

H. J. ROBERTS.
COMMON BATTERY LOCK-OUT TELEPHONE SYSTEM.
APPLICATION FILED OCT. 22, 1908.

996,143.

Patented June 27, 1911.

2 SHEETS-SHEET 1.

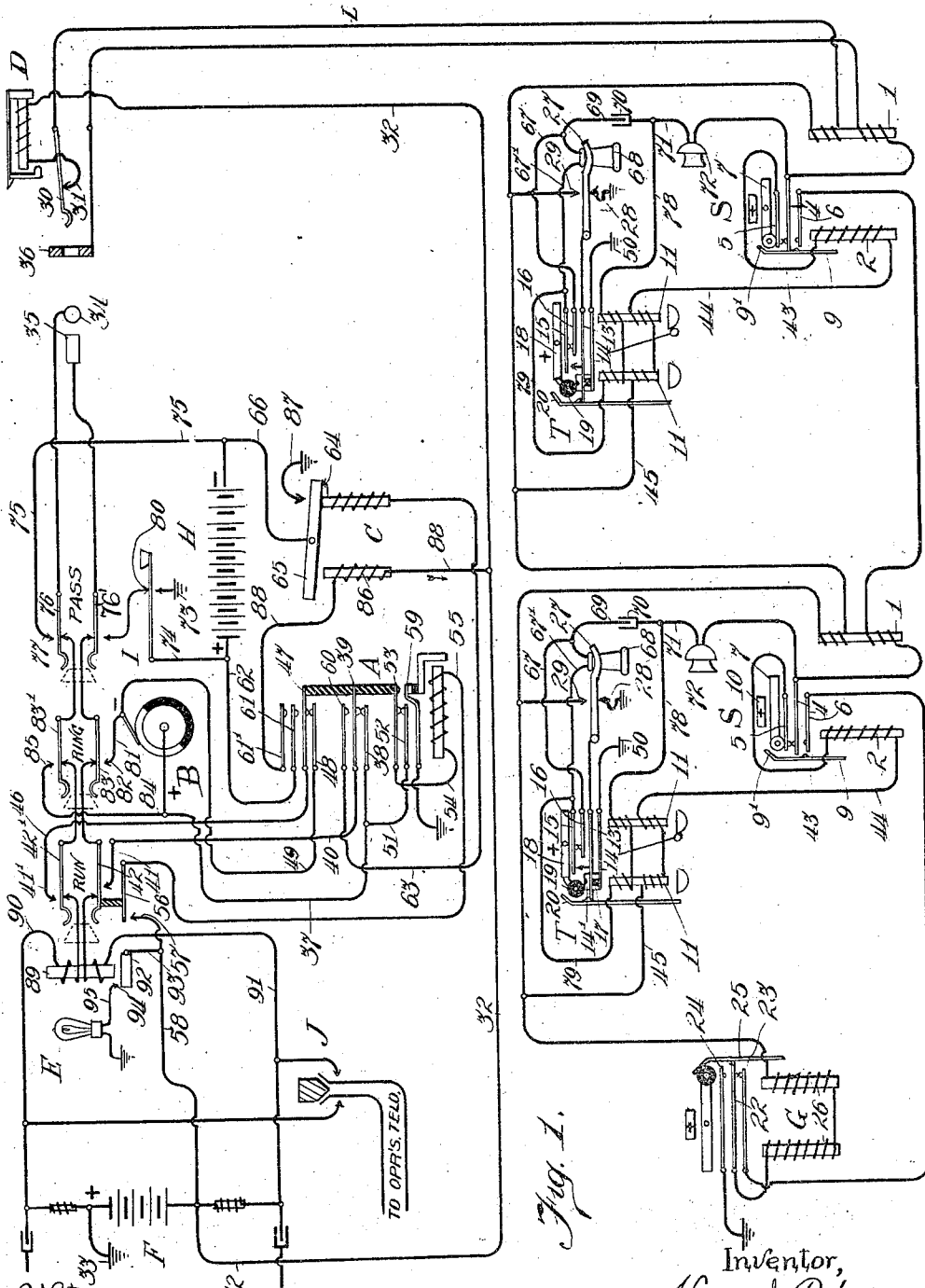


Fig. 1.

Witnesses
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Emilie Rose

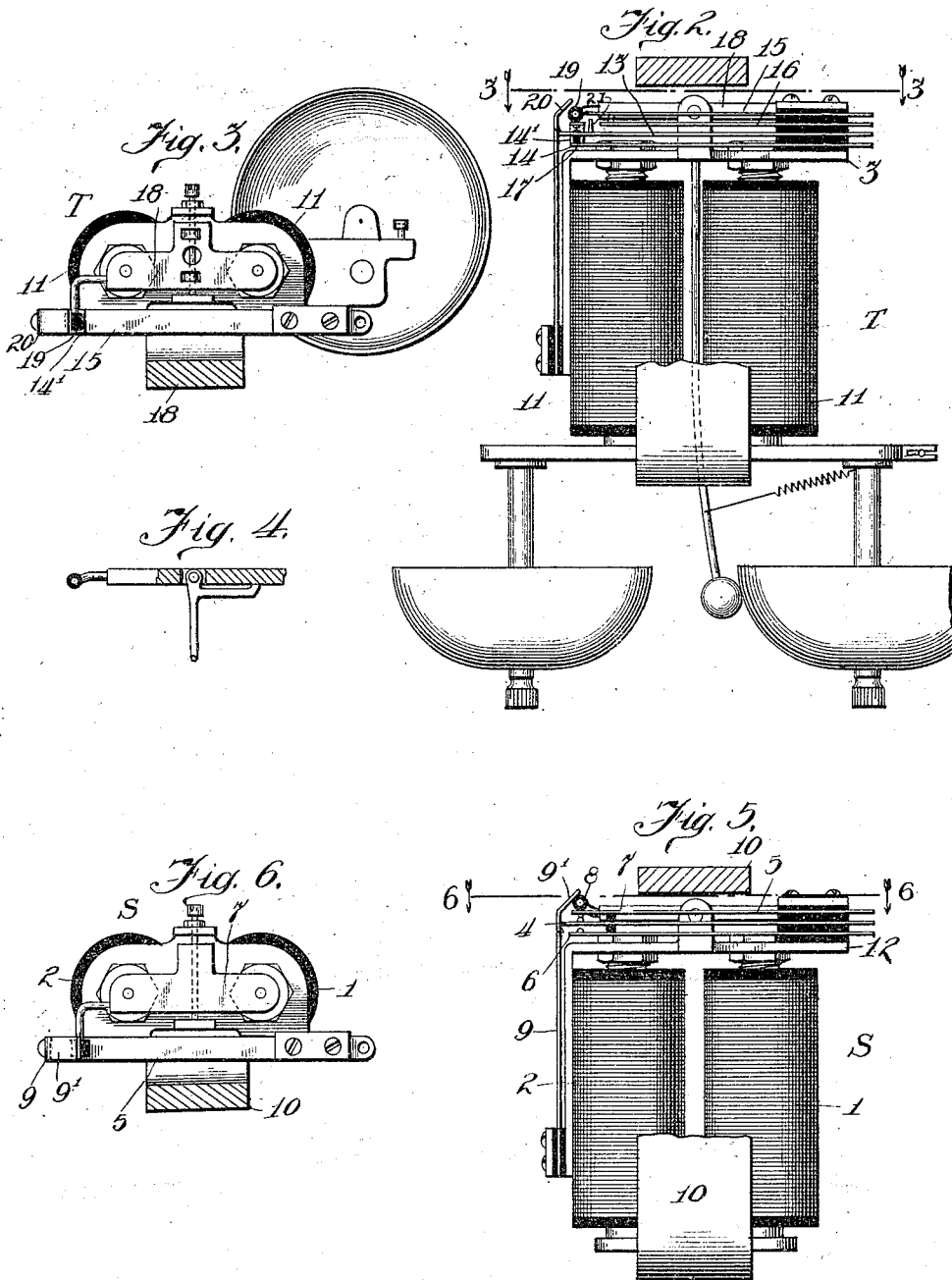
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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COMMON-BATTERY LOCK-OUT TELEPHONE SYSTEM.

996,143.

Specification of Letters Patent. **Patented June 27, 1911.**

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To all whom it may concern:

Be it known that I, HOMER J. ROBERTS, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Common-Battery Lock-Out Telephone Systems, of which the following is a specification.

This invention relates to improvements in common battery lock-out telephone systems.

Among the salient objects of the invention are to provide a practical system of the character stated; to provide in a system of the general character described, improved sub-station circuit connections and associated mechanism whereby proper talking connections are attained at any given selected station and the inductive effects of other stations practically eliminated, thus giving an efficient talking circuit; to provide a system in which continuous connections are provided at all times for signaling purposes, yet the circuits so organized as to prevent substantial interference with conversations by calling-in parties; to provide a common battery system in which the selection is effected by successively extending a metallic loop circuit from "central" to and through the successive stations, and practically eliminating the resistance at each station as it is successively passed, thus affording a most efficient and non-marginal circuit for operating the selecting mechanisms; to provide a system in which the arrival at the end of the party-line by the successive selection of stations thereon results in automatically bringing into operation mechanism which restores the entire line to normal; to provide in a common battery system means whereby any subscriber on such line may by the simple act of signaling-in place his station in "set" condition, whereby it will be automatically selected by the mechanism controlled at "central" and without necessarily involving the knowledge on the part of the exchange operator as to what station is so selected; to provide in a lock-out system means whereby the automatic selection of a station as last above described is accompanied by the automatic establishment of talking connections and the giving of an audible signal to the subscriber; to provide in a common battery lock-out system means whereby two or more parties upon the same party-line may be given

talking connections to the exclusion of all other stations; to provide in such a system a supervisory signaling system which does not clash or interfere with any of the operations of calling-in or selecting; to provide a system of the character referred to which is characterized by affording absolute supervision by the "central" operator and precludes interfering on the part of the subscriber; and in general to provide a simple, practical and efficient system of the character referred to.

The most of the apparatus employed in this system is of conventional construction, or so nearly that as to be readily understood by those skilled in the art and therefore to require no special description other than its connections in the system. The two main instruments at each sub-station are, however, special relays, which will be described before describing the circuit connections.

Referring to the drawings—Figure 1 is a diagrammatic view of an external circuit and so much of the exchange as is necessary to comprehend the invention; Fig. 2 is an elevation with parts broken away of the lock-out relay; Fig. 3 is a sectional view on line 3—3 of Fig. 2 looking downwardly; Fig. 4 is a sectional detail through the pivot connection of the clapper and armature; Fig. 5 is a side elevation of the selector relay, with part of the permanent magnet broken away; Fig. 6 is a sectional view on line 6—6 of Fig. 5 looking downwardly.

Referring to the drawings, S designates as a whole the selecting relay, and T an instrument which will be herein termed the lock-out relay; the function of this latter instrument being to control certain circuit connections in addition to operating as a ringer. The magnet of the relay S has two differently wound spools, 1 and 2, the former being included in both main limbs of the telephone line and wound so that current flowing out on one limb and back on the other neutralizes or produces no inductive effect in the spool. The spool 2 has a single ordinary winding. Upon the yoke 12 of the magnet is mounted a group of three springs,—a switch-spring 4, a back contact spring 5 and a forward contact spring 6. The armature 7, pivoted upon the yoke as usual, carries an arm having an insulated button 8 adapted to engage and depress the

springs 4 and 5 into engagement with the front spring 6. A spring-latch 9, suitably mounted upon a down-turned extension 3' of the yoke, engages and holds depressed the switch-spring 4, and upon the return of the armature 7 the back-spring 5 opens away from spring 4. The magnet of relay S is polarized, being provided with the usual permanent magnet 10. In order to restore the spring group to normal, current is sent through the magnet in a direction to lift the end of the armature carrying the insulating button 8, which latter in rising engages an inclined cam portion 9' of the latch-spring 9, and thus trips the latter off.

The ringer relay T is organized in general like the relay S. Its two spools 11 are alike, each having two similar windings so wound that when current is passed through said windings in series the two magnet spools oppose each other and approximately neutralize the inductive effect, as will more clearly appear in the description of the circuit connections. Upon the yoke 3 of the instrument is mounted a group of four springs,—a switch-spring 13, a grounding-spring 14, a top-spring 15 and an intermediate short circuiting spring 16. The grounding-spring is provided at its movable end with a lateral arm or extension 14', which is bent upwardly around and in position to overlie the end of the switch-spring; said overlying portion carrying a platinum contact point which engages the switch-spring. Between the under side of the switch-spring and the grounding-spring is interposed an insulation 17, desirably mounted on the grounding-spring. The armature 18 of the instrument carries an arm and insulated button 19, which latter in its downward movement engages the portion 14' of the grounding-spring and depresses the latter into contact with switch-spring 13, and thereafter, if the movement is continued, forces the switch-spring into latching engagement with the spring-latch 20, constructed and mounted in a manner similar to the spring 9 of the selecting relay described. Both springs 13 and 14 are tensioned to rise when released from the latch, and spring 13 carries a contact 21, which, when the spring is permitted to rise, closes with top-spring 15 with sufficient tension to lift the latter out of engagement with the short circuiting spring 16. The ringer relay is a polarized instrument, and the latch is tripped off by a reversal of current therethrough, substantially as described in connection with the selector relay. When the latch is disengaged from the switch-spring, springs 13, 14 and 15 are in electrical contact with each other, and the normally closed connection between 15 and 16 is open.

G designates a relay, which is herein termed a grounder; the function of this in-

strument being to automatically establish a ground connection at the end of the party-line which results in restoring the line to normal. This grounder is constructed almost precisely like the selector relay S, except that its switch-spring 22 is normally held down by a latch-spring 25 in contact with front-spring 23. Upon being released from the latch it rises into contact with the grounding top spring 24. The two spools 26 of this instrument are wound precisely alike and connected in series.

Referring, now, to the diagrammatic drawings, A designates a relay, herein termed the "pick-up relay," B a pulsating generator, C a grounding relay, D a line drop, E a supervisory signal, F the talking battery, and H the operating battery; all of these parts being shown diagrammatically in the conventional way.

The three keys, respectively designated "run," "ring" and "pass," are keys used in performing operations aptly described as "running," "ringing" and "passing," as will hereinafter appear.

I designates a key employed when it is desired to put two or more parties on the same line in talking connection, and J designates the operator's listening key; the operator's set being omitted.

Describing the operations and concerned mechanism, somewhat in the order in which such operations are likely to occur in practice, the subscriber desiring a connection at any station, lifts his receiver from the switch-hook 27, and in so doing establishes a momentary or "flash" ground from his station to "central", through the grounded spring 28 which is arranged to follow the switch-hook in its upward movement until shortly after the latter has encountered the top-spring 29, but opens before the switch-hook reaches its limit of movement. This circuit may be traced from contact 29 to the left line L, through one winding of each intervening magnet spool 1, to the jack-spring 30 at "central", thence through normally closed contact 31, thence to and through drop D, thence over 32 to battery F, and from opposite side of the latter over 33 to ground. This throws the shutter of the drop. Thereupon the operator inserts the cord plug, the tip 34 thereof engaging spring 30 of the jack and opening the drop circuit, and the sleeve contact 35 engaging the sleeve ring 36. The operator now closes the running key, and in so doing sends pulsating current from the generator to line over a circuit traced as follows: from positive side of generator over 37 to springs 38, 39, of relay A, thence over 40 to back-spring 41 and key-spring 42, thence over the right side of the cord circuit to right main line, through included winding of spool 1 of first relay S to switch-spring 4, to top-

spring 5, thence over 43 to and through windings of spool 2 of the selector relay, thence over 44 through the windings of both spools 11 of the ringer relay and over 45 to the left main line. The left main line includes one winding of spool 1 of the selector relay, and at "central" the circuit is over the left side of the cord circuit to running key spring 42', to coöperating outer spring 41', over conductor 46 to switch-spring 47 of relay A, thence to front-spring 48 and by conductor 49 back to negative side of the generator, thus completing the circuit. The first pulsation which goes to line from the generator, energizes spool 2 of the selector relay, draws down the armature and latches switch-spring 4, and so opens the bridging connection as to that station and extends the line or link circuit to the next station. In precisely the same manner any number of intervening stations may be passed, a station being passed for each pulsation from the generator. As soon, however, as the link circuit is extended to the station at which the subscriber has called in, a condition is there found which results in automatically arresting the further extension of the loop. It will be noted that switch-hook 27 is connected to the switch-spring, so that when the receiver is removed, and the switch-hook rises, it partially establishes a grounding connection to the left line, which grounding connection is completed whenever the armature 18 of the ringer relay depresses the grounding spring sufficiently to close contact with the switch-spring. The adjustment between these contacts is somewhat close, and inasmuch as the armature has little mechanical work to perform, except to bring these springs together during its initial movement, it follows that the left line is grounded during an early part of the impulse sent to line. The establishment of the ground at the "set" station energizes a circuit which operates relay A, and the latter operates to remove the generator connections from line and close the main battery H to line in such manner as to reverse the metallic circuit current flow. Tracing this grounded pick-up or arresting circuit, as it may be termed, and starting at the substation, the circuit is from ground at 50 to grounding-spring 14, to switch-spring 13, to switch-hook 27, to left main line over 29, thence to "central", there over the tip side of the cord circuit to spring 42' of the running-key, and thence to the negative side of the generator, as before described. From the opposite side of the generator the circuit is over 37 to a branch conductor 51, to relay spring 52, relay spring 53, thence over conductor 54 to and through the windings of the pick-up relay, thence over 55 to an insulated outer spring 56 mounted outside of and moving with the running key spring

42. From spring 56 the circuit is to back-contact 57, thence over 58 to the negative side of the talking battery and to ground over 33 at the opposite side thereof. This energizes relay A, and the armature of the latter in closing changes the positions of its three switch-springs 39, 47 and 53; these being connected to move in unison. During the initial movement of this relay, a grounding-spring 59 of relay A is brought into contact with switch-spring 53 thereof, thus establishing a holding circuit for said relay which extends from the grounding spring 59, through spring 53, conductor 54, and thence as before described to ground through the talking battery. During the further closing movement of the armature of relay A, switch-springs 39 and 47, by leaving springs 38 and 48, respectively, and engaging springs 60 and 61, respectively, take off the generator and close the main battery H to line. The circuit so established may be traced as follows: from positive side of battery H over 62 to spring 61, thence to spring 47, thence over 46 and 41' to spring 42' of running key, out over left side of line to selected station, there over bridging connections 45, 44, 43, 5 and 4 to right main line and back to "central." From spring 42 of the running key the circuit is to spring 41, thence over 40, to switch-spring 39, to top-spring 60, thence over 63 to and through the right-hand spool of relay magnet C, from the latter to normally closed contact 64 of the relay, thence through the armature 65 and over 66 to the negative side of the main battery. This completes the metallic circuit, which it will be observed is of opposite polarity from the pulsations theretofore sent to line by the generator. It will also be noted that the current flow of this metallic circuit through the spool of relay C is such as to maintain its armature 65 closed. At the sub-station the direction of current flow through the ringer relay is such as to lift the actuating end of the armature and trip off the latch, thus opening a short circuit over the conductors 67, 67', which includes the receiver, and establishing the talking circuit, which may be traced from the left main line over conductor 29, switch-hook 27, switch-spring 13, contact 21, top spring 15, conductor 67', receiver 68, conductor 69, condenser 70, conductor 71, which latter includes the transmitter 72, and to the left main line. The current flow which energizes the transmitter is from left main line, over 29 to and through switch-hook, to springs 13, 15, over 79 to 78 and over the latter through the transmitter to right main line. The clapper stem of the ringer relay is so connected with the armature that the movement of the latter last described positively oscillates the clapper and rings the bell a single stroke; 130

it being obvious that but one pulsation will flow from the battery upon a single closing.

Assuming that the calling-in subscriber who has been given talking connections as described, desires to communicate with another subscriber whose line terminates in a different jack, the operator would complete the connection by plugging in with the opposite end of the cord. This end of the cord is not shown in the diagram, and may, of course, be either a reproduction of the half shown and employed with the system now being described or may be any other suitable cord circuit adapted to the character of line upon which the wanted subscriber is located. Assuming, however, that the subscriber who called in, desires a connection with another subscriber upon the same party-line, the operation of completing this connection would vary, depending upon whether or not the subscriber wanted is between the calling subscriber and "central" or toward the opposite end of the line. In the latter event, the exchange operator upon receiving the order would first direct the subscriber to hang up his receiver momentarily, and then proceed as follows: She would first depress key I, thus putting the positive side of the main battery to ground, and thereafter, while still holding the key I closed, would operate the pass-key, the result of these two operations being to extend the circuit from the calling subscriber's station to the next succeeding station, without destroying the calling subscriber's talking connections. The circuit thus established by the operator would be from ground 73 to key I, thence over 74 to and through the main battery, thence over 75 to the tip side of spring 76 of the pass-key now in contact with the outer spring 77, and so out over the left main line to the subscriber's station who has called. There the circuit would be over 45 to and through one winding of the ringer relay, thence over 44 to and through spool 2 of the selector relay, thence over 43 to and through contact springs 4 and 5, thence over 71, through transmitter 72 and over a conductor 78 which includes the second winding of the ringer relay, thence over 79 to springs 15 and 13, which latter is connected to ground at 28 through the switch-hook. It will be noted that the circuit so traced passes through both sets of windings of the ringer relay and in such direction that one winding approximately neutralizes the inductive effect of the other, and this relay accordingly does not operate. The selector relay, however, is energized properly to draw down its armature, latch its switch spring and so extend the link circuit to the next station. Having thus passed the calling subscriber's station, the passing of any given number of additional stations to ex-

tend the line to the desired station is accomplished by simply throwing counted out impulses onto the line by repeatedly operating the pass-key, but without holding the auxiliary key I closed. The circuit for these counted out impulses is a full metallic circuit which includes the main battery the same as the circuit last described; the difference in the circuit at the exchange being simply that a top contact 80 carried by the auxiliary key I closes the positive side of the main battery direct to the sleeve side of the cord through the pass-key spring 76' and that the ground at 73 is open. At the subscriber's station this circuit is from right main line through springs 4 and 5 of the selector relay, thence over 43, spool 2, conductor 44, magnet winding of the ringer relay and conductor 45 to the left main line. Having thus arrived at the desired station, the operator presses the ringing key which places the negative side of the generator to line through conductor 81, contact 82 and key spring 83, and the positive side to line through conductor 84, contact 85 and key spring 83'. The first movement of the ringer relay at the station thus selected under this ringing current establishes talking connections, in a manner hereinbefore fully described, and the continued ringing of the bell calls the subscriber to the telephone.

In case a subscriber were wanted between the calling subscriber and "central", the previously described operations of selecting would be modified only to the extent that the exchange operator after taking the order, would "clear" or restore the line to normal (as hereinafter described), then first select the nearer subscriber by counting out and passing successive stations until the desired one was arrived at; then having rung this subscriber's bell and called him to the telephone, pass on and select the station of the subscriber who originated the call, precisely as before described.

The system is so organized that whenever the operator has passed all of the stations on the line, either by means of the running key or by means of the passing key, upon arriving at, and passing an impulse through, the grounder in the passing direction, a grounded circuit from "central" to and through the grounder is established which restores the line to normal.

In case the running key is closed at the time the end of the line is reached, an impulse passing through the grounder throws upwardly the engaging end of its armature, thus unlatching and releasing the switch-spring 22, which is tensioned to rise and engage the grounding spring 24. The establishment of this ground which, it will be seen, is upon the left main line (the right line being opened by the same switching movement) operates the relay A in pre-

cisely the same manner as in picking up a "set" station. A shunt circuit is also established through the left-hand spool 86 of the relay C which draws down the corre-

sponding end of its armature 65 and places the opposite end thereof in engagement with a grounding contact 87. The shunt circuit is from top spring 61 of the relay A to a second top spring 61', thence over 88 to and through the relay and over conductor 32 to and through the talking battery, and to ground over 33. As soon as the ground at relay C is closed a circuit is established from there through the main battery, said circuit being from the armature of the relay 65, over 66, through the main battery H, thence over 62 to springs 61 and 47, thence over 46 to the sleeve side of the running key, and so out over the left main line and to ground at the end of the line. This circuit includes one winding only of each of the several spools 1 of the several selecting relays S, as well also as both spools of the grounder magnet. The polarity of this circuit is such as to restore the selectors S and grounder G to normal. Should it happen that any one of the sub-stations has been passed without restoring the ringer relay, and thus destroying the talking connections, as would, of course, be the case after two or more parties had been placed in talking connection on the same line, the operator will accomplish the restoration of this non-locked out subscriber's station by simply running over the line a second time with the passing key.

The circuit connections and arrangement of the supervisory signal E are quite similar to those used in connection with other common battery systems.

89 designates a differentially wound relay, the windings of which are included in two branches 90 and 91 which lead from the inner springs of the running key to the respective sides of the talking battery. Armature 92 of the differential relay is connected by conductor 93 with conductor 58 and is adapted to engage when closed a front contact 94 from which the conductor 95 leads to and through the signal lamp and to ground. So long as there is no ground on the external line, differential relay 89 remains open. As soon as the subscriber hangs up his receiver after having been given talking connections, the ground thus established at his station closes a grounded circuit over the right-hand line through the corresponding winding of the differential relay, to talking battery over 91 and to ground at the opposite side of the latter. Thereupon the differential relay closes and the lamp lights through the circuit established from the talking battery through the lamp connections hereinbefore described.

While I have herein shown and described a practical and preferred embodiment of the

invention, yet it is to be understood that the invention is in no wise limited to this specific embodiment.

I claim as my invention:

1. In a party-line lock-out telephone system, a plurality of sub-stations, a pair of line wires extending through the several sub-stations, bridging connections at each sub-station, a selector relay controlling said bridging connections at each sub-station, a transmitter circuit extending across the main lines at each sub-station and including both the transmitter and switch-hook of the telephone set, a lock-out relay controlling said transmitter circuit, said lock-out relay having opposed windings, and suitable circuit connections whereby current may be sent concurrently through the selector relay and through either one or both windings of the lock-out relay to effect concurrent operation of both relays or operation of one without operating the other at will.

2. In a party-line lock-out telephone system, a plurality of sub-stations, a pair of line wires extending through the several sub-stations, bridging connections at each sub-station, a selector relay controlling said bridging connections at each sub-station, a direct current transmitter circuit extending across the main lines at each sub-station in shunt relation to the before-mentioned bridging connections and including both the transmitter and switch-hook of the telephone set, a lock-out relay controlling said transmitter circuit, said lock-out relay having opposed windings, a source of current supply and suitable circuit connections for at will sending current through the selector relay and one winding only of the lock-out relay, or through the selector relay and through both windings of the lock-out relay.

3. In an electrical selecting system, the combination with a pair of main line wires and a source of both grounded and metallic current supply, of two magnets connected in series across the main lines for operation by metallic circuit, one of said magnets being provided with two windings arranged to oppose each other when current is sent through both in series, and means for at will establishing a grounding connection whereby current is sent over one main line and serially through both windings of the one magnet and the winding of the other magnet.

4. In an electrical selecting system, the combination with a pair of main line wires and a source of both grounded and metallic current supply, of two independently operable magnets normally connected in series across the main lines for operation by metallic circuit, one of said magnets being provided with two windings arranged to oppose each other when current is sent serially through both, means for sending grounded

current over one of said main lines, a grounding branch extending from a point on the metallic circuit serially beyond the windings of both magnets, considered with reference to the line over which said grounded current is sent, back through the opposing winding of the duplex wound magnet and to ground, and contact mechanism operable at will for controlling said grounding branch.

5. In a lock-out telephone system, the combination with a pair of main line wires extending from a central exchange through a plurality of sub-stations, a battery and means for alternatively grounding one side of the battery and connecting the other to one of said main lines, or connecting both poles of the battery to the respective main lines, two independently operable magnets, normally connected in series across the main lines at each sub-station, one of said magnets being a relay magnet and the other being provided with two windings wound to oppose each other when energized by current sent serially through both, a grounding branch extending from a point on the metallic circuit serially beyond the windings of both magnets, considered with reference to the line over which grounded current is sent, back through the opposing winding of the duplex wound magnet and to ground, contact mechanism operable by said duplex wound relay for opening and closing said grounding branch, switch-hook contacts interposed in said grounding branch, and contact mechanism operable by said relay magnet.

6. In a lock-out telephone system, the combination of a pair of main line wires extending from the central exchange through a plurality of sub-stations, one of said lines being sectionalized at each sub-station, a normally closed bridging connection extending from the continuous main line at each sub-station through a lock-out relay and a selector relay in series and to the end of the section there terminating, normally disabled talking circuit connections controlled by said lock-out relay, normally open direct current transmitter circuit connections also controlled by said lock-out relay, contact mechanism controlled by the selector relay for connecting the end of the sectional line there terminating to the initial end of the succeeding section, and means for transmitting a call signal to "central" from each sub-station.

7. In a lock-out telephone system, the combination of a pair of main metallic line wires extending from the central exchange through a plurality of sub-stations, one of said lines being sectionalized as regards direct current at each sub-station, a normally closed bridging connection extending at each sub-station from the continuous main line

through a lock-out relay and a selector relay in series and to the end of the metallic section on the opposite line there terminating, normally open direct current transmitter circuit connections controlled by said lock-out relay, said latter circuit connections including relatively high resistance, contact mechanism controlled by the selector relay for connecting the end of the sectional line there terminating to the initial end of the succeeding section, means for establishing an operating current through the selector relay and concurrently establishing a neutralizing current through the lock-out relay, and electromagnetic means for restoring the lock-out and selective mechanism of each station to normal.

8. In a common battery lock-out telephone system, the combination of a battery one side of which is normally grounded, a pair of line wires, one normally continuous and the other normally sectionalized at each sub-station, a differential relay at the exchange included in both limbs of the metallic circuit, means at each sub-station for connecting the continuous line to ground and so operating said differential relay, and a signal controlled by said relay.

9. In a party-line telephone system, the combination with an exchange and a plurality of sub-stations, of a metallic link circuit normally completed from the exchange through the first sub-station, electromagnetic station-selecting means at each sub-station for successively extending the link circuit to the next succeeding station, a grounding relay connected in a normally closed bridge across the main lines beyond the last station, grounding contacts actuated by said grounding relay and closed when the latter is energized, a source of grounded current connected with the main line circuit and restoring mechanism at each sub-station, whereby upon the extending of said metallic link circuit beyond the last sub-station said grounding relay is energized, a grounded circuit established and restoration of the selecting mechanisms at the several sub-stations automatically effected.

10. In a common battery lock-out party-line system, a pair of line wires comprising a normally continuous main line and a sectional line, the sections whereof correspond to the reaches between stations, a bridging connection at each sub-station extending from the terminal portion of the section there terminating to the opposite normally continuous line, a selector relay at each sub-station controlling such bridging connection and adapted to disconnect the latter and connect the contiguous ends of sections of the sectional line, whereby a link circuit is successively extended to reach successive sub-stations, lock-out mechanism comprising means for establishing a transmitter-energiz-

ing bridging connection at each sub-station, and means for at will establishing a ground-return circuit through the selector relay at each sub-station, whereby the latter may be
5 operated to extend the link circuit independently of the existence or non-existence of an intact bridging connection at its station.

11. In a common battery lock-out party-line system, a pair of line wires comprising
10 a normally continuous main line and a sectional line, the sections whereof correspond to the reaches between stations, a bridging connection at each sub-station extending from the terminal portion of the section
15 there terminating to the opposite normally continuous line, a selector relay at each sub-station controlling such bridging connection and adapted to disconnect the latter and

connect the contiguous ends of sections of the sectional line, whereby a link circuit is
20 successively extended to reach successive sub-stations, lock-out mechanism comprising means for establishing a transmitter-energizing bridging connection at each sub-station, switch-hook contacts governing the
25 continuity of the latter circuit, and means for at will establishing a ground-return circuit through the selector relay at each sub-station, whereby the latter may be operated
30 to extend the link circuit independently of the existence or non-existence of an intact bridging connection at its station.

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