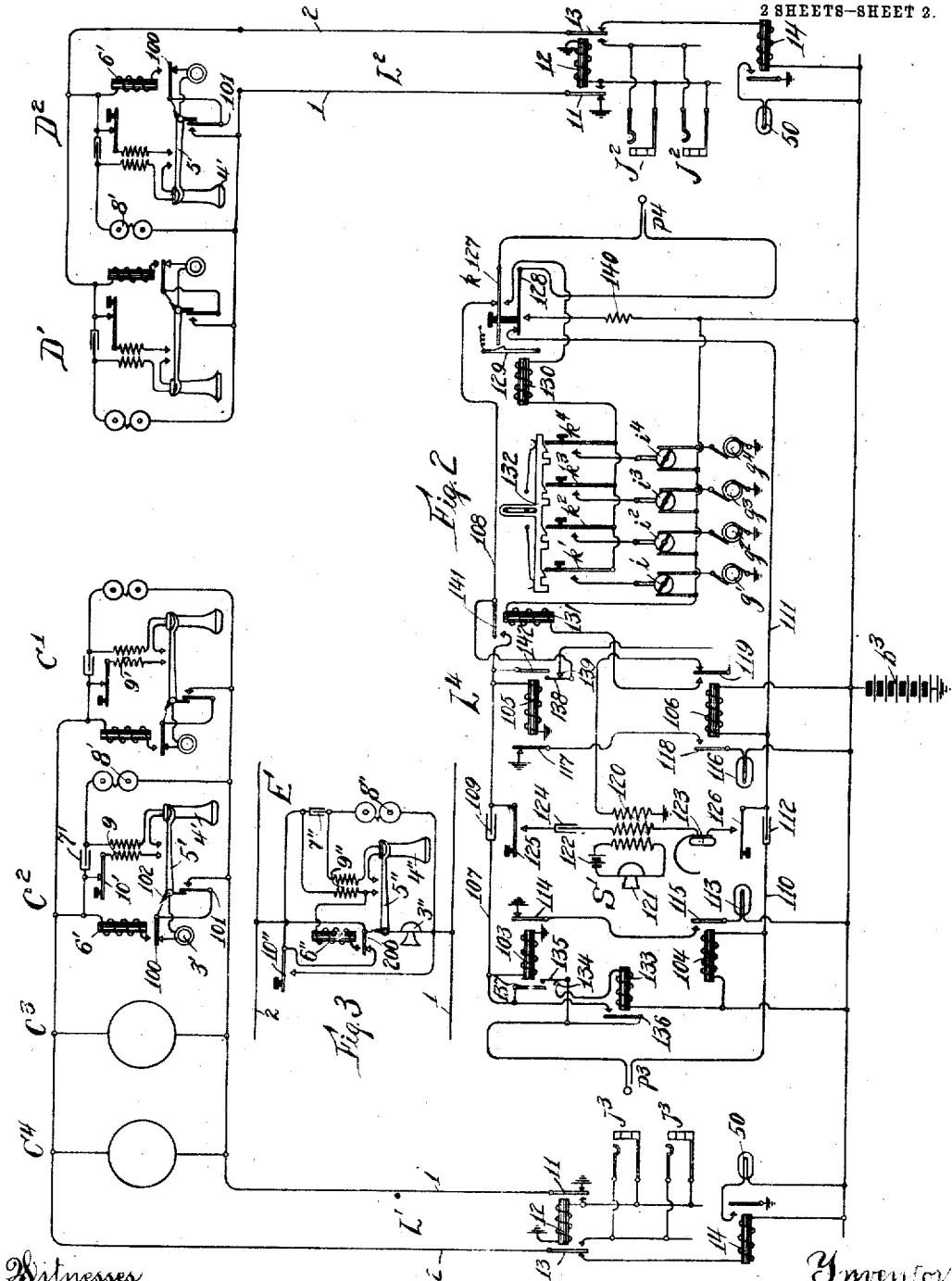
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2 SHEETS—SHEET 2.



Witnesses
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UNITED STATES PATENT OFFICE.

HARRY G. WEBSTER, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
KELLOGG SWITCHBOARD & SUPPLY COMPANY, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

1,009,813.

Specification of Letters Patent.

Patented Nov. 28, 1911.

Application filed March 7, 1907. Serial No. 361,119.

To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, residing at Chicago, in the 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 party line systems of the so-called "lock-out" type.

The principal object of the invention is to devise a novel system of the type indicated, which in operation will enable any party on the line who has obtained connection with the desired called party to hold the line to the exclusion of another who may desire to listen-in or to signal the operator at the central office, except in those cases where a calling party desires to converse with another party on the same line. In the latter event, a specific act on the part of the calling subscriber coupled with the operation of certain mechanism at the central office enables the second party to come in on the line.

The system which I have devised is especially designed for use with a centralized or common source of battery supply and with selective signaling, although obviously the latter is not essential to the practice of my invention.

In carrying out my invention I have devised certain novel circuit arrangements both at the substation and at the central office. The character of the invention however, will be more fully understood upon reference to the following detailed description taken in connection with the accompanying drawing, and the scope of the invention will be particularly pointed out in the appended claims.

In the said drawing, Figure 1 illustrates diagrammatically one system embodying the features of the present invention; Fig. 2 illustrates by a similar diagram another system embodying the features of the invention and Fig. 3 illustrates a modified arrangement of substation circuits and apparatus which may be used in lieu of those illustrated in either of the other figures.

Throughout these views like characters refer to like parts.

Referring in detail to the drawing and more particularly for the present to Fig. 1,

L'—L² designate two telephone lines extending by their limbs 1—2 from substations to a central office; line L' extending from substations A'—A² and being provided with jacks J' at the central office; and line L² extending from substations B'—B²—B³—B⁴ to the central office where they are provided with jacks J². Obviously the number of substations on each of these lines may be varied as conditions in any specific case may require. Interconnection between the jacks J'—J² is accomplished through the agency of suitable link-circuits, such as L³, provided with terminal plugs and with the usual party line operator's equipment. At the substation various circuit arrangements may be employed. In the present figure, I have illustrated a well-known substation circuit modified in accordance with the present invention. In this case, a transmitter 3 and a receiver 4 are included in normally open circuits which are controlled by the switch-hook 5 and a controlling electromagnet 6 whose winding is also included in a normally open circuit adapted to be closed by the switch-hook 5 when the receiver 4 is removed therefrom. A condenser 7 and call-bell 8 are included in a normally closed bridge. The substation equipment also includes the usual induction coil 9 and a control-key 10. The line limbs 1—2 are normally connected at the central office to the grounded and live poles respectively of a section b' of a central office battery, the line limb 1 extending through contact 11 of cut-off relay 12 to ground, or other suitable common return, and the line limb 2 extending by way of the second contact 13 of cut-off relay 12, and the winding of line relay 14 to the live, or negative, pole of the battery section b'. The interconnecting link-circuits at its central office, of which one only is shown, are of a well known three-wire type modified in accordance with the present invention. The three contacts of the answering plug P' form the terminals of strands 15—16—17 which are connected to the terminals of the section b² of the central office battery. The strand 15 is connected through the winding 18 of the repeating coil R to the grounded terminals of the battery sections b'—b². Strand 16 which is normally interrupted, is adapted to be connected through winding 19 of the repeating coil R

to the live, or positive, pole of the battery section b^2 . Strand 17 is connected to the same terminal of the battery section b^2 through the resistance 20. The three contacts of the calling plug P^2 , located at the opposite end of the link-circuit, form the terminals of the three strands 21—22—23 which have their opposite ends connected to the terminals of the battery section b^2 . The strand 21 extends through the ringing key lever 24 and winding 25 of repeating coil R to the grounded connection of the battery. Strand 22, which is normally open, extends through ringing-key lever 26 and is adapted to be connected through winding 27 of repeating coil R to the live pole of the battery section b^2 . Strand 23 in turn is adapted to be connected through resistance 28 to the same pole of battery section b^2 . The supervisory lamps 29—30 are included in the strands 17 and 23 respectively and are adapted to be controlled by the supervisory relays 31 and 32 respectively. The associated relays 33—34 are instrumental in reversing the direction of current supplied to the line from the central office battery. The interconnecting link-circuit also includes an operator's set S which includes transmitter 35 connected between the live pole of the battery section b^2 and ground at 36 and in a local circuit including condenser 37 and one winding of induction coil 38, and the head receiver 39 adapted to be included in bridge of the link-circuit strands 21—22 with the other winding of induction coil 38 and a condenser 40. The operator's set is thus cut into circuit by the listening-key levers 41—42 and inductive resistance 43 is included in a connection between battery and the transmitter 35 for the purpose of controlling the supply of battery current through the transmitter 35 while preventing the undue leakage of voice currents from the operator's transmitter circuit. For the purpose of signaling the parties at the different substations, preferably a suitable system of selective ringing should be employed, such for example, as that disclosed in Patent #779,533 granted January 10, 1905, wherein the bells of the subscribers are caused to respond to currents of different frequencies obtained from ringing generators at the central office. In the present instance I have diagrammatically illustrated a party line key in addition to the ringing-key 24—26 which includes the keys K^1 — K^2 — K^3 — K^4 associated with corresponding generators G^1 — G^2 — G^3 — G^4 . With this arrangement, the depression of any given key will supply current to the key 24—26 from the corresponding generator and the corresponding substation call signal attuned to this generator will respond. Upon the depression of any given party line key, and the simultaneous depression of key levers 24—26, the

corresponding generator will be connected to the tip side of the circuit and ringing current will thus be applied until the key levers 24—26 are released. In the present instance, locking mechanism for the party line keys is diagrammatically illustrated by the sliding plate 44 adapted to move toward and from the keys K^1 — K^2 — K^3 — K^4 through the cooperation of springs 45 and the guiding pins 46. The projections on the plate 42 adjacent to the levers K^1 — K^2 — K^3 — K^4 are inclined and shouldered so that upon the depression of any key, the sliding plate is forced against the pressure of the springs 45 out of engagement with the other keys and any previously depressed key is thereby allowed to return to normal under its own spring tension, while the key last to be depressed is retained in its depressed position.

With this preliminary description of the apparatus employed, it will be apparent that in operation, assuming that a party at A^2 on line L^1 desires to converse with a party at say, substation B^1 on line L^2 , upon the removal of his receiver 4 from its switch-hook 5, a path for current will be completed through electromagnet 6 at substation A^2 which may be traced from the live pole of the battery section b^1 through the winding of line relay 14, closed contact 13 of cut-off relay 12, line limb 2, alternate contact 47 of electromagnet 6, closed contact 48 of switch-hook 5, line limb 1 and closed contact 11 of cut-off relay 12 to ground. At this point it may be noted that upon the removal of the receiver 4 from its switch-hook 5, contact 48 is closed and by reason of the engagement of the insulating projection 49 with contact 47, said contact 47 is carried to its alternate position. In this movement the alternate contact is closed, preferably after contact 48, and just before the switch-hook reaches its final position. Before this final position is reached, the insulating projection 49 slips by the yielding end of contact 47 and said contact is free to return under its normal tension to its normal position as soon as electromagnet 6 is deenergized. From this it will be seen that the closing of the circuit just outlined energizes electromagnet 6 and thereby holds contact 47 in its alternate position. The closing of this circuit also energizes line relay 14 which in turn closes its contact to light line lamp 50 as an indication to the operator that connection with another subscriber's line is desired. It will be noted that at this time current flows through the electromagnet 6, as well as line relay 14, from the live, or negative, pole of the battery section b^1 . Upon observing the display of the call signal 50, the operator will insert answering plug P^1 into an answering jack, such as J^1 , of the line L^1 , thereby momentarily supplying current from the same

pole of the battery section b' through plug
 and jack sleeve contacts to the line limb 2
 and the electromagnet 6 at the calling sub-
 station, and at the same time closing a cir-
 5 cuit through the cut-off relay 12 of the line
 L' . The former circuit extends from the
 live, or negative, pole of the battery section
 b' through the winding of relay 33, closed
 10 contacts 51—52 of supervisory relay 31,
 strand 16, jack contact 53, line limb 2,
 alternate contact 47, winding of electro-
 magnet 6, closed contact 48, line limb 1,
 jack contact 54, strand 15, repeating coil
 15 winding 18 to the opposite or grounded pole
 of the battery section b' . At the same
 time this current is established, a circuit in-
 cluding the cut-off relay winding is com-
 pleted from the live, or positive, pole of the
 20 battery section b^2 through strand 17 includ-
 ing resistance 20, supervisory lamp 29,
 thence by jacket contact 55 and winding of
 cut-off relay 12 to ground. The energiza-
 tion of the cut-off relay destroys the normal
 25 line limb connections with the battery sec-
 tion b' , but, as noted, these are replaced by
 other similar connections through the plug
 and jack contacts. These latter circuit con-
 nections of the battery section b' with the
 30 line limbs are, however, of short duration.
 The inclusion of the relay 33 in the newly
 established circuit immediately causes its
 energization and the subsequent closing of
 its contact 56. The closing of this contact
 35 completes a momentary local circuit ex-
 tending from the live, or negative, pole of
 the battery section b' through the winding
 of relay 33, closed contacts 51—52, closed
 contact 56, the winding of supervisory re-
 40 lay 31 in parallel with the non-inductive re-
 sistance 57, the repeating coil winding 19
 to the live, or positive, pole of the battery
 section b^2 . The closing of this circuit ener-
 gizes supervisory relay 31, which thereupon
 45 closes contact 59 and contacts 52—58 and
 subsequently opens contacts 51—52. The
 closing of contact 59 closes a shunt, includ-
 ing resistance 60, about the lamp 29 and
 thereby prevents its display as a signal.
 The opening of contacts 51—52 and the pre-
 50 vious closing of contacts 52—58, interrupts
 connection between the live, or negative,
 pole of the battery section b' and the
 strand 16 and completes a connection from
 the live, or positive, pole of the battery sec-
 55 tion b^2 through repeating coil winding 19, re-
 sistance 57 in parallel with winding of relay
 31, and closed contacts 52—58 to strand 16.
 This change, it will be observed, changes the
 polarity of the battery connected to said
 60 strand and thus supplies current to the elec-
 tromagnet 6 of the calling substation A^2
 in a direction opposite to that previously
 supplied from battery section b' .

Due to the momentary local circuit in-
 65 cluding both battery sections b' — b^2 and the

following application of reversed current
 to the electromagnet 6, said magnet is de-
 energized and its contact 47 thereupon re-
 turns to its normal position. In order that
 the contact 47 may return to its normal po-
 70 sition upon a reversal of current flow
 through electromagnet 6, said magnet is so
 constructed, and its contacts are so adjusted,
 that the contact 47 will disengage its alter-
 75 nate contact at the very beginning of its
 return movement. This return of the con-
 tact 47 interrupts the previous path through
 the electromagnet 6 and replaces it by a
 path through transmitter 3, control-key 10,
 switch-hook 5 and primary winding of in-
 80 duction coil 9, thus establishing a talking
 circuit through substation A^2 which had
 not hitherto existed. The operator will now
 depress her listening-key levers 41—42 and
 thereby connect her telephone set S in cir-
 85 cuit, the receiver 39, winding of induction
 coil 38 and condenser 40 being connected in
 bridge of the strands 21—22. When so
 connected she is able to converse with the
 calling party and upon learning that substa-
 90 tion B' is to be signaled, she will then test
 line L^2 to determine its busy or idle con-
 dition. This she does in the usual way by
 touching the tip of the calling plug P^2 to
 the contact 55 of one of the multiple jacks
 95 J^2 associated with said line; and in case
 said line is in use, a potential above that of
 ground will exist at the contact thus
 touched, and current will flow therefrom
 over strand 21 through the repeating coil
 100 winding 25 to ground. Since at this time
 the listening-keys 41—42 are depressed, the
 condenser 40 will be momentarily charged
 and discharged and the usual "click" in the
 operator's receiver 39 resulting therefrom
 105 will serve as an indication to her that the
 line is busy. The potential of the contact
 55 of the tested jack will be obtained
 through the connection of a multiple of
 the jack tested with the sleeve strand of
 110 another link-circuit connected to said line.
 This connection may be either through the
 sleeve contact of an answering plug cor-
 responding to plug P^2 and the associated
 strand corresponding to strand 23, or
 115 through the sleeve contact of a calling plug
 corresponding to plug P' and the associ-
 ated strand corresponding to strand 17. If
 the line is found to be busy, the operator
 will so inform the calling party. If, on the
 120 other hand, the said line is found to be idle,
 the operator will insert the calling plug P^2
 into the tested jack and thereby complete
 a circuit through supervisory lamp 30 and
 cut-off relay 12 of the line L^2 over the strand
 125 23 in a manner similar to that previously de-
 scribed in connection with line L' , thereby
 causing the display of the supervisory lamp
 and the actuation of the cut-off relay. The
 action of the latter, as before, will be to

destroy the normal connection of the line limbs to battery section b' and line relay 14. At this time there will be no path for battery between the line limbs 1 and 2 at any of the substations and consequently the relays 32—34 will remain un-energized. With the parts in this condition, the operator will depress the ringing-key levers 24—26 and also the key $K^1-K^2-K^3-K^4$ which is designed to actuate the call-bell 8 at substation B' . Assuming that this key is that designated K^4 , it will be observed that as soon as the same is depressed, a circuit is completed from the live pole of the generator G^4 through closed key K^4 , closed key lever 24, strand 21, jack contact 54, line limb 1, the call-bell 8 and condenser 7 at each of the substations, line limb 2, jack contact 53, strand 22 and closed key lever 26 to ground. Thus ringing current is applied which causes the actuation of the call-bell 8 at sub-station B' as a signal to the called-for party, as previously pointed out.

As soon as the key K^4 is depressed, its engagement with the adjacent inclined face of the plate 44 forces said plate away from the remaining key levers far enough to allow any one of them which is retained to return to normal position under its inherent tension. By this means an operator may readily determine what particular party was last signaled since the actuated key remains down until a second key is operated. Thus it will be apparent that upon the depression of any other key, such as K^3 , the sliding plate 44 will be moved out of engagement with key K^4 , and it will be allowed to return to its normal position. As soon as the called-for party responds to the call by the removal of his receiver, the ringing-key levers 24—26 having been released, contacts 47 and 48 at his substation will be actuated, the former being moved to its alternate position and the latter being closed. This movement of the contacts 47—48 at once completes a path for current from the active, or negative, pole of the battery section b' through the winding of relay 34, closed contacts 61—62, strand 22, jack contact 53, line limb 2, alternate contact 47, winding of electromagnet 6, closed contact 48, line limb 1, jack contact 54, strand 21 and repeating coil winding 25 to the grounded positive pole of battery b' . The closing of this circuit will energize electromagnet 6 sufficiently to cause it to hold its contact 47 in its alternate position. The existence of this circuit however, will be only momentary. As soon as it is completed, relay 34 will close its contact 63 and thereby close a local circuit from the active, or negative, pole of the battery section b' through the winding of relay 34, contacts 61—62, closed contact 63, winding of supervisory relay 32 and non-inductive resistance 64 in parallel, repeating coil wind-

ing 27 to the active, or positive, pole of the battery section b^2 , thereby energizing supervisory relay 32 as previously explained in connection with supervisory relay 31 to close the shunt about its lamp 30 and to reverse the polarity of the battery connection to the strand 22. This reversal as before, causes the deenergization of the previously energized electromagnet 6 at substation B' with a consequent return of its contact 47 to its normal position to complete the previously interrupted circuit through the transmitter 3 and control-key 10. As soon as this takes place, conversation may be carried on between substations A^2 and B' , and while the receivers at these substations remain off their hooks, the associated supervisory lamps 29—30 will remain dark, but as soon as either receiver is hung upon its hook, all possible paths for battery current between the line limbs at the corresponding substations will be broken and the associated supervisory lamp will be lighted by reason of the deenergization of its supervisory relay. The lighting of both lamps will constitute a signal to the operator to take down the connection. If at any time during the existence of this connection, any party on the line L' desires to make a call or to listen to the conversation carried on between substations A^2 and B' , he will be unable to do so. This is true for the reason that after removing his receiver from its hook so as to establish a path for current through his electromagnet 6, he will be unable to obtain a reversal of current to release the contact 47 of said electromagnet to establish the conversational circuit through his substation. In this connection, it will be noticed that when contact 47 is in its alternate position, there will be no path for current through the primary winding of the associated induction coil 9, even though the receiver be off its hook. Furthermore the removal of the interfering party's receiver from its hook will not occasion the display of the associated line signal 50 since the normal connection of the relay 14 with the line is interrupted. It will be obvious from the above that if a party on line L^2 desires to listen to the conversation or to signal the operator, he will be unable to do so for the same reasons.

If in the first instance the party at substation A^2 desires to converse with another party on the same line, as, for example, a party at substation A' , he will call in the manner heretofore described and have his conversational circuit established by the operation of the reversing mechanism at the central office. The operator will then, upon learning that conversation is desired with a party at substation A' , remove the plug P' from the jack of the line and replace it by plug P^2 , and depress ringing-key levers 24—26 and the appropriate party line key K' ,

K^2 , K^3 , or K^4 , to cause the actuation of the call-bell 8 at substation A' . Since the current reversing mechanism associated with link-circuit L^3 is actuated as soon as a bridge for battery current is completed between the limbs of a connected line, it is necessary that the calling party, at substation A^2 , interrupt the path for battery current which has been completed through his transmitter 3 before the subscriber at A' raises his receiver. This he does by depressing his control-key 10. In this way, he leaves the substation equipment at substation A' free to cause the actuation of the reversing mechanism upon the release of the ringing-key levers 24—26 in the same manner as though the substation A' were on another line. As soon as the calling party hears the party at A' respond, he will restore his key 10 to its normal position and thus a conversational circuit will be established between substations A^2 and A' . During the existence of this connection, transmission current will be supplied to the two sides of the line from the battery section b^2 , through repeating coil winding 27 and strand 22 on the one hand, and repeating coil winding 25 and strand 21 on the other. During conversation, the shunt about the supervisory lamp 30 will be maintained closed and this shunt will not be removed until both parties have restored their receivers and thereby interrupted all previously existing paths for current between the line limbs. When this is done, the lamp 30 will be displayed as a signal to the operator to take down the connection.

Referring now to that form of the invention illustrated in Fig. 2, it will be seen that the line limbs of the lines L^1 — L^2 are provided at the central office with the same relays and connections as illustrated in Fig. 1, except that each of the jacks is provided with two contacts, one being designed for connection to the line limb 2, and the other for connection to the line limb 1 upon the actuation of the cut-off relay, which is permanently connected to the latter jack contact. This line construction is well known. In the present instance also, the line L^1 is provided with four substations designated C^1 , C^2 , C^3 , C^4 , while the line L^2 is provided with two substations D^1 , D^2 . Each of the substation equipments comprises a transmitter 3', receiver 4', switch-hook 5', electromagnet 6', condenser 7', call-bell 8', induction coil 9', and control-key 10', connected somewhat similarly to the corresponding parts at the substations of Fig. 1. In the present instance, however, the removal of the receiver 4' from its hook 5' causes a movement of contact 100 to its alternate position and the closure of contact 101. As in the previous case, the contact 100 is actuated by an insulating projection 102 extending from the switch-hook

5' and adapted to slip by the end of said contact just prior to the switch-hook reaching the limit of its closing movement. At the central office, the interconnecting link-circuit L^4 is of the well known Kellogg four-relay type, modified in accordance with the present invention. In this link-circuit, a pair of relays 103—104 is associated with the answering plug P^2 ; and a corresponding pair of relays 105—106 is associated with the calling end of the link-circuit and the calling plug P^4 . The link-circuit L^4 is of the two-wire type and the strands 107—108, united by the interposed condenser 109, unite the tip contacts of the plugs P^3 and P^4 ; while the strands 110—111, united by the interposed condenser 112, connect the sleeve contacts of said plugs. The relays 103—104 jointly control the supervisory lamp 113 through the agency of their contacts 114—115 respectively, while relays 105—106 control supervisory lamp 116 through the agency of their contacts 117—118 respectively. Relays 103, 105 and 106 are provided with additional contacts whose functions will be described presently. One of these contacts 119, while in its normal position, maintains a connection from the strand 108 through one winding of the induction coil 120 of the operator's telephone set S' . This connection is instrumental in making a test of a called-for line, as will be more fully explained hereinafter. The operator's telephone set includes the transmitter 121, in a local circuit with a second winding of the induction coil 120 and a local battery 122, and the head receiver 123 adapted to be included in bridge of the link-circuit strands 108—111 with another winding of the induction coil 120 and the condenser 124. The operator's set is thus included on the depression of the key-levers 125—126. For the purpose of supplying ringing current to the line, an automatically retained key k is provided in conjunction with four ringing-keys k^1 , k^2 , k^3 , k^4 , each associated with a corresponding interrupter i^1 , i^2 , i^3 , i^4 , and ringing generator g^1 , g^2 , g^3 , g^4 . The number of these party keys and interrupters and generators is dependent upon the number of parties on the lines with which the particular link-circuit is adapted to be used and may be varied as required. Any preferred method of selectively ringing stations on the line may be employed, and as before, I have chosen the harmonic method in which generators, such as g^1 , g^2 , g^3 and g^4 , are designed to supply currents of different frequencies and the substation call devices are correspondingly tuned so as to correspond therewith, as clearly indicated in the aforesaid patent. Thus when current is supplied from any particular generator, it will be instrumental in ringing the call-bell at one of the substations on the line only, and the same will

be true for each of the other generators. Upon the depression of any one key, k' , k^2 , k^3 , k^4 , at the time the key k is depressed, the corresponding generator is connected to the tip side of the circuit alternately with battery. This is brought about by the action of the associated interrupter. Upon the depression of the key k , its contacts 127—128 are moved to their alternate positions and are adapted to be retained in such positions by the catch 129 controlled by the electromagnet 130 in a manner to be hereinafter more fully explained. The link-circuit is also provided with a control relay 131 which is included in circuit between the live pole of the battery b^3 and a contact of relay 106. The party line keys k' , k^2 , k^3 and k^4 are provided, as before, with a sliding catch plate 132 which operates, as before, in retaining and releasing said keys.

With this preliminary description of the apparatus employed, it will be apparent that in operation—assuming that a party at substation C^2 , for example, desires to converse with a party at substation D^2 —the removal of the receiver $4'$ from its hook $5'$ at substation C^2 will move contact 100 to its alternate position and close contact 101 so as to complete a bridge for battery current between the line limbs 1 and 2 at said substation. As soon as this is done, a path for current will extend from the live pole of the battery b^3 through the winding of line relay 14, normal contact 13 of cut-off relay 12, line limb 2, winding of electromagnet $6'$, alternate contact 100, closed contact 101, line limb 1, and normal contact 11 of cut-off relay 12 to ground. The closing of this circuit will energize electromagnet $6'$ so as to hold its contact 100 in its alternate position, notwithstanding the projection 102 of the switch-hook $5'$ has by this time slipped past the projection on contact 100 and therefore exerts no force to hold said contact in its alternate position. The closing of the circuit will also energize line relay 14 to cause the closing of its contact and the subsequent display of the line signal lamp 50. At this time, no conversational circuit will exist at the substation, but the transmitter circuit will be interrupted at normal contact 100. Upon observing the display of the call signal 50, the operator will insert the answering plug P^8 into an answering jack, as j^3 , of the line L' . This will result in closing a circuit through relays 104 and 12, which may be traced from the live pole of battery b^3 , through the winding of relay 104, strand 110, plug and jack sleeve contacts and winding of cut-off relay 12 to ground. By the consequent energization of cut-off relay 12, the normal connection of line limbs is broken and said limbs are extended to the jack contacts. As soon as the cut-off relay contacts are actuated, relay 133 is energized, and

through its coöperation with relay 103, the connection of the battery b^3 to the line is reversed. Thus upon the actuation of cut-off relay 12, a path for current extends from the live pole of the battery b^3 , through the winding of relay 133, contacts 134—135 of supervisory relay 103, strand 107, plug and jack tip contacts, line limb 2, through electromagnet $6'$ at substation C^2 , line limb 1 to ground through the cut-off relay. This supplies current to the electromagnet $6'$ in the same direction as before and maintains said magnet energized. Immediately, however, contact 136 of relay 133 is closed and the opposite pole—namely, the grounded pole—is connected to the tip side of the circuit, thereby reversing the direction of current supplied to electromagnet $6'$ and thus causing its deenergization, with the resultant closing of the transmitter circuit at said substation. As soon as contact 136 is closed, current will be supplied to supervisory relay 103 over a path including the winding of relay 133, contacts 134—135, closed contact 136 and winding of relay 103 to ground. The completion of this circuit will at once break the contact 114, thus interrupting the circuit of the supervisory lamp 113, and will close contacts 137—135 and subsequently open contacts 134—135. As soon as contacts 134—135 are separated, relay 133 will be deenergized, but relay 103 will be continued energized by reason of the usual return over the tip side of the circuit. The complete circuit resulting at this time may be traced from the live pole of the battery b^3 , through the winding of supervisory relay 104, plug and jack sleeve contacts, to the cut-off relay, thence by one path through the winding of said relay to ground, and by another path over the line limb 1, through substation C^2 , over line limb 2, plug and jack tip contacts, closed contacts 135—137 and winding of relay 103 to ground. The direction of current flow over this circuit is also in the opposite direction to that initially established through the winding of electromagnet 6. The operator will now depress her listening-key levers 125—126, thereby including her telephone set S' in circuit. Upon learning from the calling party that connection is desired with substation D^2 , she will then test the line L^2 to determine its busy or idle condition. This she does by touching the tip of the calling plug P^4 to the sleeve contact of one of the multiple jacks associated with said line; and in case said line is in use, a potential above that of ground will exist at the contact thus touched, and current will flow therefrom over strand 108, closed contact 138—139 of supervisory relay 105, normal contact 119 of supervisory relay 106, and a winding of induction coil 120 to ground, thereby producing the usual "click" in the

operator's receiver 123 as an indication to her that the line is busy.

The potential at the sleeve contact of the tested jack will be obtained through the connection of a multiple of the jack tested with the sleeve strand of another link-circuit connected to the line. This connection may be either through the sleeve contact of a calling plug corresponding to plug P⁴ and the associated supervisory relay corresponding to relay 106, or through the sleeve contact of the plug corresponding to P⁴, and through the resistance corresponding to resistance 140, or through the sleeve contact of an answering plug corresponding to answering plug P³ and the winding of the associated supervisory relay corresponding to relay 104. If the line L² is found to be busy, the operator will so inform the calling party. If, on the other hand, said line is found to be idle, the operator will insert the calling plug P⁴ into a jack of the tested line and thereby complete a circuit through the supervisory relay 106 and cut-off relay 12 over the sleeve side of the circuit in a manner similar to that previously described in connection with line L', thereby closing contact 118 of supervisory relay 106 and moving its contact 119 to its alternate position; and by the action of the cut-off relay 12, destroying the normal connection of the line limb L² with the battery b³ and the line relay 14. The closing of contact 118 will cause the display of supervisory lamp 116, while the movement of contact 119 to its alternate position will supply a connection between the live pole of the battery b³ and strand 108, which may be traced from the live pole of said battery through the winding of relay 131, alternate contact 119 and contacts 139—138. The next act on the part of the operator in completing a connection will be to depress her key k and then depress a party line key, such as k², corresponding to the station of the party wanted. As soon as key k is depressed, contact 127 is engaged by catch 129 and the key is held in its depressed position. In this position, the previously traced circuit through the supervisory relay 106 is interrupted at normal contact 128, but current is supplied to the cut-off relay via resistance 140 and alternate contact 128. At the same time, strand 108 is interrupted at normal contact 127 and the battery and generator connection through the winding of relay 130 is established with the tip of the plug P⁴. The depression of the key k² also causes its engagement by the catch-bar 132 and it is retained in this depressed position thereby. While keys k and k² remain thus depressed, current will flow from the live pole of the generator g² through interrupter i², key k², winding of relay 130, which is unresponsive to the generator current, alternate contact 127, plug and jack tip con-

tacts, line limb 2, the substation condensers 7' and call-bells 8', line limb 1 and cut-off relay 12 to ground. By reason of the frequency of the current thus supplied, the call-bell 8' at the substation d² only is actuated as a signal to the party at such substation. As soon as he responds to the call, the removal of his receiver from its hook will close contact 101 and move contact 100 to its alternate position, thereby establishing a path for the flow of battery current between the line limbs 1 and 2. With this path through the substation, current will be supplied from the battery b³ to cause the actuation of electromagnet 130 with the consequent release of the key k.

The circuit for the retaining magnet 130 may be traced from the live pole of battery b³, through the interrupter i², key k², winding of relay 130, alternate contact 127, plug and jack tip contacts, line limb 2, through the substation bridge, line limb 1, and the winding of cut-off relay 12 to ground. Upon the return of the key k to normal, supervisory relay 106 is again energized and current at once flows from battery through the winding of relay 131, alternate contact 119 of relay 106, closed contacts 139—138, link-circuit strand 108, plug and jack tip contacts, line limb 2 through the substation, line limb 1 and winding of cut-off relay 12 to ground. This circuit, which exists momentarily, supplies current to the electromagnet 6' in the same direction as that supplied through the winding of electromagnet 130. Consequently the electromagnet 6' at substation D² maintains its contact 100 in its alternate position. The resulting energization of relay 131, however, immediately closes contact 141 to thereby establish a new path for current which may be traced from the live pole of the battery b³, through the winding of relay 131, alternate contact 119, closed contacts 139—138, closed contact 141 and winding of relay 105 to ground. The closing of this circuit immediately energizes relay 105 sufficiently to close its contacts 142—138 and subsequently to open contacts 138—139. The opening of the latter contacts interrupts the connection from the live pole of the battery b³ to the strand 108, and the closing of contacts 138—142 completes a path in bridge of contact 141 of relay 131 and thereby maintains the opposite pole of the battery b³ in connection with strand 108. By reason of this reversal of battery connections, the current through the electromagnet 6' at substation D² is reversed and the contact 100 of said electromagnet returns to its normal position, thereby completing a conversational circuit at said substation. At this time, current is supplied for transmission to the sleeve side of the line through supervisory relay 106 and to the tip side of the line through supervisory relay 105.

Upon the energization of relay 105, supervisory lamp 116 has its circuit interrupted at contact 117. With the parts in this condition, conversation may be carried on between substations C² and D². At the end of conversation, the restoration of the receiver at either of these substations to its hook breaks the existing path for battery current through the corresponding substation and causes the deenergization of the corresponding tip supervisory relay, with a consequent lighting of the corresponding lamp. The lighting of both lamps 113—116 constitutes a signal to the operator to take down the connection. If at any time during this connection, another party on the line L' desires to make a call or to listen to the conversation carried on between the connected substations, he will be unable to do so. This is true for the reason that upon removing his receiver from its hook, he will close his contact 101 and move his contact 100 to its alternate position and thereby complete a path for current through his electromagnet 6'; and since the reversing relay mechanism at the central office has already operated, he will be unable to obtain a reversal of current flow through his electromagnet 6' to cause the restoration of his contact 100 to its normal position. Without this restoration, there will be no circuit through his transmitter 3' or the primary of his induction coil 9'. This action of the interfering party will not cause the operation of the associated line relay 14 or the display of its lamp 50, since the normal connection of the line relay to the line L' has been interrupted by the previous operation of the associated cut-off relay. Obviously, a party at a substation on the line L² will be unable to interfere or signal the operator for like reasons.

Now if, instead of the subscriber at substation C² desiring to converse with a party on another line, such as at substation D² on line L² as heretofore described, he desires to converse with another party on his own line, such as a party at substation C', he will call in a manner heretofore described; and the operator, upon learning that the substation with which connection is desired is on the same line as the calling party, will remove the plug P³ from the jack of the line L' and insert in its stead plug P⁴. The operator will then depress her ringing key *k* and the proper party line ringing key *k'*, *k*², *k*³ or *k*⁴ and signal the called party in the usual way. Since the existence of a path for battery current between the line limbs 1 and 2 at any point on the line will be instrumental in causing the operation of the magnet 130, releasing the key *k* at the central office, thus disconnecting the ringing generator from the line, it is necessary that the subscriber at the calling station—namely, C²—interrupt the ex-

isting path for battery current through his substation prior to the depression of key *k*. This is also necessary prior to the response of the called party in order that the removal of the receiver from the switch-hook of the called party will set the reversing relay mechanism in operation to reverse the current flow over the line and thereby close the conversational circuit at the called-for party's substation. This interruption of the path for battery current at the calling party's substation is brought about by the pressing of key 10' so as to interrupt the existing path through closed contact 101, normal contact 100, transmitter 3', switch-hook 5', winding of induction coil 9' and key 10'. As soon as the calling party hears the response of the called party, he may restore his key 10' to normal and from that time on will be able to converse with the desired party. During this conversation, current will be supplied to the substations, as before, through the winding of supervisory relay 106 to the sleeve side of the circuit, and through the winding of supervisory relay 105 to the tip side of the circuit. At the end of conversation, with the parties thus connected, it will be necessary for both receivers to be restored to their switch-hooks in order to cause the display of the associated supervisory lamp 116. In the case of a connection of this sort, the display of this lamp will serve as a signal to the operator to take down the connection.

In Fig. 3 of the accompanying drawing, I have illustrated a still further modification of substation circuits which may be employed in the systems of either of the preceding figures. In this instance, the transmitter 3'', receiver 4'', switch-hook 5'', electromagnet 6'', condenser 7'', call-bell 8'', induction coil 9'' and control-key 10'' are substantially the same as those heretofore described, but are differently connected. By the arrangement of this figure, a conversational circuit is completed through the substation, as a result of the reversal of current supplied to the electromagnet 6'', whenever a call is transmitted from said substation or a call is transmitted to it from a substation on some other line; but whenever a call is transmitted to it for the purpose of establishing a conversational circuit between it and another substation on the same line, the conversational circuit through the called substation is completed by shunting current from the called substation electromagnet 6''. In other words, it is possible to permit a second subscriber to be connected with the same line by shunting current from the electromagnet of said line so that it will restore its contacts to thereby establish the necessary conversational circuit. In the operation of this modified circuit arrangement, the removal of the receiver for the purpose

of initiating a call completes a circuit from the line limb 1 to the line limb 2, which may be traced through transmitter 3'', switch-hook 5'', electromagnet 6'' and alternate contact 200, said contact 200 being thrown to its alternate position upon the closing movement of the switch-hook 5'' in a manner similar to that heretofore described in connection with the switch-hooks 5 and 5'. When the operator answers, the current reversing mechanism of either of the cord-circuits will cause a reversal of current flow through the electromagnet 6'' and the transmitting circuit will be completed from the line limb 1, through transmitter 3'', switch-hook 5'', winding of induction coil 9'' and normal contact 200 to line limb 2. In case the substation is called, ringing current will flow through the condenser 7'' and call-bell 8'' as before.

If the subscriber at the substation is called for the purpose of conversing with a subscriber at a substation on another line, the response of the party in removing his receiver from its hook will close the path for battery current through the electromagnet 6'', previously traced, and this will at once be instrumental in actuating the current reversing mechanism at the central office, as before, to reverse the current flow through the electromagnet 6'' and thereby cause the completion of the conversational circuit at said substation. In case a calling party with this substation equipment desires to converse with another party on his own line, he calls in the usual way and obtains a suitable conversational circuit in the manner heretofore pointed out. In making the connection, the operator as before inserts the calling plug into the jack of the line and rings the called-for party in the usual way. Since there is a path for battery current through the transmitter 3'', switch-hook 5'', winding of induction coil 9'' and normal contact 200 at the substation of the calling party, it will be necessary, where the link-circuit L⁴, of Fig. 2, is used, that the operator hold down the key k, since otherwise the associated retaining magnet 130 would be energized and the key would be released. When the called party responds by removing his receiver, electromagnet 6'' and transmitter 3'' will be included in bridge of the line limbs, but there will be no circuit from the receiver 4''. This will be true since the movement of the switch-hook moves the contact 200 to its alternate position and current will flow through the electromagnet 6'' to maintain said contact in said position. As soon as the called-for party responds, the calling party will deenergize the called party's electromagnet 6'' by depressing his key 10'' to shunt current from said electromagnet and thereby permit its contact 200 to retract and thus complete the conversa-

tional circuit at that substation. In this connection it should be noted that the current reversing mechanism at the central office cannot be utilized to restore the contact 200 of the called party by reversing the direction of current flow through the associated electromagnet 6'', since said reversing mechanism is operated as soon as the link-circuit is connected to the line, provided a bridge for battery current exists between the line limbs. This does exist in the case of the calling line and consequently if this reversing mechanism were relied upon, it would operate before the called party had removed his receiver. In the present case, supervision is obtained as heretofore explained.

It will be apparent from the above disclosure that my invention is capable of use in systems of various sorts. It will also be apparent to those skilled in the art that many alterations and modifications may be made in the circuit arrangements and in the apparatus diagrammatically illustrated, without departing from the spirit and scope of my invention. I therefore do not wish to be limited to the specific matter illustrated, but aim to cover by the terms of the appended claims, the invention in its various uses and in its various modified forms.

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

1. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, means under the control of each subscriber for actuating said signal without closing a conversational circuit at his substation and an electromagnet at the exchange automatically actuated on connection made with the line to cause the closure of said conversational circuit.

2. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a transmitter, receiver and switch-hook at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a signaling circuit without connecting the transmitter and receiver for conversation, a signal at the central office responsive to the closing of said signaling circuit, and an electromagnet at the exchange automatically actuated on connection made with the line to cause the closure of said conversational circuit.

3. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a transmitter, receiver and switch-hook at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a

signaling circuit without closing a circuit through the transmitter, a signal at the central office responsive to the closing of said signaling circuit, and an electromagnet at the exchange automatically actuated on connection made with the line to cause the closure of said conversational circuit.

4. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, means under the control of each subscriber for actuating said signal without closing a conversational circuit at his substation, means for subsequently closing said conversational circuit at the said substation, and means subsequently under the control of the subscriber at said substation to permit the closing of a like conversational circuit at another substation on said line.

5. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, each having a transmitter, receiver and switch-hook, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a signaling circuit without connecting the transmitter and receiver for conversation, a signal at the central office responsive to the closing of said signaling circuit at any particular substation, means for subsequently connecting the transmitter and receiver at said substation for conversation, and means subsequently under the control of the subscriber at said substation to permit the connection of the transmitter and receiver at another substation on said line for conversation.

6. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, each having a transmitter, receiver and switch-hook, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a signaling circuit without closing a circuit through said transmitter, a signal at the central office responsive to the closing of said signaling circuit at any particular substation, means for subsequently closing the circuit through the transmitter at the substation, and means subsequently under the control of the subscriber at said substation to permit the closing of a like circuit through the transmitter of another substation on said line.

7. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying current to his electromagnet,

a pole changing relay at the exchange controlled responsive to the line connections at a substation to modify the current supplied to said electromagnet and means responsive to such modification to alter the circuit connections at the acting subscriber's substation.

8. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying current to his electromagnet, a pole changing relay at the exchange controlled responsive to the line connections at a substation to modify the current supplied to said electromagnet and means responsive to such modification to close a conversational circuit at the acting subscriber's substation.

9. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a pole changing relay at the exchange controlled responsive to the line connections at a substation to modify the current supplied to said electromagnet and means responsive to such modification to alter the circuit connections at the acting subscriber's substation.

10. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a pole changing relay at the exchange controlled responsive to the line connections at a substation to modify the current supplied to said electromagnet, and means responsive to such modification to connect the transmitter and receiver at the acting subscriber's substation for conversation.

11. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying a unidirectional current to his electromagnet, means for reversing the direction of current supplied to said electromagnet, and means responsive

to such reversal to alter the circuit connections at the acting subscriber's substation.

12. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying a uni-directional current to his electromagnet, means for reversing the direction of current supplied to said electromagnet, and means responsive to such reversal to close a conversational circuit at the acting subscriber's substation.

13. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, means for reversing the direction of current supplied to said electromagnet, and means responsive to such reversal to alter the circuit connections at the acting subscriber's substation.

14. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, means for reversing the direction of current supplied to said electromagnet, and means responsive to such reversal to connect the transmitter and receiver at the acting subscriber's station for conversation.

15. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, telephone equipment at each substation responsive only to a reversal of battery current flow over the line to complete a conversational circuit at said substation, a battery, and means for causing a reversal of battery connections to the line to complete thereby a conversational circuit at a subscriber's substation.

16. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, telephone equipment at each substation responsive only to a definite modification of the battery current flow over the line to complete a conversational circuit at said substation, a battery, a pole changing relay at the exchange for operation responsive to the condition of said telephone equip-

ment for causing the said modification of battery current to complete thereby a conversational circuit at said subscriber's station.

17. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each of said substations, means under the control of each subscriber for actuating said signal and for supplying a current to his said electromagnet, means for modifying the current supplied to said electromagnet, means responsive to such modification to complete a conversational circuit at said substation, and means for controlling the modification of current supplied to a second electromagnet on said line whereby the closing of a second conversational circuit at a second substation on the line is accomplished.

18. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, each having a transmitter, receiver, switch-hook and controlling electromagnet, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the electromagnet, a signal at the central office responsive to the closing of said circuit at any particular substation, means for modifying the current supplied to said electromagnet, means responsive to such modification to connect the transmitter and receiver for conversation, and means for controlling the modification of current supplied to a second electromagnet on said line whereby the connection of the transmitter and receiver of a second substation on the line for conversation is accomplished.

19. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each of said substations, means under the control of each subscriber for actuating said signal and for supplying a uni-directional current to his said electromagnet, means for reversing the direction of current supplied to said electromagnet, means responsive to such reversal to complete a conversational circuit at said substation, and means for controlling the reversal of current supplied to a second electromagnet on said line whereby the closing of a second conversational circuit at a second substation on the line is accomplished.

20. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, each having a transmitter, receiver, switch-hook and controlling electromagnet,

circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the electromagnet, a signal at the central office responsive to the closing of said circuit at any particular substation, means for reversing the direction of current supplied to said electromagnet, means responsive to such reversal to connect the transmitter and receiver for conversation, and means for controlling the reversal of current supplied to a second electromagnet on said line whereby the connection of the transmitter and receiver of a second substation on the line for conversation is accomplished.

21. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying current to his electromagnet, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to modify the current supplied to said electromagnet, and means responsive to such modification to alter the circuit connection at the acting subscriber's substation.

22. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying current to his electromagnet, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to modify the current supplied to said electromagnet, and means responsive to such modification to close a conversational circuit at the acting subscriber's substation.

23. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to modify the current supplied to said electromagnet, and means responsive to such modification to alter the circuit connections at the acting subscriber's substation.

24. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to modify the current supplied to said electromagnet, and means responsive to such modification to connect the transmitter and receiver of the acting subscriber for conversation.

25. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying a uni-directional current to his electromagnet, a link-circuit, plug and jack connecting means for uniting said line and link circuit, means responsive to the connection of said plug and jack to reverse the direction of current supplied to said electromagnet, and means responsive to such reversal to alter the circuit connections at the acting subscriber's substation.

26. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a signal associated with said line at the central office, a controlling electromagnet at each substation, means under the control of each subscriber for actuating said signal and for supplying a uni-directional current to his electromagnet, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to reverse the direction of current supplied to said electromagnet, and means responsive to such reversal to close a conversational circuit at the acting subscriber's substation.

27. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection for said plug and jack to reverse the direction of current supplied to said electromagnet,

and means responsive to such reversal to alter the circuit connections at the acting subscriber's substation.

28. A party line telephone system comprising a telephone line terminating at a central office, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook normally closes a circuit through the associated electromagnet, a signal at the central office responsive to the closing of said circuit, a link-circuit, plug and jack connecting means for uniting said line and link-circuit, means responsive to the connection of said plug and jack to reverse the direction of current supplied to said electromagnet, and means responsive to such reversal to connect the transmitter and receiver of the acting subscriber for conversation.

29. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a link-circuit for connection with said line, a battery connected to said line by the connection of said line and link-circuit, means subsequently under the control of each subscriber to reverse the battery connections to said connected line, means responsive to such reversal to complete a conversational circuit through the substation of a subscriber exercising such control, and means whereby a subscriber on said line already having communicated with the operator may place the battery reversing means under the control of another subscriber on said line, whereby a conversational circuit between said subscribers may be obtained.

30. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a link-circuit for connection with said line, a battery connected to said line by the connection of said line and link-circuit, electromagnetically controlled means for reversing said battery connections, a switch at each substation for controlling the actuation of said reversing means, means responsive to such reversal to complete a conversational circuit through the substation of a subscriber exercising such control, and means whereby a subscriber on said line already having communicated with the operator may place the battery reversing means under the control of another subscriber on said line, whereby a conversational circuit between said subscribers may be obtained.

31. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a link-circuit for connection with said line, a battery connected to said line by the connection of said line and link-circuit, electromagnetically controlled means for re-

versing said battery connections, a controlling electromagnet at each substation, means at each substation for actuating said reversing means and the controlling electromagnet at said substation, means actuated by the reversal of current through said electromagnet to complete a conversational circuit through said substation, and means whereby a subscriber on said line already having communicated with the operator may place the battery reversing means under the control of another subscriber on said line, whereby a conversational circuit between said subscribers may be obtained.

32. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a transmitter, receiver, switch-hook and controlling electromagnet at each substation, circuit connections at each substation whereby the removal of the receiver from its hook completes a conductive path through the corresponding electromagnet, a link-circuit for connection with said line, a battery connected to said line by the connection of said line and link-circuit, electromagnetically controlled means for reversing said battery connections upon the subsequent removal of a receiver from its hook at any substation, means actuated by the consequent reversal of current in the controlling electromagnet at the substation of the acting subscriber to connect the associated transmitter and receiver for conversation, means whereby a subscriber on said line already having communicated with the operator may interrupt the path for battery current through his transmitter to allow the battery reversing means to respond to the act of another subscriber on the same line in removing his receiver from its hook, whereby a conversational circuit between said subscribers may be obtained.

33. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, means at each substation for completing a path for battery current between the line limbs, a link-circuit for connecting with said line, a battery connected to said line by the connection of said line and link-circuit, means for reversing the battery connections to said line upon the completion of a path for battery current at any of said substations, and means responsive to such reversal to complete a conversational circuit through the substation of the acting subscriber.

34. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, an electromagnet at the exchange for operation to cause completing of a conversational circuit through one of said substations, a link-circuit for establishing connection with

said line, and means under the control of the subscriber at said substation after connection between said line and link-circuit to permit the reoperation of said magnet to permit the additional closing of a conversational circuit through another of said substations.

35. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a link-circuit for establishing connection with said line, an electromagnet at the exchange controlling means whereby a subscriber at one of said substations may signal and converse with the operator at the central office, means whereby the operator may signal the subscriber at another of said substations, and means under the control of the first subscriber after connection between said line and link-circuit for enabling the second subscriber to cause the operation of said magnet to complete a talking circuit through his substation.

36. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substations on said line, a subscriber's switch at each substation, a link-circuit for establishing connection with said line, means responsive to the operation of one subscriber's switch only and the connection of said line and link-circuit to vary the circuit connections at said subscriber's substation and to prevent the subsequent similar variation of circuit connections at any of the remaining substations, and means under the subsequent control of the first subscriber to allow the said variation of circuit connections at another substation in response to the manipulation of the subscriber's switch at such station.

37. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substation equipments on said line, each responsive to a reversal of current flow over said line, a link-circuit at the central office for establishing connection with said line, a supervisory signal associated with said link-circuit, relay mechanism for controlling said signal, a battery, a relay under the control of the substation for varying the connections of said relay mechanism and the battery to the line.

38. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substation equipments on said line, each responsive to a reversal of current flow over the line, a link-circuit at the central office for establishing connection with said line, a battery normally having one pole connected to strand of the link-circuit, and relay mechanism under the control of the substation for connecting the other pole of said battery to said link-circuit strand.

39. A party line telephone system com-

prising a telephone line terminating at a central office, a plurality of substation equipments on said line each responsive to a reversal of current flow over the line, a link-circuit at the central office for establishing connection with said line, a battery normally having one pole connected to one strand of said link-circuit, a relay included in said connection, and means actuated by the energization of said relay to alter the battery connections to said link-circuit strand.

40. A party line telephone system comprising a telephone line terminating at a central office, a plurality of substation equipments on said line each responsive to a reversal of current flow over the line, a link-circuit at the central office for establishing connection with said line, a supervisory signal associated with said link-circuit, relay mechanism for controlling said signal, a battery normally having one pole connected to one strand of said link-circuit, a relay included in said normal battery connection, and means actuated by the energization of said relay to alter the battery and relay mechanism connections to said link-circuit.

41. A telephone system including a telephone line having two limbs only, a link-circuit at the exchange, a source of current thereat and adapted to be connected with said line limbs, a switch at the substation of said line for causing a flow of current in one direction through the substation, means responsive to said flow for automatically changing the direction of current, and party line mechanism controllable thereby.

42. A telephone system including a telephone line, a central source of current connected therewith, means controlled by the removal of the receiver at the substation to produce a reversed direction of current flow in said line, and party line substation telephone circuits modified upon such reversal.

43. A telephone system including a lock-out party line, having a plurality of substations, means for causing a flow of current over said line from the exchange, switching means at a substation for reversing the direction of current flow to permit the establishment of a talking connection to the line at said substation, apparatus at said substation operable at the will of the subscriber to permit the operative actuation of corresponding switching means at another substation of said line to again reverse the direction of current, whereby a second talking connection to the line may be established.

44. A telephone system including a two-conductor telephone line, a substation telephone individual to said line, and a relay circuit at the exchange controlled from said substation to connect said station in conversational relation with the line.

45. A telephone system including a poly-

station line, a relay circuit at the exchange controlled from a substation to connect said station in conversational relation with the line, and means at a substation for permitting control of said relay circuit from another substation to connect the latter in conversational relation with the line while maintaining the first substation in said relation.

46. In a telephone system, a telephone line, a plurality of stations connected therewith, an electromagnet at the exchange adapted to be connected with said line, and means controlled at a substation to operate said electromagnet to connect said station in conversational relation with said line.

47. In a telephone system, a telephone line, a plurality of stations connected therewith, an electromagnet at the exchange adapted to be connected with said line, means controlled at a substation to operate said electromagnet to connect said station in conversational relation with said line, and switching means controlled at said station to alter the operative condition of said magnet to permit re-operation thereof from another substation of said line whereby both said stations will be in conversational relation with said line.

48. A telephone system including a poly-station line, a relay at each substation of said line adapted to be energized on removal of the receiver to prevent establishment of a conversational circuit with the line at the substation, an electromagnet at the exchange adapted for connection with said line, and means for operating said magnet in circuit with a relay at a substation whose receiver is removed to deenergize said relay whereby conversational relation with the line is established.

49. A telephone system including a poly-station line, a relay at each substation of said line adapted to be energized on removal of the receiver to prevent establishment of a conversational circuit with the line at the substation, an electromagnet at the exchange adapted for connection with said line, means

for operating said magnet in circuit with a relay at a substation whose receiver is removed to deenergize said relay whereby conversational relation with the line is established, and a switching device at a substation in conversational relation with the line for controlling said magnet, to permit its re-operation from another substation.

50. A telephone system including a poly-station line, a pole changing electromagnet at the exchange adapted for association with said line and for operation responsive to current thereover, and relay means at each substation adapted to establish a talking connection with the line effective only when said magnet actuates while the respective receiver is removed.

51. A telephone system including a telephone line having two limbs only, a pole changing relay at the exchange, a central source of current at the exchange, and means for operating said relay responsive to current over said line, when used as a calling line, to reverse the connections of said source.

52. A telephone system including a poly-station line, an electromagnet at the exchange, means at each substation responsive to actuation of said magnet to connect a substation in talking relation with the line, and means controlled from the substations for permitting the connection of a plurality of substations in talking relation with the line.

53. A telephone system including a calling line and a called line, a plurality of stations connected thereto, a cord-circuit connected in circuit between said lines, pole changing relays for said cord-circuit, means for operating said relays on the closing of circuits over said lines, and circuit connections modified by said pole changing relays.

In witness whereof I hereunto subscribe my name this 5th day of March, 1907.

HARRY G. WEBSTER.

Witnesses:

CAROLYN WEBER,
THOMAS H. FERGUSON.