

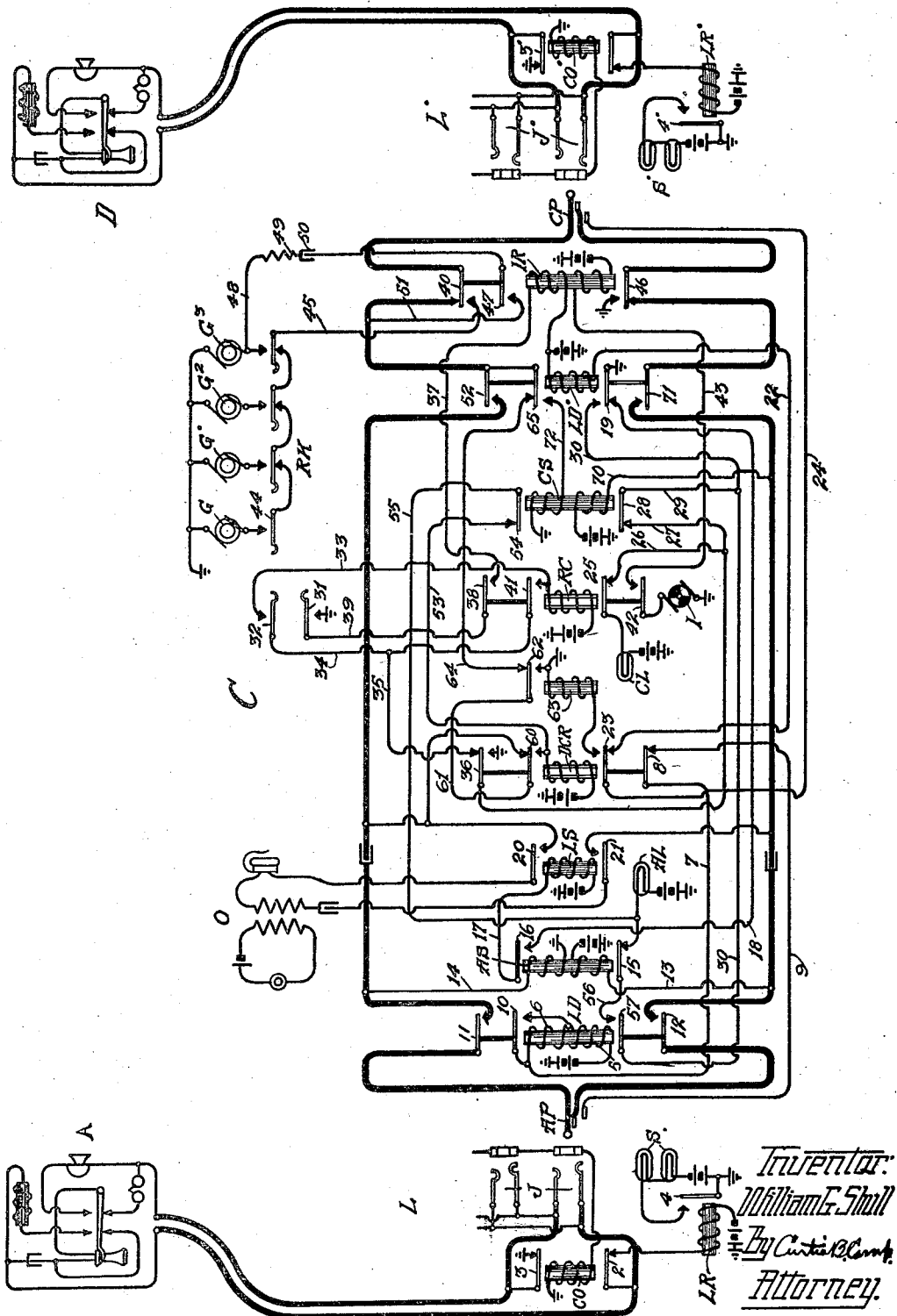
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W. G. SHULL

TELEPHONE SYSTEM

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UNITED STATES PATENT OFFICE.

WILLIAM G. SHULL, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

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To all whom it may concern:

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

My invention relates to telephone systems in which manual link or cord circuits are provided for interconnecting telephone lines, and has to do more particularly with the so-called multiple line lamp systems in which instantaneous disconnect and recall are provided.

In cord circuits of the above character provisions have been made whereby when a calling subscriber replaces his receiver upon the switchhook, means are provided in the cord circuit which operate to disassociate the line current from the connected cord. Should the calling subscriber wish to recall after replacing his receiver upon the switchhook, the removal of the said receiver from its switchhook causes the multiple line lamps to again be lighted so that the recall may be seized by the same operator who handled the original connection, or by another operator, either one to the exclusion of the other.

A feature of my invention is the provision of means in the cord circuit whereby the line circuit of the called subscriber is disassociated from the connected cord circuit when he places his receiver upon the switchhook so that in case he wishes to recall the subsequent removal of the receiver will again bring about the lighting of the multiple line signals associated with his line so that the recall may be seized by another operator.

Another feature of my invention is the provision of means whereby the called subscriber is prevented from initiating a recall until after the calling subscriber has replaced his receiver, and the said means also prevents a calling subscriber from initiating a recall until after the called subscriber has replaced his receiver so that both subscribers must replace their receivers upon their respective switchhooks before their associated line circuits are disassociated from the con-

nected cord to place them in condition to bring about the lighting of the multiple line signals in case either subscriber recalls.

The above features, as well as others, will be more fully hereinafter described in the following specification.

For a better understanding of my invention, reference may be had to the accompanying drawing, in which I illustrate my invention operating in connection with a suitable telephone system.

In the drawing I show a calling substation A and a called substation D, the said calling and called substation A and D connected, respectively, at the exchange to line circuits L and L'. The line circuits L and L' at the exchange comprise, respectively, the usual line relays LR and LR', cut-off relays CO and CO', multiple jacks J and J', and the multiple line signals S and S'. The jacks of the lines are distributed among different operators' positions, and there is a line signal S for each jack so that when a call is initiated over any line, the line signals at the various operators' positions are lighted, and any one of a plurality of operators may seize the call to the exclusion of the other operators.

The cord circuit C for interconnecting substations as A and D is provided with an answering plug AP and a calling plug CP, the said answering and calling plugs AP and CP being connected by the heavily marked conductors. The answering end of the cord circuit C is provided with a combined sleeve and link disconnect relay LD which is energized when the answering plug AP is inserted into the jack J of the calling line. The relay LD is provided with a high resistance winding and a low resistance winding, and upon the actuation of the said relay the high resistance winding is shunted, and this prevents the relay LD in another cord from being energized should another operator attempt to answer the call after it has been seized by an operator, so that an operator at any other cord attempting to seize the call after the first operator has connected to the calling line is prevented from communicating with the subscriber, as

the shunt of the low winding of the relay LD of the first cord prevents the relay LD of the second cord from operating. As the said second operator is not connected to the calling line, due to the relay LD of the second cord remaining at normal, she does not secure an answer from the calling subscriber and withdraws the answering plug of her cord pair from the connected jack.

10 An answering supervisory relay AS is provided which is energized upon the actuation of the relay LD, the said relay AS operating over the line. The relay AS upon actuation prevents the premature lighting of the answering supervisory lamp AL. A listening relay LS is provided and is actuated in response to the energization of the relay AS to connect the operator's set O to the cord conductors.

20 The calling end of the cord circuit C is provided with a combined sleeve and link disconnect relay LD', actuated when the calling plug CP is inserted into the jack J' of the called line. This relay upon energization opens the circuit of the listening relay LS, which relay de-energizes to disconnect the operator's set O from the cord conductors. A party-line ringing key RK is provided for connecting any one of a plurality of generators G, G', G² and G³, depending upon the key plunger that is depressed, to signal the called-for subscriber. An interrupter relay IR is energized upon the actuation of the ringing key RK, the said relay remaining energized as long as the party-line ringing key RK is held in its fully depressed position to assure giving the called subscriber an instantaneous first ring. The depression of the ringing key RK and the operation of relay LD' closes a circuit for the ringing control relay RC, which relay RC controls the connection of ringing current to the called line, and also connects the interrupter I to the interrupter relay IR to intermittently energize and de-energize the said relay IR. A calling supervisory relay CS is also provided which is actuated upon the response of the called subscriber to interrupt the circuit of the relay RC to disconnect ringing current from the line of the answering called subscriber. A calling supervisory lamp CL is provided and is for the usual supervisory purposes. I provide a disconnect control relay DCR, which relay is energized only after both subscribers have replaced their receivers upon their respective switchhooks to condition the line circuits of the respective calling and called line for a recall, as will be more fully hereinafter described.

60 Having described in general the arrangement of the circuits and apparatus employed in my invention, I will now describe in detail the operation of the apparatus in extending a call from the subscriber at the sub-

station A to the subscriber at the called substation D.

Assuming now that the subscriber at the calling substation A initiates a call, the removal of the receiver at the substation closes an energizing circuit for the line relay LR of the line circuit L from battery through the winding of relay LR, normal contact 2 of cut-off relay CO, through the substation A and back to ground at normal contact 3 of relay CO. The line relay LR upon energization closes its alternate contact 4 to light the line lamps S at a plurality of operators' positions. Assuming that it is the operator associated with the cord circuit C that answers the call, the insertion of the answering plug AP into the jack J of the calling line establishes a series energizing circuit for the cut-off relay CO of the line circuit L and the combined sleeve and link disconnect relay LD of the cord circuit C, traced from battery through the windings 5 and 6 of the relay LD, conductor 7, normal contact 8 of the disconnect control relay DCR, conductor 9, sleeve contacts of the connected plug AP and jack J, and through the winding of the cut-off relay CO to ground. The closure of alternate contact 10 of relay LD upon its energization closes a low resistance circuit through its winding 5 by shunting the high winding 6, this circuit being traced from battery through the low resistance winding 5, alternate contact 10, conductor 7, normal contact 8 of relay DCR, conductor 9, sleeve contacts of the connected plug AP and jack J to ground through the winding of cut-off relay CO. The high resistance winding 6 of the relay LD is shunted, this arrangement providing for secret service, as a relay LD of a second cord circuit will not operate in series with the cut-off relay CO as the shunt of the low resistance winding 5 of the relay LD of the first cord circuit renders the relay LD of the second cord circuit that attempted to answer the call inoperative.

The closure of alternate contacts 11 and 12 of the relay LD establishes an energizing circuit for the answering supervisory relay AS, traced from battery through the lower winding of relay AS, conductor 13, alternate contact 12 of relay LD, ring contacts of the connected plug AP and jack J, through the closed contacts at the substation switchhook, back through the tip contacts of the connected jack J and plug AP, alternate contact 11 of the relay LD, conductor 14, and through the upper winding of supervisory relay AS to ground, and the opening of normal contact 15 of the supervisory relay AS prevents the premature lighting of the answering supervisory lamp AL. The energization of the cut-off relay CO of the line circuit L opens the energizing circuit of the line relay LR, which relay restores and the interruption of its contact 4 effaces the

line singals S. The closing of alternate contact 16 of relay AS establishes an energizing circuit for the listening relay LS traced from battery through the winding of listening relay LS, conductor 17, alternate contact 16 of relay AS, conductor 18 to ground at normal contact 19 of the combined sleeve and link disconnect relay LD'.

The listening relay LS upon energization closes its alternate contacts 20 and 21 to connect the operator's set O to the cord conductors. Should another operator attempt to seize the call after the operator associated with the cord circuit C is connected thereto, the low resistance path of the winding 5 of the relay LD prevents the relay LD of the second cord from operating, and the relay LD of the second cord circuit failing to operate does not connect the operator's set O of the second cord across the cord conductors. The second operator failing to receive a response when she answers, knows that the call has been answered by another operator and withdraws the plug of her cord circuit from the multiple jack of the calling line.

The operator having been connected to the cord conductors, now inquires the want of the calling subscriber at the substation A, and assuming that it is the subscriber at the substation D that is wanted, the operator now tests the multiple jack J' of the called line as to its idle or busy condition, and if the line is busy the operator will receive the usual busy click in the head receiver of her set.

Assuming that the line is idle, the operator inserts the calling plug CP into the multiple jack J' of the called line D to close a series energizing circuit for the combined sleeve and link disconnect relay LD' of the cord circuit C and the cut-off relay CO' of the line circuit L' associated with the called line D, the circuit being traced from battery through the winding of the relay LD', conductor 22, normal contact 23 of the disconnect control relay DCR, conductor 24, sleeve contacts of the connected plug CP and jack J', and through the winding of the cut-off relay CO' to ground. The opening of normal contact 19 of the relay LD' opens the energizing circuit of the listening relay LS, and the said relay LS restoring opens its alternate contacts 20 and 21, to disconnect the operator's set O from the cord conductors.

The closing of alternate contact 19 of the relay LD' establishes a circuit for the calling supervisory lamp CL, traced from battery through the calling supervisory lamp CL, normal contact 25 of the ringing control relay RC, conductors 26 and 27, normal contact 28 of the calling supervisory relay CS, conductors 29 and 30 to ground at alternate contact 19 of the relay LD', and the said calling supervisory lamp CL is

lighted over this circuit and remains lighted until the operator depresses the party-line ringing key RK. The operator having inserted the plug CP now depresses the proper ringing key plunger of the party-line ringing key RK to its fully depressed position to close the end spring contacts 31 and 32 and to connect the proper ringing generator G, G', G² or G³ to signal the called-for subscriber at the substation D. The closing of alternate contact 32 of the end springs of the party-line ringing key RK brings about the energization of the ringing control relay RC during the interval that the key RK is held down, over a circuit traced from battery through the winding of the ringing control relay RC, conductor 33, closed end spring contact 32, conductors 34 and 35, normal contact 36 of the disconnect control relay DCR, conductor 27, normal contact 28 of calling supervisory relay CS, conductor 29 and 30 to ground at alternate contact 19 of relay LD'. The closing of end spring contact 31 brings about the energization of the interrupter relay IR during the interval that the ringing key RK is held down, over a circuit traced from battery through the upper winding of relay IR, conductor 37, alternate contact 38 of relay RC, conductor 39 to ground at alternate contact 31 of the end spring of the ringing key RK. The interrupter relay IR is energized over this circuit and the closing of alternate contact 40 of the said relay IR connects ringing current from generator G, which we will assume is the generator selected to ring the call bell of the subscriber at the called substation S, giving an instantaneous first ring to the called subscriber's call bell at the substation D.

The ringing control relay RC having been energized, due to the closure of the end spring contact 32, as already described, closes its alternate contact 41 to establish a locking circuit for itself traced from battery through the winding of ringing control relay RC, its alternate contact 41, conductors 34 and 35, normal contact 36 of relay DCR, conductor 27, normal contact 28 of relay CS, conductors 29 and 30 to ground at alternate contact 19 of the relay LD'. The opening of normal contact 25 of the relay RC now effaces the calling supervisory signal CL.

The closing of alternate contact 42 of relay RC connects interrupter I to the lower winding of the interrupter relay IR, the circuit being traced from ground, through the constantly rotating interrupter I, alternate contact 42 of relay RC, conductor 43 to battery and ground through the lower winding of interrupter relay IR. The relay IR is intermittently energized and de-energized over this circuit to connect ringing generator G to the called line over a circuit

traced from the ungrounded pole of the generator G, alternate contact 44 of the depressed ringing key plunger, conductor 45, alternate contact 40 of relay IR, tip contacts of the connected plug CP and jack J', through the condenser and call bell at the called substation D, back through the ring contacts of the connected jack J' and plug CP, to ground through alternate contact 46 of relay IR.

The closing of alternate contact 47 of the interrupter relay IR transmits a ringing tone to the calling subscriber at the substation A, the ringing tone being traced from the low frequency generator G³, which is of 16 cycles, over conductor 48, through resistance 49, condenser 50, alternate contact 47 of relay IR, conductor 51, alternate contact 52 of relay LD', alternate contact 11 of relay LD, tip contacts of the connected plug AP and jack J, through the receiver at the calling substation A, back through ring contacts of the connected plug AP and jack J, alternate contact 12 of relay LD, conductor 13 and through the winding of the answering supervisory relay AS to battery and ground. This tone just traced gives the calling subscriber at the substation A an audible signal notifying him that the called subscriber at substation D is being signaled. The called subscriber at the substation D is thus automatically signaled until he answers in response to his call signal, or until the calling subscriber replaces his receiver before the called subscriber answers.

Should the calling subscriber at the substation A replace his receiver before the called subscriber answers, the answering supervisory relay AS will restore, due to the open switchhook contacts at the calling substation A. The closing of normal contact 15 of the answering supervisory relay establishes an energizing circuit for the disconnect control relay DCR traced from battery through the winding of said relay DCR, conductor 53, normal contact 54 of the calling supervisory relay CS, conductor 55, normal contact 15 of answering supervisory relay AS, conductor 56, alternate contact 57 of the relay LD, conductor 30 to ground at alternate contact 19 of the relay LD'. The disconnect control relay DCR upon energization opens its normal contact 36 which opens the locking circuit of the ringing control relay RC, which relay now de-energizes and restores, and the opening of its alternate contact 42 disconnects the interrupter I from the interrupter relay IR. The relay IR restores to normal, opening its alternate contact 40 to prevent further application of ringing current to the called line. The relay DCR upon energization opens its normal contacts 8 and 23 to open the energizing circuits of the combined sleeve and link disconnect relays LD and LD', respectively,

and the said relays LD and LD' now restore, opening the initial energizing circuit of the disconnect control relay DCR at their respective contacts 57 and 19, but due to the slow to release construction of the relay DCR it is momentarily held energized until a locking circuit is established for it which may now be traced from battery through the winding of relay DCR, its alternate contact 60, conductor 61, normal contact 62 of relay 63, conductor 64, normal contact 65 of relay LD', normal contact 40 of relay IR, tip contacts of the connected plug CP and jack J' to ground at normal contact 3' of the cut-off relay CO' of line circuit L', the said cut-off relay CO' having restored to normal, upon the energization of relay DCR, which relay interrupted the series energizing circuit of the relay LD' and the cut-off relay CO' at its normal contact 23.

The closing of alternate contact 36 of relay DCR establishes a circuit for the calling supervisory lamp CL, traced from battery through the lamp CL, normal contact 25 of relay RC, conductors 26 and 27 to ground at alternate contact 36 of relay DCR, bringing about the lighting of the calling supervisory signal CL. A circuit is also established for the answering supervisory lamp AL, traced from battery through the lamp AL, conductor 55, normal contact 54 of relay CS, conductor 53, alternate contact 60 of relay DCR, conductor 61, normal contact 62 of relay 63, conductor 64, normal contact 65 of relay LD', normal contact 40 of relay IR, tip contacts of the connected plug CP and jack J' to ground at normal contact 3' of relay CO', the said answering supervisory lamp AL being lighted over this circuit. The answering supervisory lamp AL and the calling supervisory lamp CL are now lighted over the above traced circuits and indicate to the operator that disconnection is desired, which now takes place in the usual manner.

Assuming that the subscriber at the called substation D, in response to his call bell removes his receiver from its switch-hook, when the interrupter relay IR is in one of its de-energized positions, an energizing circuit is established for the calling supervisor relay CS, traced from battery through the lower winding of relay CS, conductor 70, alternate contact 71 of relay LD', normal contact 46 of relay IR', ring contacts of the connected plug CP and jack J', through the now closed contacts of the substation switch-hook, back through the tip contacts of the connected plug CP and jack J', normal contact 40 of relay IR, alternate contact 65 of relay LD', conductor 72 and through the upper winding of relay CS to ground. The opening of normal contact 28 of relay CS opens the locking circuit of the ringing control relay RC, which relay de-

energizes to open its alternate contact 42, which disconnects the ringing interrupter I from the lower winding of the relay IR. The relay IR now remains at normal and the opening of its alternate contact 40 prevents further application of ringing current to the called subscriber's line.

The calling and called subscribers at the substations A and D are now in conversation, the talking circuit being traced over the heavily marked conductors. After the subscribers have finished conversation, they replace their receivers upon their respective switchhooks, causing the answering and calling supervisory relays AS and CS to restore due to the opening of the switchhook contacts at the respective substations A and D. The closing of normal contacts 15 and 54 of the respective supervisory relays AS and CS closes an energizing circuit for the disconnect control relay DCR traced from battery through the winding of relay DCR, conductor 53, normal contact 54 of the calling supervisory relays CS, conductor 55, normal contact 15 of answering supervisory relay AS, conductor 56, alternate contact 57 of the relay LD, conductor 30 to ground at alternate contact 19 of the relay LD'. The relay DCR upon energization opens its normal contacts 8 and 23 and the opening of normal contact 8 interrupts the energizing circuit of the relay LD, and the opening of normal contact 23 opens the energizing circuit of the relay LD' and the two relays LD and LD' now restore to normal. The relays LD and LD' open their respective contacts 57 and 19, opening the initial energizing circuit of the disconnect control relay DCR, but due to the slow-to-release construction of the relay DCR, it is momentarily held energized until a locking circuit is established for it, which may now be traced from battery through the winding of relay DCR, its alternate contact 60, conductor 61, normal contact 62 of relay 63, conductor 64, normal contact 65 of relay LD', normal contact 40 of relay IR, tip contacts of the connected plug CP and jack J' to ground at normal contact 3' of cut-off relay CO', the said relay CO' having restored when the series energizing circuit of the relay LD' and CO' was interrupted at contact 23 upon the energization of relay DCR. The series energizing circuit of the relay LD and cut-off relay CO is interrupted at the contact 8 of the energized relay DCR and relays LD and CO restore. The relay LD upon restoration opens its alternate contacts 11 and 12, disassociating the calling line from the strands of the link or cord circuit C, and the restoration of relay LD' opens its alternate contacts 52 and 71, disassociating the called line from the strands of the cord circuit C. The closing of alternate contact 36 of the relay DCR establishes a

circuit for the calling supervisory lamp CL, traced from battery through the lamp CL, normal contact 25 of relay RC, conductors 26 and 27 to ground at alternate contact 36 of relay DCR, and the lamp CL is thus lighted over this circuit. A circuit is also established for the answering supervisory lamp AL traced from battery through the lamp AL, conductor 55, normal contact 54 of relay CS, conductor 53, alternate contact 60 of relay DCR, conductor 61, normal contact 62 of relay 63, conductor 64, normal contact 65 of relay LD', normal contact 40 of relay IR, tip contacts of the connected plug CP and jack J' to ground at normal contact 3' of the relay CO', and the answering supervisory lamp AL is thus lighted over this circuit. The closing of alternate contact 23 of relay DCR connects relay 63 over conductor 24 to the sleeve of the connected jack J', but relay 63 is not energized at this time as ground from the sleeve of the connected jack J' extends over the sleeve contacts of the jack J' and plug CP over conductors 24 and through alternate contact 23 of relay DCR to one terminal of the winding of relay 63, while the other terminal of the winding of relay 63 is also connected to ground. The ground potential upon the sleeve of the multiple jacks J' prevents the sleeves of the jacks J' from testing busy when the subscribers have replaced their receivers and the plugs AP and CP are still connected in the respective jacks J and J' so that, should another operator test the line of substation D as to its idle or busy condition, the operator in testing a multiple jack J' will not receive a busy click even though the plug CP is still in the jack J'. Thus, should an operator be busy handling other connections and permit the plugs AP and CP to remain in the jacks, the lines are immediately available as called lines and will test idle.

The operator noting the two lighted supervisory signals AL and CL removes the answering plug AP and calling plug CP from their respective jacks J and J', and the removal of the calling plug CP from the jack J' of the called line opens the energizing circuit of the disconnect control relay at the tip contacts of the plug CP and jack J', and the relay DCR upon de-energization opens its alternate contacts 60 and 36, which opens the circuits of the answering and calling supervisory signals AL and CL, respectively, thus effacing the two signals. The removal of the plug AP from the jack J of the calling line disconnects the answering end of the cord circuit C from the calling line, and the apparatus used in establishing a connection between the calling subscriber at substation A and the called subscriber at substation D is now at normal and available for establishing other connections.

Assuming now that the subscribers at the

calling and called substations A and D have finished conversation, and before the plugs AP and CP have been withdrawn from their respective jacks J and J', the subscriber at the substation A wishes to recall, the removal of the receiver at the substation A brings about the energization of the line relay LR of the line circuit L, and the closure of the alternate contact 4 of the line relay LR brings about the lighting of the multiple line signals S. The recall as initiated by the subscriber at the substation may now be seized by the operator who handled the initial connection, or by an operator at another position.

Assuming that the operator who originally established the connection seizes the recall, the said operator associated with the cord circuit C withdraws the calling plug CP from the jack J' of the called line. This withdrawal of the plug CP opens the locking circuit of the disconnect control relay DCR at the tip contacts of the now disconnected plug CP and jack J', and the relay DCR now restores. The closing of normal contact 8 of the restored relay DCR again closes an energizing circuit for the combined sleeve and link disconnect relay LD from battery through windings 5 and 6 of the relay LD to ground through the winding of the cut-off relay CO, as previously described. The closing of alternate contact 10 of relay LD establishes a circuit through the low resistance winding 5 of relay LD, which shunts the high resistance winding 6 of the said relay LD to prevent a second operator from seizing the recall, as already described. The closing of alternate contacts 11 and 12 of relay LD establishes a circuit for the calling supervisory relay AS, as previously described, and the closing of alternate contact 16 of relay AS closes an energizing circuit for the listening relay LS as already described, and the closing of alternate contacts 20 and 21 of the listening relay LS connects the operator's set O to the cord conductors, and she now inquires the wants of the recalling subscriber at substation A. The operator now tests the line wanted by the recalling subscriber in the usual manner, and the connection from this point is the same as previously described, and a further description is not necessary.

Should an operator other than the one associated with the cord circuit C answer the recall before the operator of the cord circuit C can seize it, the low resistance path through the winding of the relay LD of the second cord that is connected to the recalling line A prevents the relay LD of the cord circuit C from operating for the reasons already described, and the operator at the cord circuit C failing to receive a response knows that the call has been an-

swered and now withdraws the plug AP from the jack J of the recalling line A.

Again assuming that the subscriber at the substations A and D have finished conversation and they replace their receivers upon their respective switchhooks, and before the plugs AP and CP have been withdrawn from their respective jacks J and J', the subscriber at the called substation D wishes to recall. The removal of the receiver at the substation D closes an energizing circuit for the line relay LR', through the switchhook contacts, and the closing of alternate contact 4' of relay LR' brings about the lighting of the multiple line signals S'. The line signals appear before a plurality of operators as previously described, and any one of the operators before whom the signals S' appear may seize the recall to the exclusion of the others. The operator seizing the recall inserts the answering plug AP of a cord pair into the multiple jack J' of the recalling line D, thereby establishing a series of energizing circuit for the combined sleeve and link disconnect relay LD of the cord used and the cut-off relay CO' of the recalling line D. The operation of the recalling connection from this point is the same as previously described, and a further description is not thought necessary. The operator of the cord circuit C that supervised the original connection between the substation A and the now recalling substation D cannot seize the recall of the called substation, while either plugs AP or CP remain in the jacks J and J', but the operator may withdraw both the answering and calling plugs AP and CP from the jacks J and J', and then establish a connection with the recalling line D by inserting the answering plug AP into the jack J' of the recalling line and handle the call in the usual way, as previously described.

The insertion of the plug AP of the cord seizing the recall of substation D places a busy or battery potential upon the sleeves of the multiple jacks J' of the recalling line for the usual busying purposes, and this battery also extends from the sleeve of the jack J' with which the calling plug CP of the first cord circuit is still connected to the sleeve of the plug CP, over conductor 24, through alternate contact 23 of relay DCR and through the winding of relay 63 to ground. The locking circuit of relay DCR was interrupted upon the energization of the cut-off relay CO' when the recall was seized by another operator, as before described, by the opening of normal contact 3'. The relay DCR being slow to release is held momentarily energized until a substitute locking circuit is established for it, upon the energization of the relay 63, as above described, which upon energization closes its alternate

contact 62, establishing this substitute circuit traced from battery through the winding of relay DCR, its alternate contact 60, conductor 61, to ground at alternate contact 62 of relay 63. The relay 63 and relay DCR will remain energized until the operator of the cord circuit C withdraws the plug CP so that there will be no possible interference with the recalling line, as is readily apparent. When the operator of cord C withdraws the plug CP from the jack J', relay 63 restores and the opening of its alternate contact 62 opens the locking circuit of relay DCR, which now restores to normal and the withdrawal of the plug AP from the jack J now restores the apparatus of cord circuit C to normal and it is available for use in establishing other connections.

From the above description it may be seen that both receivers of the respective parties must be upon their respective switchhooks before a recall by either party may be initiated. Should the called subscriber at the substation D fail to replace his receiver upon the switchhook and should the calling subscriber at the substation A attempt a recall, the replacing of the receiver on the switchhook at the substation A would bring about the de-energization of the answering supervisory relay AS, which will close a circuit for the supervisory lamp AL to ground at alternate contact 19 of relay LD'. The subscriber at the substation D having failed to replace his receiver, the calling supervisory relay CS remains energized and no circuit is established for the disconnect control relay DCR, so the link disconnect relays LD and LD' remain energized through the normal contacts 8 and 23 of relay DCR. Now, when the subscriber at substation A removes his receiver to recall, this removal of the receiver will again energize supervisory relay AS and again efface the supervisory signal AL. The link disconnect relays LD and LD' are held energized in series relation with cut-off relays CO and CO', respectively, and the line circuit L of the calling substation A is not disassociated from the cord circuit C, and the cut-off relay CO remaining energized, the line signals S are not lighted. Thus, it will be seen that all the recalling subscriber can do is to wink his switchhook to flash the supervisory signal AL. Should the calling subscriber at substation A fail to replace his receiver and should the called subscriber replace his receiver and then immediately recall, this action of the cord circuit C would be the same in that relay DCR would fail to energize due to the continued energization of the answering supervisory relay AS and thus the subscriber at substation D under these conditions will only control the calling supervisory lamp

CL, for the same reason as above described.

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.

What I claim as new and desire to secure by Letters Patent, is:

1. A telephone system including a pair of telephone lines connected for conversation by means of a link circuit applied to multiple terminals of said lines, means controlled by the subscribers jointly to operatively free both lines from said link circuit while applied to said terminals, said means including a pair of relays one for each line energized during conversation, each to close a switch contact in the talking circuit between said lines.
2. A telephone system including a pair of telephone lines, a link circuit for interconnecting said telephone lines in conversational circuit, normally open contacts in the talking conductors of each end of said link circuit, a pair of relays energizable to close said contacts during conversation, means controlled by the subscribers jointly to de-energize said relays to open said contacts to free said lines from said link circuit.
3. A telephone system including a calling line and a called line, and a link circuit interconnecting them having a talking strand with a normally open switch contact, a link circuit relay normally conductively connected between one pole of a source of current and a terminal of said link circuit and energized by the application of said terminal to the calling line, said relay serving on energization to close said switch contact, means controlled over the calling line and called line to de-energize said relay, multiple terminals for said line, and switching means controlled over a contact of said relay to remove a busy condition from said terminals while said link circuit remains connected with said line.
4. A telephone system including a calling line and a called line interconnected for conversation by link circuit means applied to terminals of said lines, said means including a relay having one end of its winding normally connected to battery and the other end connected to a terminal of the link circuit, said relay energized by the connection of said terminal to a line, talking strands of said link circuit having normally open contacts of said relay connected in them, said contacts closed when said relay is energized, and means cooperatively controlled over the calling and called line to free said lines from busy test and to recall while said link

circuit is connected to terminals of said lines.

5. A telephone system including a calling line and a link circuit applied to a multiple terminal thereof, a relay for said link circuit energized on such application to close talking contacts of said link circuit and to short-circuit a portion of its winding, a called line connected to said calling line over said link circuit, and switching means controlled over said lines to make them test idle and display signals while said link circuit is applied to said multiple terminal, said switching means including a contact of said relay.

6. A telephone system including a telephone line provided with multiple terminals, a link circuit connected to one of said terminals, a relay for said link circuit energized on connection to close a talking contact of said circuit, means to establish a low resistance holding circuit for said relay, subscriber-operated apparatus to cause said line to test idle while said circuit is connected to said terminal, and means to display a recall signal before an operator.

7. A telephone system including a telephone line provided with multiple terminals, a link circuit connected to one of said terminals, a relay for said link circuit energized on connection, means to establish a low resistance holding circuit for said relay for secret service purposes, a second relay for said link circuit connected to said terminal and so to said telephone line by the energization of said first relay, and means responsive to said second relay to de-energize the first, said means including a third link circuit relay held energized to prevent reoperation of said first relay.

8. A telephone system including a telephone line and a link circuit having a terminal connected to a multiple terminal thereof, a link circuit relay for operation by current over said line normally disconnected from said link circuit terminal, another relay connected in series with battery by the connection of said circuit and said line and energized to close a talking contact to connect said first relay to said line, means for de-energizing said other relay controlled by said first relay, and a third relay to remove the busy test from said line while said link circuit is connected with said line.

9. A telephone system including a subscriber's line and a cord circuit connected thereto, a pair of relays for said cord circuit, one serving when disconnection is desired to switch the subscriber's line limbs clear at the cord and the other serving to remove the busy test from the line, a third relay for said link circuit for closing a contact of the circuit of said other relay, said first relay controlling contacts in the circuit

of said third relay, a supervisory signal of said cord circuit, and a circuit for said supervisory signal including contacts controlled by said first and third relays.

10. A telephone system including a calling subscriber's line terminating in multiple terminals, a cord circuit connected to said line via one of said terminals and whose talking strands pass through normally open contacts of a cord circuit relay, means for holding said relay energized during conversation, said relay provided with means for preventing another cord circuit from being operatively connected to said line while said relay is energized, means controlled over said line to de-energize said relay to switch the subscriber's line limbs free at the cord by opening said strands, and a relay energized by the subscriber to free his line from busy potential.

11. A telephone system including a pair of telephone lines connected for conversation by means of a link circuit applied to multiple terminals of said lines, means controlled by the subscribers jointly to operatively free both lines from said link circuit while applied to said terminals, said means including a pair of relays one for each line energized during conversation, each to close a switch contact in the talking circuit between said lines, supervisory signals for said link circuit, line signals for said lines respectively, and means whereby the subscribers cause the display of said supervisory signals and of their respective line signals simultaneously.

12. A telephone system including a calling line and a called line, and a link circuit interconnecting them having a talking strand with a normally open switch contact, a link circuit relay normally conductively connected between one pole of a source of current and a terminal of said link circuit and energized by the application of said terminal to the calling line, said relay serving on energization to close said switch contact, means controlled over the calling line and called line to de-energize said relay, multiple terminals for said line, and switching means controlled over a contact of said relay to remove a busy condition from said terminals while said link circuit remains connected with said line, line signals for the calling and called line respectively, and means for displaying said signals while said link circuit remains applied to terminals of said lines.

Signed by me at Chicago, in the county of Cook and State of Illinois, this 27 day of January, 1921.

WILLIAM G. SHULL.