

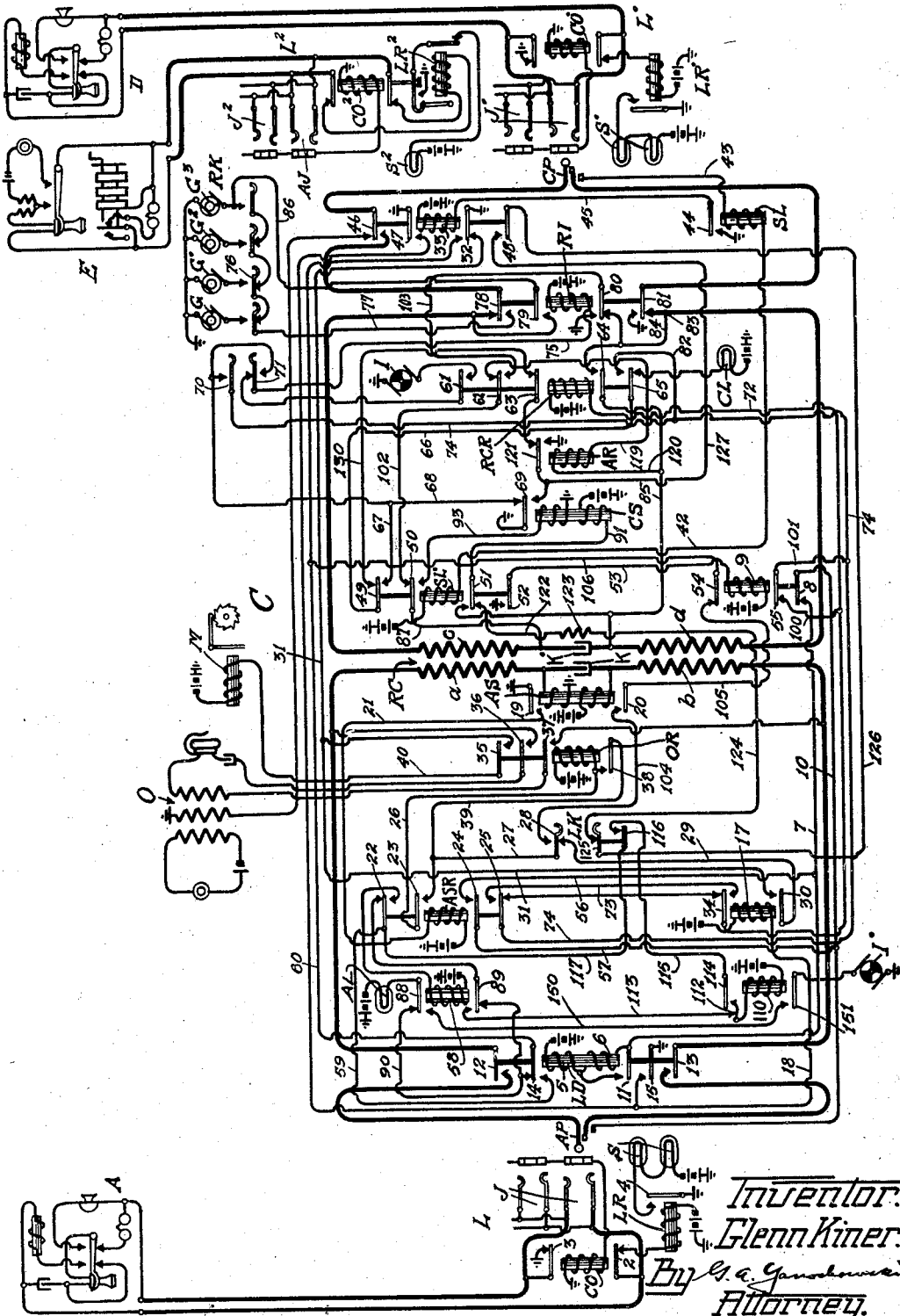
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TELEPHONE SYSTEM

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TELEPHONE SYSTEM

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My invention relates in general to telephone systems in which manual link or cord circuits are provided for interconnecting telephone lines, and has to do more particularly with cord circuits of the "feature type" in which means are provided for interconnecting common battery substations or common battery and magneto substations as calling and called lines.

10 In a common battery exchange system of the single office type in addition to the common battery subscribers' lines which terminate at the local positions of the exchange switchboard the same may be equipped with
15 a tool or rural position at which the rural or toll lines terminate and which is used for extending connections to the outlying or rural section of the community which substations may be of the magneto type. An
20 operator handling a connection between a common battery line and a toll line extends the connection over a trunk circuit to the operator at the rural or toll position of the exchange switchboard and this toll operator
25 in turn completes the connection by connecting a plug ended trunk circuit with the wanted toll line of the rural subscriber. This type of system in addition to the usual apparatus at the local and toll positions is equipped
30 with trunk lines and order wires for purposes well understood and calls from common battery subscribers' lines terminating at the local positions of the exchange switchboard to magneto rural lines terminating at
35 the rural position of the exchange switchboard are handled by the local operators and the rural or toll operator thus necessitating two operators for the completion of a connection of this kind.

40 To obviate the necessity of two operators I devise means in the form of a combination cord circuit whereby in addition to completing connections between common battery subscribers terminating at the different local
45 positions of the exchange switchboard the cord may be used for extending a connection from a calling common battery substation directly to a called rural or magneto substation which terminates at the rural or toll
50 position of the exchange switchboard.

To accomplish this direct connection of a common battery calling subscriber to a magneto rural called line, the rural lines terminating at the toll position of the exchange switchboard are multiplied in the different
55 local positions of the exchange switchboard so that any of the operators at the different local positions may plug into one of the multiples of these rural lines that terminate at the rural position and connect a calling common
60 battery substation to a called magneto substation. The rural position of the exchange switchboard in addition to the magneto equipped rural lines which terminate thereat is equipped with the multiples of the
65 common battery local lines terminating at the local positions and by means of a universal cord circuit which is well understood in the art connections from a calling rural line may be extended to a local common battery called
70 line through a multiple appearing at the rural position.

One object of the present invention is the provision of a new and improved combination cord circuit for effecting the above noted
75 types of connections.

A feature of my invention is the provision of means in a combination cord circuit which provides automatic listening, automatic ringing, secret service, line lamp recall and other
80 features which are well known, when the cord is used in establishing connections between two local common battery subscribers.

A further feature of my invention is the provision of means in a combination cord circuit whereby the operator may connect the operator's set in circuit to supervise a connection between a common battery and a rural line and in which, when the calling
85 common battery subscriber wishes to recall the operator on a connection of this kind, the restoration of the receiver at the calling substation and the removal of the same to initiate a recall causes means in the cord circuit
90 to operate to flash the answering supervisory lamp of the cord to attract the operator's attention.

The above features as well as others not specifically pointed out will be more fully
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hereinafter described in the following specification.

For a more complete understanding of my invention reference may be had to the accompanying drawing. To the left of the drawing I show a common battery substation A terminating at the central exchange in a line circuit L comprising a line relay LR and cut off relay CO. I also provide a plurality of answering jacks J, each having an associated line lamp S; each jack J and its lamp S appearing at different operator's positions so that when the line relay is energized upon the initiation of a call, the associated line lamps S are lit at the different positions and any one of a plurality of operators may seize the call to the exclusion of the others.

Referring to the cord circuit C it comprises an answering plug AP and a calling plug CP connected by the heavily marked conductors and having the repeating coil RC and condensers K and K' interposed. The answering end of the cord circuit C comprises a link disconnect relay LD which is operated when the answering plug AP is inserted into the jack J of a calling line and an answering supervisory relay AS which is operated when the relay LD is operated. An auxiliary supervisory relay ASR is provided and is operated upon the energization of the relay AS and this relay ASR controls the operation of the operators listening relay OR which connects the operators' set O to the cord conductors. A relay 58 controls the operation of the answering supervisory lamp AL and in association with a relay 110 controls the connection of an interrupter I' to the lamp AL for flashing the lamp AL when the calling subscriber recalls on a common battery to magneto connection as will be more fully hereinafter described. A relay 17 is also provided for controlling the energization of the relay LD when the cord C is connected with lines of different character. A listening key LK when actuated controls the operation of the relay OR on a common battery to magneto connection to connect the operator's set O to the cord conductors for supervision purposes.

The calling end of the cord circuit C comprises sleeve relays SL and SL' which operate differently depending upon the connection of the calling plug CP with a common battery or magneto line and a relay 33 under the control of the relay SL which controls the disconnection of the operator's set O from the cord conductors and a relay 9 under the control of the relay SL' which controls the operation of the relay LD on common battery to common battery or common battery to magneto connections all of which will be more fully hereinafter described. A ringing control relay RCR is provided which is operated when a ringing key plunger of the party line ringing key RK is depressed to connect ring-

ing current of the proper ringing frequency to the called line from the generators G, G', G² and G³ which are associated with the ringing key RK.

A ringing interrupter relay RI is also provided which through the medium of the interrupter I is intermittently energized to connect ringing current from the selected generator to actuate the call bell at a called common battery substation. The relays RCR and RI are also energized when ringing a called magneto substation but each time the called magneto line is signalled the said relays are energized to connect ringing current as will be more fully hereinafter described. A calling supervisory relay CS is also provided as is also its associated calling supervisory signal CL. An alternating current relay AR is also provided which is operated when a called magneto line signals for disconnection to control the calling supervisory relay CS and signal CL for disconnect purposes.

To the right of the drawing I illustrate a called common battery substation D terminating at the exchange in a line circuit L' comprising the usual line relay LR', cut off relay CO', multiple answering jacks J' and their associated multiple line signals S'.

The common battery substations A and D in the drawing terminate in line circuits L and L' at the local positions of the exchange switchboard and as previously pointed out the switchboard is provided with a rural or toll position at which the rural magneto subscribers' lines terminate in line circuits. In the drawing I illustrate a magneto substation E terminating in a line circuit L² which comprises a cut off relay CO², a line relay LR², a line signal S² and an answering jack AJ all of which are located at the rural position of the board. The rural magneto substation jacks are multiplied in the different local positions of the exchange board and the multiple jack of the magneto substation E is shown as J² and appears in the position with which the cord circuit C is associated for purposes which will presently be described.

Having described in general the arrangement of the circuits and apparatus employed in my invention, I will now describe more in detail the operation of the cord circuit C in establishing a connection between the common battery substations A and D and a connection between the common battery substation A and the rural magneto substation E.

Assuming that the subscriber at the common battery substation A initiates a call, the removal of the receiver thereat closes an energizing circuit for the line relay LR traced from battery through relay L, normal contact 2 of relay CO of line circuit LR, through the closed contacts of the substation switchhook at A to ground at normal contact 3 of relay CO. Relay LR upon energization closes its

alternate contact 4 to light the multiple line lamps S at a plurality of operators' positions. The operator associated with the cord C answers the call by inserting the answering plug AP of the cord C into the jack J of the calling line A. An energizing circuit is established for the cut off relay CO of the line circuit L and the link disconnect relay LD of the cord circuit C traced from battery through the low and high windings 5 and 6 of the link disconnect relay LD, conductor 7, normal contact 8 of the relay 9, conductor 10, sleeve contacts of the plug AP and jack J to ground through the winding of relay CO. The relays LD and CO are energized over this circuit and the closing of alternate contact 11 of relay LD closes a low resistance circuit through its winding 5 traced from battery through the winding 5, alternate contact 11 to ground through cut off relay CO over the previously described path. Relay CO upon energizing opens its normal contacts 2 and 3 to deenergize relay LR and the relay LR upon deenergizing brings about the effacement of the multiple line signals S. The high resistance winding 6 of relay LD is shunted and this arrangement provides secret service, as the link disconnect relay LD of a second cord will not operate in series with the relay CO as the shunt of the low winding 5 of the relay LD of the first cord as C renders the relay LD of the second cord inoperative so that should the operator at any other position attempt to seize the call after the operator associated with cord C has connected to the calling line, the operator of the second cord is prevented from connecting with the calling subscriber as the shunt of the low winding 5 of the relay LD of the cord C prevents the relay LD of the second cord from operating, and this prevents the operator of the second cord from being connected to the calling line.

The relay LD energizing its contacts 12, 13, 14 and 15 are moved to their alternate positions. Closing of alternate contacts 12 and 13 completes an energizing circuit for the answering supervisory relay AS traced from battery through the lower winding of relay AS, the winding "b" of the repeating coil RC, alternate contact 13 of relay LD, ring contacts of the plug AP and jack J, through the closed contacts of the substation switchhook, the tip contacts of the connected jack J and plug AP, alternate contact 12 of relay LD, winding "a" of the repeating coil RC to ground through the upper winding of relay AS. The closing of alternate contact 15 of relay LD establishes an energizing circuit for relay 17 traced from battery through winding of relay 17, conductor 18 to ground at alternate contact 15 of relay LD for purposes which will presently be described. The relay AS energizing its contacts 19 and 20 are moved to their alternate positions. The closing of alternate contact 19 of relay AS

establishes an energizing circuit for the auxiliary supervisory relay ASR traced from battery through the winding of relay ASR, conductor 21 to ground at alternate contact 19 of relay AS. The relay ASR energizing, its contacts 22, 23, 24 and 25 are moved to their alternate positions. The closing of alternate contact 23 establishes an energizing circuit for the operator's listening relay OR traced from battery, through the winding of relay OR, conductor 26, alternate contact 23 of relay ASR, conductor 27, normal contact 28 of the listening key LK, conductor 29, alternate contact 30 of relay 17, conductor 31 to ground at normal contact 32 of relay 33. The relay OR energizing, its contacts 35, 36, 37 and 38 are moved to their alternate positions and the closing of alternate contact 38 establishes a locking circuit for the relay OR, traced from battery through the winding of relay OR and its alternate contact 38, conductors 39 and 27, through normal contact 28 of the listening key LK to ground at normal contact 32 of relay 33 over the previously described path. The closing of alternate contact 35 of relay OR establishes an energizing circuit for the meter magnet M traced from battery through the winding of magnet M, conductor 40, alternate contact 35 of relay OR, conductor 31 to ground at normal contact 32 of relay 33. The closing of alternate contacts 36 and 37 of relay OR connects the operator's set O to the tip and ring conductors of the cord C and the operator may now inquire the wants of the calling subscriber at the substation A.

Assuming that the subscriber at the common battery substation D is wanted the operator tests the called line as to its idle or busy condition in the usual manner by placing the tip of the plug CP to the sleeve of the jack J' of the called line. Assuming that the line is idle the operator inserts the calling plug CP into the jack J' of the called line thus closing an energizing circuit for the cut off relay CO' of the line circuit L' associated with the called line D and the sleeve relays SL and SL' of the cord C, traced from battery through the winding of relay SL', conductor 42, the winding of relay SL, conductor 43, sleeve contacts of the connected plug CP and jack J' to ground through winding of relay CO'. The relays CO', and SL and SL' are energized over this circuit and the relay SL energizing closes its alternate contact 44 to establish an energizing circuit for the relay 33 traced from battery through the winding of relay 33, conductor 45 to ground at alternate contact 44 of relay SL. Relay 33 energizing its contacts 46, 47, 32 and 48 are moved to their alternate positions. The opening of normal contact 32 of relay 33 opens the locking circuit of relay OR which deenergizes and by opening its alternate contacts 36 and 37 disconnects the operators' set O from the cord con-

ductors. The opening of alternate contact 35 of relay OR brings about the deenergization of the meter magnet M which causes the actuation of the register mechanism to register an answered call.

The closing of alternate contact 32 of relay 33 also establishes an energizing circuit for relay 58 traced from battery through relay 58, alternate contact 22 of relay ASR, conductor 59, alternate contact 14 of relay LD, conductor 60 to ground at alternate contact 32 of relay 33 but the energization of the relay 58 is only incidental at this time. The relay SL' energizing, its contacts 49, 50, 51 and 52 are moved to their alternate positions. The closing of alternate contact 52 closes an energizing circuit for the relay 9, traced from battery through the winding of relay 9, conductor 53 to ground at alternate contact 52 of relay SL'. The relay 9 upon energizing moves its contacts 54, 55 and 8 to their alternate positions. The opening of normal contact 8 of relay 9 opens the initial locking circuit of relay LD but a substitute locking circuit, established for the relay LD when relay ASR energized, may be traced from battery, through the winding of relay LD, its alternate contact 11, conductors 7 and 56, alternate contact 24 of relay ASR, conductors 57 and 10 to ground through cut off relay CO. The closing of alternate contact 49 of relay SL' establishes a circuit for the calling supervisory lamp CL traced from battery through the lamp CL, normal contact 65 of relay RCR, conductor 66, alternate contact 49 of relay SL', conductors 67 and 68 to ground at normal contact 69 of the calling supervisory relay CS and the lamp CL is lighted over this circuit indicating to the operator that the subscriber at the called substation D has not as yet been signaled.

The operator now depresses a key plunger of the party line ringing key RK to select the ringing frequency for operating the call bell at the called substation D. When the key plunger of the ringing key RK associated with the selected frequency is fully depressed the end springs 70 and 71 are moved to their alternate positions. The closing of the alternate contact of end spring 70 establishes an energizing circuit for the ringing control relay RCR traced from battery through the winding of relay RCR, conductor 72, alternate contact 34 of relay 17, conductor 73, alternate contact 25 of relay ASR, conductor 74, alternate contact of the end spring 70, conductor 68 to ground at normal contact 69 of relay CS. The closing of the alternate contact of the end spring 71 closes an energizing circuit for the ringing interrupter relay RI traced from battery through the winding of relay RI, conductor 75, the alternate contact of the end spring 71, alternate contact 70, conductor 68 to ground at normal contact 69 of relay CS. Assuming that the generator G'

is the frequency selected for signaling the called substation D the closure of alternate contact 76 of the depressed key plunger connects ringing current from the generator G' through alternate contact 76, conductor 77, alternate contact 78 of the energized relay RI, alternate contact 46 of relay 33, tip contacts of the plug CP and jack J', through the call bell and condenser at the called substation D, back through the ring contacts of the jack J' and plug CP to ground at alternate contact 81 of relay RI. This preliminary application of ringing current over the circuit just traced gives the called subscriber at D an instantaneous first ring. The relay RCR energizing, its alternate contact 65 is closed thus establishing a locking circuit for itself traced from battery through the winding of relay RCR, conductor 72, alternate contact 34 of relay 17, conductor 73, alternate contact 25 of relay ASR, conductors 74 and 82, alternate contact 65 of relay RCR, conductor 66, alternate contact 49 of relay SL', conductors 67 and 68 to ground at normal contact 69 of relay CS. The relay RCR is maintained energized over this circuit independent of the end spring contact 70 as the pressure when released from the actuated key plunger allows the same to assume its indicating position and the end springs 70 and 71 restore to open their alternate contacts.

The opening of normal contact 65 of relay RCR also brings about the effacement of the calling supervisory lamp CL. The closure of alternate contact 61 of the relay RCR now connects the constantly rotating interrupter I in circuit with the ringing interrupter relay RI to intermittently energize the same. This circuit may be traced from battery through the winding of relay RI, conductor 75, normal contact of the end spring 71, alternate contact 61 of relay RCR to ground through the constantly rotating interrupter I. The ringing circuit extends over the same path as described in connection with the instantaneous first ring and the call bell at the substation D is operated intermittently due to the interrupter in the circuit of relay RI. During the application of ringing current a shunt is placed about the winding "d" of the repeating coil RC which may be traced from the point 83, over conductor 84, alternate contact 64 of relay RCR, conductor 85 through the winding "d" to the point 83. This shunt is placed around the winding "d" or the repeating coil RC to take care of the discharge of the condenser at the substation D after each application of ringing current so as not to effect a premature energization of the calling supervisory relay CS as is well understood. The calling subscriber at the substation A also receives a revertive ringing tone the circuit for which extends from the generator G' over conductor 86, alternate contact 79 of relay RI, over the tip conductor of the

cord C, through the winding "c" of the repeating coil RC, conductor 87, alternate contact 50 of relay SL', to ground through the upper winding of relay CS. This ringing tone is induced in the winding "a" of the repeating coil RC from which it extends to the calling substation A to give the subscriber thereat an audible ringing signal.

Should the calling subscriber at the substation A replace his receiver upon the switchhook before the called subscriber at the substation D answers, he will bring about the deenergization of the answering supervisory relay AS. The alternate contact 19 of relay AS is opened upon the deenergization of the relay AS to open the energizing circuit of the relay ASR. The relay ASR deenergizing, its alternate contact 24 is opened to interrupt the locking circuit of the relay LD. Relay LD deenergizes and the opening of its alternate contact 14 opens the energizing circuit of relay 58. The relay ASR deenergizing, its alternate contact 25 is again opened to interrupt the locking circuit through the ringing control relay RCR. The relay RCR deenergizing, its alternate contact 61 is again opened to disconnect the interrupter I from the ringing interrupter relay RI and the relay RI now remains deenergized to prevent further application of ringing current to the called line D. The closing of normal contact 65 of relay RCR again closes a circuit for the calling supervisory lamp CL to light the same and the closing of normal contacts 88 and 14 of the respective relays 58 and LD close a circuit for the answering supervisory lamp AL traced from battery through the lamp AL, normal contact 88 of relay 58, conductor 90, normal contact 14 of relay LD, and conductor 60 to ground at alternate contact 32 of relay 33. The operator noting the two lighted signals AL and CL may now withdraw the plugs AP and CP from the respective jacks J and J' to restore the apparatus to normal as will be more fully hereinafter described.

Assuming that the called subscriber, in response to the call signal, removes his receiver from the switchhook when the ringing interrupter relay RI is in a deenergized condition which is during the silent period, the calling supervisory relay CS will be energized over a circuit traced from battery through the lower winding of relay CS, conductor 91, alternate contact 51 of relay SL', conductor 85, through the winding "d" of the repeating coil RC, normal contact 81 of relay RI, ring contacts of the connected plug CP and jack J' through the now closed contacts of the switchhook at the substation D, back through the tip contacts of the jack J' and plug CP, alternate contact 46 of relay 33 and normal contact 78 of relay RI, the winding "c" of the repeating coil RC, conductor 87, alternate contact 50 of relay SL' and conductor

93 to ground through the upper winding of the relay CS. The relay CS is energized and upon opening its normal contact 69 interrupts the locking circuit of the relay RCR. The relay RCR restores and the opening of its alternate contact 61 disconnects the ringing interrupter I from the relay RI thus preventing further application of ringing current to the called line D. The subscribers A and D are now connected and the talking circuit may be traced over the heavily marked conductors.

The subscribers at the substations A and D having finished their conversation replace their receivers upon their respective switchhooks. The replacing of the receiver at the substation A brings about the deenergization of the relay AS and the relay AS in turn at its alternate contact 19 interrupts the energizing circuit of relay ASR. The relay ASR deenergizing its alternate contact 24 is again opened to interrupt the locking circuit of the link disconnect relay LD and relay LD of the cord C and relay CO of the line circuit L deenergize and the relay LD restoring also opens the circuit of the relay 58 which restores. The replacing of the receiver at the substation D brings about the deenergization of the relay CS. The relays 58 and LD restoring cause the answering supervisory lamp AL to light as previously described and the relay CS restoring causes the calling supervisory lamp CL to light as previously described.

Should the calling subscriber at the substation A wish to recall before the plugs AP and CP are removed from their respective jacks J and J', the removal of the receiver at the substation A will bring about the energization of the line relay LR of the line circuit L to again light the multiple line lamps S and anyone of a plurality of operators may seize the recall to the exclusion of the others or the same operator who handled the original connection may seize the recall by removing the calling plug CP from the jack J' of the called line D. This removal of the plug CP from the jack J' brings about the deenergization of the relays SL and SL' and the relay SL restoring allows relay 33 to restore and the restoration of relay SL' allows relay 9 to restore. The relay 9 restoring its normal contact 8 is again closed to bring about the energization of the relay LD. The operation of the answering end of the cord C to connect the operator's set O to the cord conductors in answering this recall is the same as previously described.

Referring again to the disconnection of the cord C from the calling and called lines A and D, the operator noting the two lighted supervisory signals AL and CL withdraws the plugs from the respective jacks J and J'. The removal of the plug AP from the jack J disconnects the answering end of the cord

C from the calling line A and the removal of the calling plug CP from the jack J' of the called line allows relays SL, SL', 33 and 9 to restore as before described. Relay SL' restoring effaces the signal CL and relay 33 brings about the effacement of the signal AL and the restoration of relay 17. The apparatus used for establishing a connection between the calling subscriber at the substation A and the called subscriber at the substation D is now at normal and is now available for establishing other connections.

Assuming now that the subscriber at the common battery substation A desires to talk to a magneto substation subscriber, upon initiating a call, the operation of the cord circuit C is the same up to and including the connection of the operator's set O to the tip and ring conductors of the cord C. The operator having been connected to the calling line A now inquires the wants of the subscriber thereat and upon being informed that the subscriber at the magneto substation E is wanted, tests the multiple jack J² of the substation E which appears at her position as to its idle or busy condition. Assuming that the line is idle, the calling plug CP of the cord circuit C is inserted into the multiple jack J² of the wanted magneto line. The insertion of the plug CP into the jack J² of the line D closes a circuit traced from battery through the winding of relay SL', conductor 42, through the winding of relay SL, conductor 43, sleeve contacts of the connected plug CP and jack J² to ground through the winding of relay CO² of the line circuit L² associated with the magneto substation E. Relays CO² and SL are energized over this circuit but due to the high resistance of the relay CO² the relay SL' remains deenergized. As relay SL' does not energize over this circuit the relay 9 also remains at normal. The relay SL energizing its alternate contact 44 is closed to bring about the energization of the relay 33. Relay 33 opens its normal contact 32 to interrupt the locking circuit of the relay OR to disconnect the operator's set O from the cord conductors. The relay 9 remaining at normal the initial locking circuit of relay LD is not interrupted as previously described but the locking circuit of relay LD is maintained through normal contact 8 of relay 9 and alternate contact 24 of relay ASR as well as the circuit extending through alternate contact 24 of relay ASR for purposes which will presently be described.

The call bell at the magneto substation E is rung manually, that is, for each application of ringing current the key plunger of the ringing key RK associated with the selected generator frequency must be depressed to its fully actuated position. The application of ringing current to the called line D will now be described. Assuming that the generator G' is of the selected ringing

frequency the depression of the key plunger associated therewith brings about the operation of the end springs 70 and 71. The closing of the alternate contact of end spring 71 brings about the energization of the relay RI to give the called subscriber at substation E an instantaneous first ring as previously described. The closing of the alternate contact of the end spring 70 brings about the energization of the ringing control relay RCR traced from battery through the winding of relay RCR, conductors 72 and 100, normal contact 55 of relay 9, conductors 101 and 74, closed contact of the end spring 70, conductor 68 to ground at normal contact 69 of relay CS. The relay RCR energizes over this circuit but no locking circuit is established therefor as relay SL' is not energized. Relays RCR and RI remain energized as long as the key plunger of the selected frequency is in its fully depressed position to maintain the end spring contacts closed and the ringing circuit extends from the generator G' through the alternate contact 76 of the depressed key plunger, conductor 77, alternate contact 78 of relay RI, alternate contact 46 of relay 33, the tip contacts of the connected plug CP and jack J² through the call bell at the called substation E, through the ring contacts of the jack J² and plug CP to ground at alternate contact 81 of relay RI. The calling subscriber at the calling substation A also receives a reverberative ringing tone the circuit for which may be traced from the generator G² over conductor 86, alternate contact 79 of relay RI, tip conductor of the cord C, winding "c" of the repeating coil RC, conductor 87, normal contact 50 of relay SL', conductor 102, alternate contact 62 of relay RI, conductor 103 to ground at alternate contact 80 of relay RI. This ringing tone is induced in the winding "a" of the repeating coil RC and transmitted to the calling subscriber at A, giving him a reverberative ringing tone.

Each time the call bell at the called substation E is operated the key plunger of the selected ringing frequency must be depressed to bring about the operation of the relays RCR and RI. To supervise the connection between the calling common battery substation A and the called magneto substation E the operator actuates the listening key LK to close its alternate contact 28 which establishes an energizing circuit for the relay OR traced from battery through the winding of relay OR, conductor 26, alternate contact 23 of relay ASR, conductors 39 and 27, alternate contact 28 of the listening key LK, conductor 104, alternate contact 20 of relay AS, conductor 105, normal contact 54 of relay 9, conductors 106 and 60 to ground at alternate contact 32 of relay 33. The relay OR is energized over this circuit and the closing of its alternate contacts 36 and 37 connects the op-

erator's set O to the tip and ring conductors of the cord C. The subscriber at the called substation E, in response to his call bell, removes the receiver from the switchhook which places him in a conversational circuit with the calling subscriber at A over the heavily marked conductors. The operator now restores the listening key LK to open its alternate contact 28 to interrupt the circuit of relay OR which now restores and disconnects the operator's set O from the cord conductors.

The subscribers having finished their conversation replace their receivers on their respective switchhooks. The replacing of the receiver at the calling substation A brings about the deenergization of the relay AS. Relay AS in turn opens the energizing circuit of the relay ASR which deenergizes to open the energizing circuit of the relay 58 but the relay 58 being slow to release is held momentarily energized to close an energizing circuit for the relay 110 traced from battery through the winding of relay 110, its normal contact 112, conductor 113, alternate contact 89 of relay 58, normal contact 22 of relay ASR, conductor 59, alternate contact 14 of relay LD and conductor 60 to ground at alternate contact 32 of relay 33. The relay 110 energizing its make before break contact 114 closes a locking circuit for itself traced from battery through the winding of relay 110, its make before break contact 114, conductor 115, normal contact 116 of the listening key LK, conductors 117 and 59, alternate contact 14 and conductor 60 to ground at alternate contact 32 of relay 33 independent of normal contact 22 of relay ASR. The relay LD does not deenergize when the subscriber at the station A replaces his receiver due to the deenergization of relay ASR as is the case on a common battery to common battery connection as relay LD is held up through the normal contact 8 of relay 9 as relay 9 did not energize when the calling end of the cord C was connected to the called magneto line. The relay 58 deenergizing, its normal contacts 88 and 89 are closed to establish a circuit to light the answering supervisory lamp AL, traced from battery through the lamp AL, normal contact 88, conductor 90, normal contact 89 of relay 58, normal contact 22 of relay ASR, conductor 59, alternate contact 14 of relay LD, conductor 60 to ground at alternate contact 32 of relay 33. The subscriber at the called magneto substation E after replacing his receiver upon the switchhook operates the hand generator at the substation E and the current therefrom passes through the tip contacts of the connected jack J² and plug CP, alternate contact 46 of relay 33, normal contact 78 of relay RI, through the winding "c" of the repeating coil RC, conductor 87, normal contact 50 of relay SL', conductor 102, normal

contact 62 of relay RCR, conductor 119, through the winding of the relay AR, conductors 120 and 85, winding "d" of the repeating coil RC, normal contact 81 of relay RI, ring contacts of the plug CP and jack J² back to the hand generator at the substation E. The relay AR is energized by the current from the generator and closing its alternate contact 121 establishes an energizing circuit for the calling supervisory relay CS traced from battery through the lower winding of relay CS, conductor 91, normal contact 51 of relay SL', conductor 122, the resistance 123, conductor 124, normal contact 125 of the listening key LK, conductor 126, alternate contact 48 of relay 33 and conductor 127 to ground at alternate contact 121 of relay AR. The relay CS upon energizing closes a locking circuit for itself traced from battery through its lower winding to ground at its alternate contact 69 over the previously described path independent of the ground at alternate contact 121 which is opened after the called subscriber at substation E has discontinued operating the hand generator thereat. A circuit is also established for the calling supervisory lamp CL traced from battery through the lamp CL, normal contact 65 of relay RCR, conductor 66, normal contact 49 of relay SL', conductor 130, normal contact 63 of relay RCR, normal contact 121 of relay AR to ground at alternate contact 69 of relay CS and the lamp CL is lighted over this circuit. The lighted signals AL and CL give an indication to the operator that the subscribers at the respective stations A and E have replaced their receivers and she may now remove the plugs AP and CP from the respective jacks J and J².

Assuming now that the subscriber at the calling substation A wishes to recall before the plugs AP and CP are removed from the jacks J and J², the removal of the receiver at the calling common battery substation A again brings about the energization of the relay AS over the line and the relay AS in turn closes an energizing circuit for the relay 58 and the relay 58 energizing, its normal contacts 88 and 89 are opened to efface the answering supervisory signal AL but the closing of alternate contact 89 of the relay 58 closes a substitute circuit for the lamp AL traced from battery through the lamp AL, alternate contact 88 of relay 58, conductor 150, alternate contact 151 of relay 110 to ground through the constantly rotating interrupter I'. The lamp AL is now intermittently lighted and effaced to give the operator a flashing signal which indicates to her that the calling subscriber at the substation A is signalling for a recall. To converse with the recalling subscriber at substation A the operator now actuates her listening key LK to close an energizing circuit for the relay OR traced over a circuit previously described.

Relay OR energizes and closes its alternate contacts 36 and 37 to connect the operator's set O to the cord conductors of the cord C. The listening key LK, when actuated, opens its normal contact 116 which interrupts the locking circuit of the relay 110 which restores and by the opening of its alternate contact 151 disconnects the interrupter I' to prevent further flashing of the lamp AL. In a common battery to magneto connection the called magneto subscriber is rung manually by the operator supervising the connection. After ringing the subscriber the operator usually attends to other calls and if the calling subscriber, after waiting a reasonable time, receives no answer the replacing of his receiver and the immediate removal of the same will bring about the flashing of the signal AL to attract the attention of the operator so that the calling subscriber at A may ask the operator to re-ring the called substation E.

Returning again to the lighted supervisory signals AL and CL, the operator noting the signals removes the plugs AP and CP from the respective jacks J and J². The removal of the plug CP from the jack J² opens the energizing circuit of the relay SL of the cord C and the cut off relay CO² of the line circuit L². The relay SL deenergizing, its alternate contact 44 is opened to bring about the deenergization of relay 33. Relay 33 deenergizing, its alternate contact 48 is opened to bring about the deenergization of the relay CS and the relay CS restoring causes the effacement of the signal CL. The relay 33 restoring, its alternate contact 32 is opened to interrupt the circuit of the lamp AL to efface the same. The removal of the plug AP from the jack J opens the energizing circuits of the relay LD of the cord C and the cut off relay CO of the line circuit L. Relay LD restoring in turn opens the energizing circuit of the relay 17. The apparatus which was used in establishing a connection between a common battery substation as A and a magneto substation E as calling and called lines is now at normal and available of use in establishing other connections.

While I have described my invention operating in connection with a certain circuit arrangement, I do not wish to be limited to the same as changes and modifications may readily suggest themselves to those skilled in the art, and I therefore aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention, what I claim is new and desire to secure by United States Letters Patent, is:

1. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line with a local battery line, and disconnect

means in said cord for disconnecting the answering end of said cord from a calling common battery line incident to actuating the hook switch at the calling station upon termination of conversation between a pair of common battery telephone lines.

2. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line with a local battery line, disconnect means in said cord for disconnecting the answering end of said cord from a calling common battery line incident to the operation of the hook switch at the calling station upon termination of conversation between a pair of common battery telephone lines, and a disconnect signal operative upon the actuation of said hook switch.

3. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line with a local battery line, link disconnect means for the answering end of said cord circuit operative to disconnect said answering end of said cord from a calling common battery line incident to the operation of the hook switch at the calling station upon the termination of conversation between a pair of common battery lines, and means in association with the calling end of said cord to prevent the operation of said disconnect means upon the termination of conversation between a common battery line and a local battery line.

4. A telephone system comprising telephone lines of different character, including common battery lines and local battery lines, a cord circuit including answering and calling terminals for interconnecting two common battery lines or a common battery line with a local battery line, link disconnect means for the answering end of said cord, means in said cord operative incident to actuating the hook switch at the calling substation upon the termination of conversation between a pair of common battery lines to effect the operation of said link disconnect means to disconnect said answering end of said cord from said calling line, and means associated with said calling end of said cord effective when said calling end of said cord is connected with a local battery line to prevent the disconnection of said answering end of said cord from said calling line.

5. A telephone system including a link circuit including answering and calling terminals for interconnecting two common battery lines or a common battery line with a local battery line, a signal associated with said answering end of said cord responsive to actuation of the hook switches at the con-

nected substations to give a disconnect signal upon the termination of conversation between two common battery lines or a common battery line and a local battery line, and means responsive to a subsequent momentary actuation of the hook switch of a calling subscriber to automatically cause an intermittent operation of said signal before disconnection between a calling common battery line and a called local battery line.

6. A telephone system including a link circuit having answering and calling terminals for interconnecting two common battery lines or a common battery line with a local battery line, a signal associated with said answering end of said cord, a link disconnect means for said answering end, means operative incident to the actuation of the switch at the calling substation upon the termination of conversation between a pair of common battery lines to effect said link disconnect means to disconnect said cord from said line to permit a subsequent recall by the calling subscriber, and means in said cord effective upon a connection between a common battery line and a local battery line to prevent the disconnection of said cord from said calling line, and means operative upon a subsequent recall by the calling common battery subscriber for causing an automatic intermittent operation of said signal to denote a recall.

7. In a telephone system, telephone lines including common battery lines and local battery lines, a link circuit for interconnecting two common battery lines or a calling common battery line with a local battery line, a supervisory signal for said link circuit, means operative incident to actuation of the hook switch at the calling station upon the termination of conversation between two common battery lines or between a common battery line and a local battery line to display said signal as a disconnect signal, link disconnect means operative to disconnect said link circuit from the calling line upon termination of conversation between two common battery lines to permit said calling line to recall and relay means effective upon the termination of conversation between a common battery line and a local battery line to prevent the operation of said disconnect means and to cause the operation of said signal in a distinctive manner upon the subsequent recall of said calling common battery line.

8. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line and a local battery line, disconnect means in said cord for operatively disconnecting the answering end of said cord from a calling common battery line, said disconnect means comprising a relay having a high and a low

resistance winding and energizing upon the connection of said cord circuit and said calling line.

9. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit having an answering terminal and a calling terminal, for interconnecting two common battery lines or a common battery line and a local battery line, a disconnect relay having a low resistance winding and a high resistance winding, said relay operable upon the connection of said answering terminal to a calling common battery line, a shunt circuit for said high resistance winding closed upon the energization of said relay to prevent another operator connecting to said calling line, said relay comprising means for operatively disconnecting said cord circuit from said calling line incident to the actuation of the hook switch at the calling station upon the termination of conversation between a pair of common battery telephone lines.

10. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit having an answering terminal and a calling terminal, for interconnecting two common battery lines or a common battery line and a local battery line, a disconnect relay having a low resistance winding and a high resistance winding, said relay operable upon the connection of said answering terminal to a calling common battery line, a shunt circuit for said high resistance winding closed upon the energization of said relay to prevent another operator connecting to said calling line, said relay comprising means for operatively disconnecting said cord circuit from said calling line incident to the actuation of the hook switch at the calling station upon the termination of conversation between a pair of common battery telephone lines, and means for rendering said disconnect means inoperative upon the termination of conversation between a calling common battery line and a called local battery line.

11. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line and a local battery line, a disconnect relay in said cord circuit having a high resistance winding and a low resistance winding, said relay being energized upon the connection of said cord to a calling common battery line, a shunt circuit for said high resistance winding to prevent another operator connecting to said calling line, said relay upon energizing closing the talking conductors of said cord circuit, and deenergizing upon the actuation of the hook switch at said calling station thereby opening said talking conductors and operatively disconnecting said calling

common battery line from said cord circuit.

12. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit for interconnecting two common battery lines or a common battery line and a local battery line, a disconnect relay in said cord circuit having a high resistance winding, said relay being energized upon the connection of said cord to a calling common battery line, a shunt circuit for said high resistance winding to prevent another operator connecting to said calling line, said relay upon energizing closing the talking conductors of said cord circuit, and deenergizing upon the actuation of the hook switch at said calling station thereby opening said talking conductors and operatively disconnecting said calling common battery line from said cord circuit, and means associated with the calling terminal of said circuit to prevent the operation of said disconnect means upon the termination of conversation between a common battery line and a local battery line.

13. A telephone system comprising telephone lines of different character including common battery lines and local battery lines, a cord circuit having an answering terminal and a calling terminal, for interconnecting two common battery lines or a common battery line and a local battery line, a disconnect relay having a low resistance winding and a high resistance winding, said relay operable upon the connection of said answering terminal to a calling common battery line, a shunt circuit for said high resistance winding closed upon the energization of said relay to prevent another operator connecting to said calling line, said relay comprising means for operatively disconnecting said cord circuit from said calling line incident to the actuation of the hook switch at the calling station upon the termination of conversation between a pair of common battery telephone lines, and means associated with the calling terminal of said cord circuit to prevent the operation of said disconnect means upon the termination of conversation between a common battery line and a local battery line.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 21st day of May, 1928.

GLENN KINER.

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