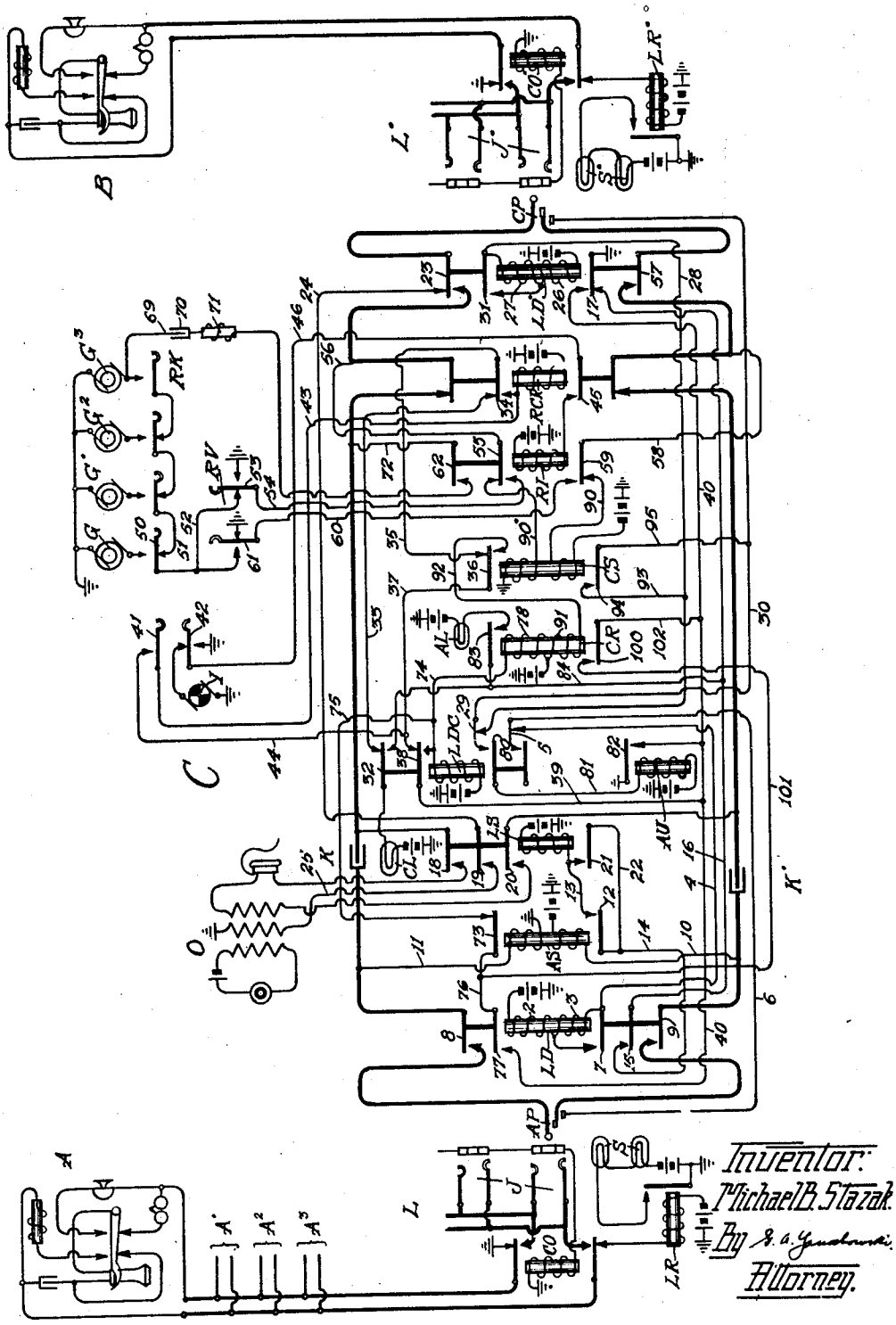
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TELEPHONE SYSTEM

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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 the so called multiple answering jack systems in which the answering jacks of the lines are distributed among different operators' positions, and in which there is a line signal for each jack at the different operators' positions so that when a call is initiated over any line the line signals at the operators' positions are lighted and any one of a plurality of operators may seize the call to the exclusion of the other operators and in which instantaneous disconnect and recall are provided.

In cord circuits of the above character on a revertive call in which a calling subscriber initiates a call and wishes to converse with a subscriber on the same line the usual procedure is for the operator to request the calling subscriber to replace his receiver for a moment while the called party is being signaled and on a call of this kind the operator withdraws the answering plug and inserts the calling plug into the answering jack of the calling line and then signals the called subscriber in the usual manner. After the completion of conversation the subscribers replace their receivers upon their switchhooks to bring about the lighting of the supervisory lamps. Should either of the subscribers recall they would immediately efface the supervisory signals of the cord circuit connected to the line and to attract the attention of the operator the receiver at the recalling substation is operated to flash the supervisory signals to signal for a recall. This arrangement permits the subscribers to recall but only the operator that handled the original connection is able to answer the recall. To overcome this objection I provide means in the cord circuit whereby when the subscribers on a revertive call replace their receivers the means in the cord circuit operates to disconnect the cord conductors from the connected jack and also bring about the deenergization of the cut off relay of the connected line to place the line relay of the line under the control of the subscribers so that should either one on the party line to which the cord is connected recall before the plug is withdrawn the line relay will operate to light the line signals so that the same operator that handled the original call may seize this recall or another operator, either one to the exclusion of the other.

Another feature of my invention is the provision of means in the cord circuit whereby the line circuit of the calling subscriber is disconnected from the connected cord circuit so that upon the removal of the receiver at the calling substation from its switchhook the multiple line signals associated with the calling line are lighted and the recall may be seized by the same operator that handled the original call or by another operator, either one to the exclusion of the other, depending on which one seized the recall first.

A further feature of my invention is the provision of means in the cord circuit whereby the called subscriber is prevented from initiating a recall until after the calling subscriber has replaced his receiver at which time the means in the cord circuit operate to disconnect the connected cord from the line circuit so that upon the removal of the receiver at the called substation from the switchhook the multiple line signals of the called line are lighted and the call may be answered by the operator who established the original connection or by any other operator.

The above features as well as others, will be more fully 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 exchange in a line circuit L comprising the usual 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 and its lamp appearing at different operator's positions so that when the line relay LR is energized upon the initiation of a call, the associated line lamps S are lighted and any one of a plurality of operators may seize the call to the exclusion of the others.

Referring now to the cord circuit C it comprises an answering plug AP and a calling plug CP connected by the heavily marked tip and ring conductors and having the condensers K and K′ interposed. The answering end of the cord circuit comprises a link disconnect relay LD which is operated when the answering plug is inserted

into the jack of a calling line and an answering supervisory relay AS which is operated when the relay LD is operated. A listening relay LS is also provided which operates to connect the operator's set O to the cord conductors. A link disconnect control relay LDC, an auxiliary sleeve relay AU and a revertive recall control relay CR are also provided for the cord circuit C and the function of these relays will be more fully hereinafter described.

The calling end of the cord circuit C comprises a link disconnect relay LD' which is operated when the calling plug is inserted into the jack of a called line. 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 ringing current of the proper frequency to the called line from the generators G, G', G^2 and G^3 depending upon the ringing key plunger which is depressed.

A ringing interrupter relay RI is also provided which through the medium of the interrupter I is intermittently energized and deenergized to connect ringing current from the selected generator of the proper frequency to intermittently actuate the call bell at the called substation. A calling supervisory relay CS is also provided as are also the answering and calling supervisory signals AL and CL for the usual supervisory purposes.

To the right of the drawing I illustrate a called substation B 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 line signals S'.

Having described in general the arrangement of the circuits and apparatus employed in my invention, I now describe more in detail the operation of the circuit A in establishing a connection between a calling and a called subscriber. Assuming that the subscriber at the substation A initiates a call the removal of the receiver at the substation closes an energizing circuit for line relay LR of the line circuit L and the closing of its alternate contact lights the line lamps S at a plurality of operators' positions. Assuming that the operator associated with the cord circuit C answers the call, the insertion of the answering plug AP into the jack J of the calling line A establishes a series energizing circuit for the cut off relay CO of the line circuit L and the link disconnect relay LD of the cord circuit C which is traced from battery through the low and high windings 2 and 3 of the relay LD, conductor 4, normal contact 5 of the link disconnect control relay LDC, conductor 6, sleeve contacts of the connected plug AP and jack J to ground through the winding of the cut off relay CO. The closing of alternate contact 7 of the relay LD due to its energizing closes a low resistance circuit through its winding 2 from battery through the winding 2 of relay LD its alternate contact 7, conductor 4, normal contact 5 of relay LDC, conductor 6, sleeve contacts of the plug AP and jack J to ground through the winding of the cut off relay CO. The high resistance winding 3 of the relay LD is shunted, this arrangement providing for secret service as the relay LD of a second cord will not operate in series with the relay CO, as the shunt of the low winding 2 of the relay LD of the first cord circuit renders the relay LD of the second cord inoperative so that should the operator at any other cord attempt to seize the call after the first operator 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 2 of the relay LD of the first cord circuit 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 operator of the second cord not receiving an answer from the calling subscriber, knows that the call has been answered by another operator and therefore withdraws the plug of the second cord from the multiple answering jack of the calling line.

The relay LD upon energization closes its alternate contacts 8 and 9 to establish a circuit for the answering supervisory relay AS of the cord C, traced from battery, through the lower winding of the relay AS, conductor 10, alternate contact 9 of the relay LD, ring contacts of the connected plug AP and jack J, the closed contacts of the switchhook at substation A back through the tip contacts of the connected jack J and plug AP, alternate contact 8 of the relay LD, and conductor 11 to ground through the upper winding of the relay AS. The closing of alternate contact 12 of the relay AS closes a circuit for the listening relay LS, traced from battery through the winding of the relay LS, conductor 13, alternate contact 12 of the relay AS, conductor 14, alternate contact 15 of relay LD and conductor 16 to ground at normal contact 17 of the link disconnect relay LD' associated with the calling end of the cord C. The relay LS upon energizing closes its alternate contacts 18, 19 and 20 to connect the operator's set O to the cord conductors and the closing of its alternate contact 21 establishes a locking circuit for itself traced from battery through the winding of the relay LS, its alternate contact 21, conductors 22 and 14, alternate contact 15 of relay LD, conductor 16 to ground at normal contact 17 of relay LD'.

The operator having been connected with the cord conductors now inquires the wants of the calling subscriber at substation A.

Assuming that it is the subscriber at the substation B that is wanted, the operator tests the multiple answering jack J' of the called line as to its idle or busy condition and if the said line is busy the sleeve of the jack is of a battery potential different than that of the cord circuit C and the operator's receiver will receive an impulse of current which produces the usual busy click in the head receiver of the operator's set. This impulse of current extends from the tip of the calling plug CP thru normal contact 23 of the relay LD', conductor 24, alternate contact 19 of the listening relay LS, conductor 25 to ground through the tertiary winding of the operator's induction coil. This impulse of current produces a click in the operator's head receiver in the well known manner.

Assuming that the line is idle the operator inserts the calling plug CP into the jack J' of the wanted line closing a series energizing circuit for the link disconnect relay LD' and the cut off relay CO' of the line circuit L' associated with the called line B traced from battery through the windings 26 and 27 of the relay LD', conductor 28, normal contact 29 of the relay LDC, conductor 30, sleeve contacts of the connected plug CP and jack J' to ground through the cut off relay CO'. The closing of alternate contact 31 establishes a circuit for the relay LD' from battery through the low resistance winding 26 of the relay LD', its alternate contact 31 to ground through the winding of the cut off relay CO', over the path just described, and this circuit just traced shunts out the high resistance winding 27 of the relay LD' permitting relay CO' to operate.

The opening of normal contact 17 of the relay LD' opens the energizing circuit of the listening relay LS and the relay LS upon deenergizing opens its alternate contacts 18, 19 and 20 to disconnect the operator's set O from the cord conductors. The closing of alternate contact 17 of relay LD' also establishes a circuit for the calling supervisory lamp CL, from battery through the lamp CL, normal contact 32 of the relay LDC, conductor 33, normal contact 34 of the ringing control relay RCR, conductor 35, normal contact 36 of the calling supervisory relay CS, conductor 37, normal contact 38 of the relay LDC, conductors 39 and 40 to ground at alternate contact 17 of the relay LD'. The calling supervisory lamp signal CL is lighted over this circuit and remains lighted until the operator depresses the party line ringing key RK. Having inserted the calling plug CP in the jack J' of the called line the operator now depresses the proper ringing key plunger of the party line ringing key RK to a fully depressed position to close the end spring contacts 41 and 42 and to connect the proper ringing generator G, G', G^2 or G^3 to signal the called for subscriber at substation B.

The closing of alternate contact 41 of the end springs of the ringing key RK closes an energizing circuit for the relay RCR traced from battery through the winding of relay RCR, conductor 43, alternate contact 41 of the end springs, conductor 44, normal contact 38 of the relay LDC, conductors 39 and 40 to ground at alternate contact 17 of the relay LD'. The closing of alternate contact 45 of the relay RCR establishes an energizing circuit for the ringing interrupter relay RI, from battery through the winding of the relay RI, alternate contact 45, conductor 46 to ground at alternate contact 42 of the end springs. The relay RCR energizing closes its alternate contact 34 to establish a locking circuit for itself, traced from battery through the winding of the relay RCR, its alternate contact 34, conductor 35, normal contact 36 of relay CS, conductor 37, normal contact 38 of relay LDC, conductors 39 and 40 to ground at alternate contact 17 of the relay LD'. The relay RCR upon energization opens its normal contact 34 to open the circuit of the calling supervisory lamp CL which is effaced and gives the operator an indication that the called subscriber at substation B is being signalled.

After the ringing key plunger of the ringing key RK associated with the selected ringing frequency is released it assumes its indicating position which allows the end spring contacts 41 and 42 to assume their normal position, but as the relay RCR is locked to ground at alternate contact 17 of the relay LD' as just described, the ringing interrupter relay RI is now connected to the constantly rotating interrupter I; traced from battery through the winding of relay RI, alternate contact 45 of relay RCR, conductor 46, normal contact 42 of the end springs to ground through the constantly rotating interrupter I. Ringing current from the generator G which we will assume is the ringing frequency selected is now traced from the generator G, alternate contact 50 of the ringing key plunger, conductors 51 and 52, normal contact 53 of the reversing key RV, conductor 54, alternate contact 55 of the ringing interrupter relay RI, conductor 56, alternate contact 23 of the relay LD', tip contacts of the connected plug CP and jack J' through the condenser and call bell at the called substation B, back through the ring contacts of the connected jack J', and plug CP, alternate contact 57 of the relay LD', conductor 58, alternate contact 59 of relay RI, conductor 60, to ground at normal contact 61 of the reversing key RV. The relay RI is intermittently energized and deenergized by the interrupter I and the ringing current from the generator G is thus applied to intermittently

operate the call signal at the called substation B. The closing of alternate contact 62 of relay RI transmits a ringing tone to the calling subscriber at the substation A which is traced from the generator G³, over conductor 69 through the condenser 70 and resistance 71 through alternate contact 62 of the relay RI and over conductor 72 to the tip conductor of the cord C and to the calling substation A. This gives the calling subscriber at the substation A an audible signal notifying him that the called subscriber at substation B is being signalled. The called subscriber at substation B is thus automatically signalled over the ringing circuit just traced until he answers in response to his call signal or until the calling subscriber at the substation A replaces his receiver before the called subscriber answers.

Should the calling subscriber at the substation A replace his receiver upon the switchhook before the called subscriber answers, the supervisory relay AS will restore due to the interrupted switchhook contacts at the substation A. The relay AS upon deenergization closes its normal contact 73 which establishes an energizing circuit for the link disconnect control relay LDC traced from battery through the winding of the relay LDC, conductors 74 and 75, normal contact 73 of relay AS, conductor 76, alternate contact 77 of the relay LD, conductor 40 to ground at alternate contact 17 of the relay LD′. The relay CR is also energized upon the closure of normal contact 73 over a circuit traced from battery through its upper winding 78, conductors 74 and 75 to ground at alternate contact 17 of relay LD′ over the path just traced for relay LDC. The relay LDC upon energization opens its normal contacts 5 and 29 which open the energizing circuits of the relays LD and LD′, said relays restoring to normal. The opening of normal contact 38 of the relay LDC opens the locking circuit for the ringing control relay RCR and the relay deenergizes to open its alternate contact 45, which opens the circuit of the ringing interrupter relay RI and the relay RI restoring to normal, its alternate contact 55 is opened to disconnect the generator G and prevent further application of ringing current to the called subscriber's line.

The closing of alternate contact 80 of the relay LDC establishes an energizing circuit for the auxiliary sleeve relay AU, traced from battery through the winding of the relay AU, conductor 81, alternate contact 80 of the relay LDC, conductor 30, sleeve contacts of the connected plug CP of jack J′ to ground through cut off relay CO′ of the line circuit L. The relay LDC has its initial energizing circuit opened at alternate contact 17 of relay LD′ when the same deenergizes but the closing of alternate contact 82 of the relay AU establishes a substitute circuit for the relay LDC traced from battery through the winding of the relay LDC, its alternate contact 38, conductors 39 and 40 to ground at alternate contact 82 of relay AU and the relay CR is also maintained energized over this circuit from battery through its winding 78, alternate contact 38 to ground at contact 82 of relay AU. The closing of alternate contact 83 of the relay CR establishes a circuit for the answering supervisory lamp AL traced from battery through the lamp AL, alternate contact 83 of relay CR conductors 84 and 16 to ground at normal contact 17 of the relay LD′ and the closing of alternate contact 32 of the relay LDC establishes a circuit for the calling supervisory lamp CL, traced from battery through the lamp CL, alternate contact 32, conductors 84 and 16 to ground at normal contact 17 of the relay LD′. The two lighted supervisory signals CL and AL are now lighted and indicate to the operator of the cord C that the calling subscriber at substation A has replaced his receiver.

The opening of alternate contacts 8 and 9 of the relay LD disconnects the cord conductors from the calling line and the opening of normal contact 5 of the relay LDC opens the energizing circuit of the cut off relay CO allowing the relay to restore which permits the calling subscriber at substation A to immediately recall so that upon the removal of the receiver at substation A the line relay LR will again energize to permit the lighting of the line signals S. The opening of alternate contacts 23 and 57 of the relay LD′ disconnects the calling end of the cord conductors from the called line and as the relay AU is now in series circuit with the cut off relay CO′ in place of the relay LD′ which was disconnected when the normal contact 29 of relay LDC was opened the cut off relay CO′ deenergizes due to the high resistance of the relay AU to again place the line relay LR′ of the line circuit L′ under the control of the called subscriber at the substation B so that should the subscriber at the called substation B remove his receiver the line relay LR′ will energize to light the line signals S′.

Returning now to the point where the call bell at the called station B is intermittently rung, the subscriber at the called substation B in response to his call signal removes his receiver from the switchhook. When the relay RI is in a deenergized condition which is during a silent period the calling supervisory relay CS will operate over a circuit traced from battery through the lower winding of the relay CS, conductor 90, normal contact 59 of relay RI, conductor 58, alternate contact 57 of the relay LD′, ring contacts of the connected plug CP and jack J′, through the now closed contacts of the substation switchhook, back through the tip

contacts of the connected jack J′ and plug CP, alternate contact 23 of the relay LD′, conductor 56, normal contact 55 of the relay RI, conductor 90′ to ground through the upper winding of the relay CS. The relay CS upon energizing opens its normal contact 36 which opens the locking circuit of the ringing control relay RCR, and the ringing control relay RCR upon deenergization opens its alternate contact 45 which disconnects the ringing interrupter I from the relay RI. The relay RI is prevented from energizing and remains at normal thus preventing the further application of ringing current to the called subscriber's line.

The closing of alternate contact 36 of the relay CS establishes an energizing circuit for the relay CR traced from battery through its lower winding 91, conductor 92, alternate contact 36 of the relay CS, conductor 37, normal contact 38 of the relay LDC, conductors 39 and 40 to ground at alternate contact 17 of relay LD′.

The calling subscriber at the substation A and the called subscriber at substation B are now connected in a conversational circuit, the talking circuit being traced over the heavily marked conductors. After the subscribers have finished their conversation, they replace their receivers upon their respective switchhooks. The replacing of the receiver at the substation A allows the relay AS to restore to normal due to the interruption of its energizing circuit at the switchhook contacts. The closing of normal contact 73 of the relay AS establishes an energizing circuit for the link disconnect control relay LDC traced from battery through the winding of the relay LDC, conductors 74 and 75, normal contact 73 of the relay AS, conductor 76, alternate contact 77 of the relay LD, conductor 40 to ground at alternate contact 17 of the relay LD′ and the relay LDC upon energizing opens its normal contact 5 which opens the energizing circuit of the link disconnect relay LD. The relay LD upon deenergization restores to normal and the opening of alternate contacts 8 and 9 disconnects the cord conductors of the cord C from the jack J and the relay CO of the line circuit L also restores to normal due to the opening of normal contact 5 of relay LDC. The relay CO upon deenergization again places the line relay LR of the link circuit L under the control of the calling subscriber at the substation A so that if he wishes to recall, the removal of the receiver at the substation again causes the energization of the line relay LR which relay LR again brings about the lighting of the line signals S.

Relay LDC upon energization opens its normal contact 29 to open the initial energizing circuit of the link disconnect relay LD′, but the relay LD′ is held energized over a circuit traced from battery through the winding 26 of the relay LD′, its alternate contact 31, conductors 28 and 93, alternate contact 94 of relay CS conductors 95 and 30, sleeve contacts of the connected plug CP and jack J′ to ground through the cut off relay CO′. The closing of alternate contact 80 of the relay LDC establishes an energizing circuit for the relay AU traced from battery through the winding of the relay AU, conductor 81, alternate contact 80 of the relay LDC conductor 30, sleeve contacts of the plug CP and jack J′ to ground through the cut off relay CO′ and the relay AU is energized in parallel with the link disconnect relay LD′ over the circuit just traced. The relay LD upon deenergization opens its alternate contact 77 which opens the initial energizing circuit of the relay LDC, but the relay LDC is held energized over a circuit traced from battery through the winding of the relay LDC its alternate contact 38, conductors 39 and 40 to ground at alternate contact 82 of the relay AU. The opening of normal contact 38 of the relay LDC also opens the initial energizing circuit for the relay CR but the relay CR is held energized over a substitute circuit which may be traced from battery through its upper winding 78, conductor 74, alternate contact 38 of relay LDC, conductors 39 and 40 to ground at alternate contact 82 of the relay AU.

When the called subscriber at substation B replaces his receiver upon the switchhook the circuit of the calling supervisory relay CS is interrupted at the switchhook contacts and the relay CS upon restoring opens its alternate contact 94 which allows the relay LD′ to restore to normal and the opening of its alternate contacts 23 and 57 opens the tip and ring conductors of the cord C. The closing of normal contact 17 now closes a circuit for the answering supervisory lamp AL and the calling supervisory lamp CL, the circuit for the supervisory lamp CL being traced from battery through the lamp CL, alternate contact 32 of relay LDC, conductors 84 and 16 to ground at normal contact 17 of the relay LD′, and the circuit for the answering supervisory lamp AL is traced from battery through the lamp AL alternate contact 83 of relay CR, conductors 84 and 16 to ground at normal contact 17 of relay LD′.

The relay AU remains connected in series circuit with the cut off relay CO′, after the relay LD′ is deenergized due to the high resistance of relay AU the relay CO′ deenergizes and again places the line relay LR′ under the control of the called subscriber at substation B and should the subscriber at substation B initiate a recall, the removal of the receiver at substation B will close an energizing circuit for the line relay LR to again light the multiple line signals S′. The

operator associated with the cord circuit C noting the two lighted supervisory signals AL and CL withdraws the answering plug AP from the jack J and the calling plug CP from the jack J'. The withdrawal of the answering plug AP disconnects the cord C from the jack J and the withdrawal of the plug CP from the jack J' brings about the deenergization of the relay AU, and the relay AU deenergizing, opens its alternate contact 82 to open the energizing circuits of the relays LDC and CR. The opening of alternate contact 32 of the relay LDC effaces the calling supervisory signal CL and the opening of alternate contact 83 of relay CR effaces the answering superivsory signal AL and the apparatus used in establishing a connection between the calling substation at substation A and the called subscriber at substation B is now at normal and available for use in establishing other connections.

Assuming that the called subscriber at substation B is the first to replace his receiver, the replacement opens the energizing circuit for the relay CS at the switchhook contacts and the relay CS restores to normal. The closing of normal contact 36 of the relay CS closes a circuit for the calling supervisory lamp CL traced from battery through the lamp CL, normal contact 32 of relay LDC, conductor 33, normal contact 34 of relay RCR, conductor 35, normal contact 36 of relay CS, conductor 37, normal contact 38 of relay LDC, conductors 39 and 40 to ground at alternate contact 17 of relay LD' and the signal CL is thus lighted over this circuit. The opening of alternate contact 36 of the relay CS also opens the energizing circuit for the relay CR. The called subscriber replacing his receiver does not affect the link disconnect relay LD' associated with the calling end of the cord C as the relay LD' is held up through normally closed contacts of the relay LDC and should the called subscriber wish to recall before the calling subscriber has replaced his receiver, the supervisory relay CS will be under the control of the switchhook contacts and the movement of the switchhook at the called substation will cause the relay CS to energize and deenergize to flash the calling supervisory signal CL. Now when the calling subscriber at A replaces his receiver the opening of the switchhook contacts brings about the deenergization of the answering supervisory relay AS and the closing of its normal contact 73 brings about the energization of the relay LDC and the operation of the apparatus to effect disconnection is the same as previously described.

Assuming now that the subscriber at the substation A initiated a call the removal of the receiver thereat energizes the line relay LR which relay LR upon energization causes the line signals S to light. The operator associated with the cord circuit C seizes the call to the exclusion of other operators as before described by inserting the answering plug AP into the jack J of the calling line to bring about the operation of the cut off relay CO of the line circuit L and the relays LD, AS and LS of the cord circuit C as previously described. The relay LS upon energizing closes its alternate contacts 18, 19 and 20 to connect the operator's set O to the cord conductors and she now inquires the wants of the calling subscriber at the substation A. The subscriber at the calling substation A is on a party line comprising substations A, A', A^2 and A^3 and upon inquiry of the operator the subscriber at substation A informs the operator that he wishes to converse with the subscriber A^2. The operator is immediately aware of the fact that the party wanted is on the same line with the calling subscriber at A due to the fact that the answering plug AP is already inserted in the jack of the party line into which subscribers A and A^2 terminate. The operator now asks the calling party at the substation A to replace his receiver and then withdraws the answering plug AP from the jack J of the party line and inserts the calling plug CP of the cord circuit C in the jack J. The withdrawal of plug AP allows relays CO, LD, AS and LS to restore.

The insertion of the plug CP into the jack J of the party line to which both the calling and called parties are connected brings about the energization of the link disconnect relay LD', traced from battery through the windings 26 and 27 of the relay LD', conductor 28, normal contact 29 of relay LDC, conductor 30, sleeve contacts of the connected plug CP and jack J to ground through the winding of the cut off relay CO. The relay LD' upon energizing closes its alternate contact 31 and closes a locking circuit for itself which extends from battery through its winding 26, its alternate contact 31, and over the path just described to ground through the winding of relay CO and the relays LD' and CO are thus energized over this circuit. The relay LD' upon energizing closes its alternate contact 17 to light the calling supervisory lamp CL over a circuit as previously described and the lamp CL remains lighted until the operator depresses the party line ringing key RK to signal the called for substation A^2.

The operator 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 41 and 42 and to connect the proper ringing generator G, G', G^2 or G^3 to signal the called for subscriber at the substation A^2. The closing of the end spring 41 closes an energizing

circuit for the ringing control relay RCR, traced from battery through the winding of relay RCR, conductor 43, alternate contact 41 of the end springs, conductor 44, normal contact 38 of the relay LDC, conductors 39 and 40 to ground at alternate contact 17 of the relay LD'. The closing of alternate contact 45 of relay RCR, closes an energizing circuit for the ringing interrupter relay RI traced from battery through the winding of relay RI, alternate contact 45 of relay RCR, conductor 46, to ground at alternate contact 42 of the end springs. The relay RCR upon energizing closes its alternate contact 34 establishing a locking circuit for itself traced from battery through its winding, its alternate contact 34, conductor 35, normal contact 36 of relay CS, conductor 37, normal contact 38 of relay LDC, conductors 39 and 40 to ground at alternate contact 17 of relay LD'. When the operator releases the ringing key plunger it assumes its ringing or indicating position to allow the end springs to restore to normal, and the closing of normal contact 42 of the end springs now connects the constantly rotating interrupter I in circuit with the relay RI to intermittently energize the same. The closing of alternate contact 55 of the relay RI connects ringing current from the generator G^2 which we will assume is the generator selected to ring the call bell of the subscriber at substation A^2. Ringing current from the generator G^2 is thus transmitted to the called substation A^2 to intermittently signal the called substation A^2 due to the energization and deenergization of relay RI under the influence of the constantly rotating interrupter I, and the ringing current from the generator G^2 traverses a path as previously described.

The subscriber at the substation A^2 in response to his call signal removes his receiver from the switchhook which closes an energizing circuit for the calling supervisory relay CS through normal contacts 55 and 59 of relay RI when in a deenergized condition and the now closed contacts at the switchhook at substation A^2. The relay CS upon energizing opens its normal contact 36 which opens the locking circuit of relay RCR which relay upon deenergizing opens its alternate contact 45 to open the energizing circuit of the relay RI which prevents further application of ringing current to the called substation A^2. The closing of alternate contact 36 of relay CS closes an energizing circuit for relay CR traced from battery through the lower winding 91 of relay CR, conductor 92, alternate contact 36 of relay CS, conductor 37, normal contact 38 of relay LDC, conductors 39 and 40 to ground at alternate contact 17 of relay LD'. The relay CR is energized over this circuit and the closing of its alternate contact 100 closes a circuit for the relay LDC traced from battery through the winding of relay LDC, conductors 74 and 75, normal contact 73 of relay AS, conductor 101, alternate contact 100 of relay CR, conductors 102 and 40 to ground at alternate contact 17 of relay LD'. The relay LDC upon energizing opens its normal contact 29 to open the initial energizing circuit of the relay LD', but a substitute circuit is established for the relay LD' traced from battery through its winding 26, its alternate contact 31, conductors 28 and 93, alternate contact 94 of relay CS, conductors 95 and 30, sleeve contacts of the plug CP and jack J to ground through the cut off relay CO. The relay LDC upon energizing closes its alternate contact 38 to establish a locking circuit for itself from battery through the winding of relay LDC, its alternate contact 38, conductors 39 and 40 to ground at alternate contact 17 of relay LD'. The closure of alternate contact 38 of relay LDC also closes a circuit through the upper winding of relay CR traced from battery through the winding 78 of relay CR, conductor 74, alternate contact 38, conductors 39 and 40, to ground at alternate contact 17. The closing of alternate contact 80 of relay LDC closes a circuit for the relay AU traced from battery through the winding of relay AU, conductor 81, alternate contact 80 of relay LDC, conductor 30 to ground through the winding of the cut off relay CO'. The relay AU and the relay LD' are in parallel circuit and remain energized for purposes as will presently be described.

The calling subscriber at the substation A removes his receiver in due time and the called subscriber at the substation A^2 on this same line and the subscriber at the calling substation A are now in conversational circuit. The subscribers having finished their conversation replace their receivers upon the switchhooks which causes the relay CS to restore. The relay CS deenergizing, its alternate contact 94 is restored which opens the circuit for the relay LD' which restores opening its alternate contacts 23, 31, 17 and 57. The locking circuit for relay LDC is opened at alternate contact 17 of relay LD' as is also the circuit through the upper winding 78 of relay CR but relay LDC and relay CR are maintained energized over a substitute circuit over conductors 39 and 40 to ground at alternate contacts 82 of relay AU. The relay LDC remaining energized, relay AU is now the only relay in series with the cut off relay CO but due to the high resistance of the relay AU, the cut off relay CO deenergizes to again place the line relay LR under the control of either the calling or called subscribers at A and A^2 to permit them to immediately recall as the removal of the receivers at any of the sta-

tions on the party line will operate the line relay LR to light the line signals S. When the subscribers replaced their receivers the calling and called supervisory lamps AL and CL were lighted through alternate contacts 32 of relay LDC and 83 of relay CR to ground at normal contact 17 of relay LD' and the operator observing the two lighted signals AL and CL withdraws the calling plug CP from the jack J which opens the circuit of relay AU and the opening of alternate contact 82 of relay AU opens the circuits for relays LDC and CR. The apparatus is now at normal and available for 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 having party lines each provided with a plurality of answering jacks and line signals terminating at a plurality of operators' positions, link circuits provided with connection terminals for interconnecting said lines, a calling subscriber and a called subscriber on one of said party lines connected in conversational circuit via one of said link circuits, and means in said link circuit including a disconnect relay energized upon the connection of one of said terminals to the party line and a supervisory relay controlled over said subscribers' telephone line for deenergizing said disconnect relay thereby disconnecting said link circuit from the jack of said party line.

2. A telephone system having party lines each provided with a plurality of answering jacks and line signals terminating at a plurality of operators' positions, link circuits provided with connection terminals for interconnecting said lines, a calling subscriber and a called subscriber on one of said party lines connected in conversational circuit via a termial of one of said link circuits, means in said link circuit controlled over said subscribers' telephone line for disconnecting said link circuit from the jack of said party line to place said line signals of said party line under the control of said subscribers on said connected party line, and supervisory signals for said link circuit controlled over said party line.

3. A telephone system having party lines each provided with a plurality of answering jacks and line signals appearing at a plurality of operators' positions, link circuits provided with answering and calling plug terminals for interconnecting said lines, a calling subscriber and a called subscriber on one of said party lines connected for conversation by said calling plug terminal of one of said link circuits with the jack of said party line, and means in said link circuit controlled by said subscribers' telephones for disassociating said link circuit from said party line and supervisory signals for said link circuit controlled by said subscribers' telephones on said party line.

4. A telephone system having party lines each provided with a plurality of answering jacks and line signals appearing at a plurality of operators' positions, link circuits provided with answering and calling plug terminals for interconnecting said lines, a calling subscriber and a called subscriber on one of said party lines connected for conversation by the calling plug of one of said link circuits, a link disconnect relay for said cord energized upon the connection of said calling plug with the jack of said party line, and means including a supervisory relay in said connected cord for controlling the deenergization of said link disconnect relay to disassociate said connected cord from the jack of said party line.

5. A telephone system having party lines each provided with a plurality of answering jacks and line signals appearing at a plurality of operators' positions, link circuits provided with answering and calling terminals, a calling and a called subscriber on one of said party lines connected for conversation by the calling terminal of one of said link circuits with a jack of said party line, a link disconnect relay for said link circuit energized upon connection of said link circuit with the jack of said party line, a supervisory relay for said cord controlled by said subscribers' telephones and a second relay caused to be energized by said supervisory relay, said second relay controlling means in said connected link circuit operable upon termination of conversation of said subscribers to deenergize said link disconnect relay to disassociate said link circuit from said jack of the connected party line.

6. A telephone system having party lines each provided with a plurality of jacks and line signals appearing at a plurality of operators' positions, link circuits provided with answering and calling plug terminals for connecting said lines, a calling and a called subscriber on one of said party lines connected for conversation by a calling plug terminal of one of said link circuits with a jack of said party line, a link disconnect relay for said cord energized by the connection of said calling terminal with the party line, subscribers' controlled means adapted to deenergize said link disconnect relay for disassociating said link circuit from said party

line and a second relay for said cord affected by said subscriber controlled means to render said party line available for connection.

7. A telephone system having party lines each provided with a plurality of jacks and line signals appearing at a plurality of operators' positions, link circuits provided with answering and calling plug terminals for interconnecting said lines, a calling and a called subscriber on one of said party lines connected for conversation by the engagement of the calling terminal of one of said link circuits with a jack of said party line, a link disconnect relay for said cord energized upon connection of said link circuit with said party line, a supervisory relay for said cord controlled by said subscribers' telephones, a second relay energized by said supervisory relay for controlling means in said link circuit operable upon termination of conversation of said subscribers to deenergize said link disconnect relay to disassociate said link circuit from said jack of the connected party line, a relay associated with said means adapted to render said party line available for connection or recall, and supervisory signals for said link circuit controlled over said subscriber's line.

8. A telephone system including a subscriber's polystation telephone line, a link circuit for connection thereto when substations on said line are to be included in conversational circuit, subscriber controlled means controlled over said line for freeing said line from said link circuit, and supervisory signal in said link circuit controlled over said line for indicating the condition of said link circuit.

9. A telephone system including a subscriber's polystation telephone line, a link circuit for connection thereto when substations on said line are to be included in conversational circuit, subscriber controlled means controlled over said line for freeing said line from said link circuit so that the subscribers on said line may recall before the link circuit is returned to normal, and supervisory signals for said link circuit controlled over said subscriber's line for indicating the condition of said link circuit.

10. A telephone system including a subscriber's polystation line having multiple line signals and jacks, a link circuit for connection to said line when subscribers on said line wish to converse with each other, link circuit means controlled over said line permitting the subscribers thereon to recall and operate said line signals before the operator disconnects the link circuit from said line, and supervisory signals in said link circuit controlled over said subscriber's line for indicating the condition of said link circuit.

Signed at Chicago, county of Cook and State of Illinois, this 15th day of June, 1926.

MICHAEL B. STAZAK.