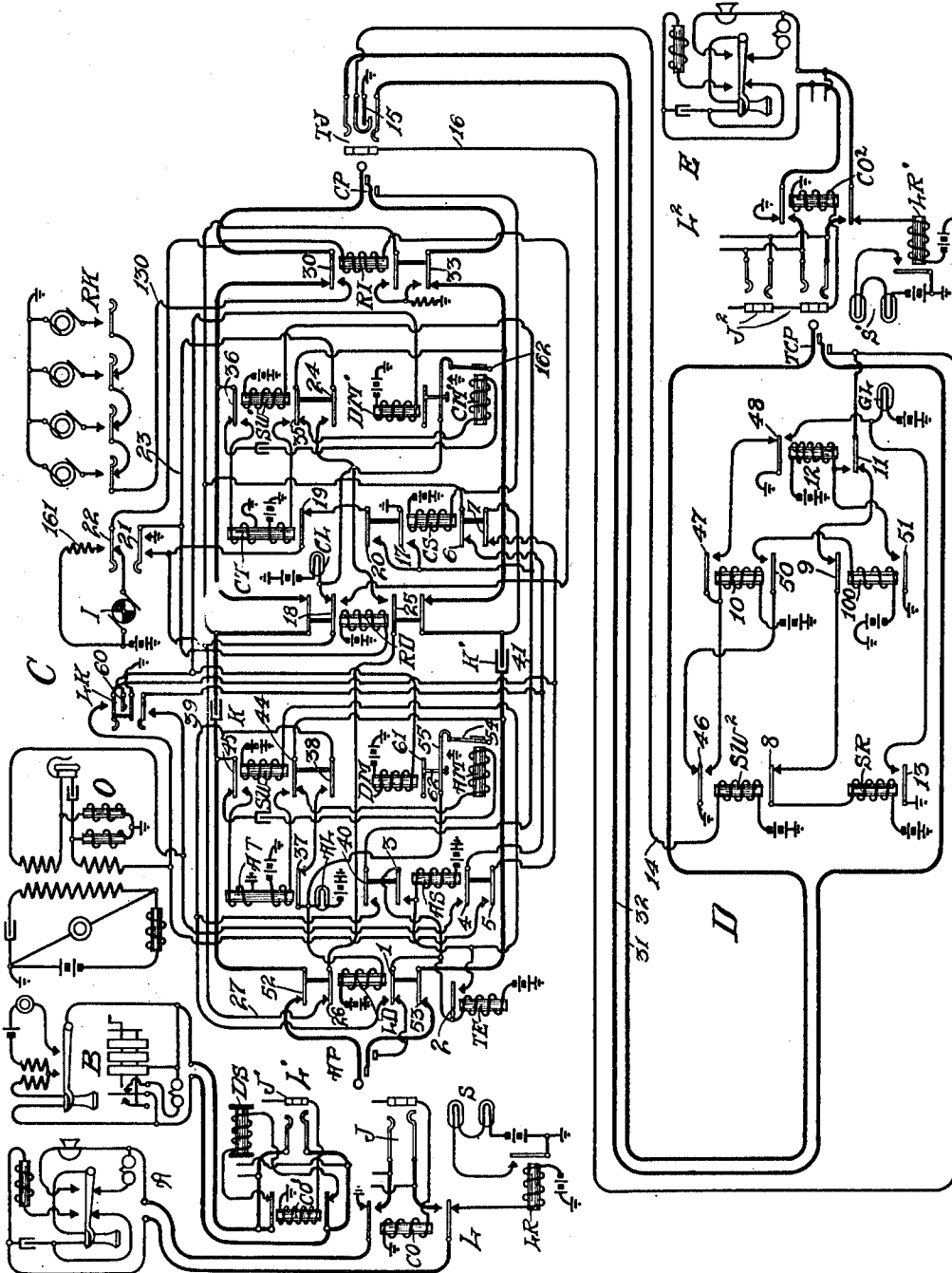


J. E. HILBISH.
TELEPHONE SYSTEM.
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TELEPHONE SYSTEM.

1,314,804.

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To all whom it may concern:

Be it known that I, JOHN E. HILBISH, a citizen of the United States of America, residing in La Grange, 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 link or trunk circuits are employed, and has to do more particularly with manually operated link circuits of the so-called universal type for interconnecting lines of different character, such as local battery and common battery lines.

One of the features of my invention is the provision of so-called instantaneous disconnect and recall for use with a cord circuit of the universal type, that is prior to the removal of the answering plug from the connected jack should the subscriber wish to recall, he may immediately do so due to automatic means in the cord circuit that adjusts itself to place the line circuit of the recalling subscriber in normal condition as soon as the calling subscriber has signaled for disconnection.

Another feature of my invention is the provision of means whereby when connection is made between lines of one character, as between common battery lines, automatic connection and disconnection of the operator's circuit is provided giving so-called secret service, while when connection is established between lines of a different character such as local battery or magneto lines, or between a local battery and a common battery line, it is necessary for the operator to operate a listening key in order to connect the operator's circuit with the cord circuit. I have also arranged the cord circuit for use in extending calls over a trunk circuit to a second operator's position at which position the trunk circuit terminates in a so-called three-wire or three-conductor plug used for directly establishing connection with called subscribers' lines. I arrange the equipment of the trunk circuit associated with the second operator's position in such a manner that the called subscriber is permitted to immediately recall even though the calling plug remains connected to the jack of the called subscriber. When I use a universal cord circuit for extending trunking connections to a second operator's posi-

tion for connecting with a called subscriber of the common battery type, I provide automatic ringing controlled by the operator at the first operator's position while when the universal cord circuit is used for directly extending connection to a magneto or local battery line, I provide so-called manual ringing, which is directly controlled by the operator associated with the said cord circuit.

For a better understanding of my invention, reference may be had to the accompanying drawing in which is shown a common battery substation A and a magneto substation B terminating at the central office in line circuits L and L¹, respectively. The common battery line circuit L comprises the usual line relay LR, cut-off relay CO, the multiple jack J, and line signals S. The line circuit as illustrated, is known as a multiple line lamp circuit in which a line lamp appears before each line jack so that when a call is initiated a signal appears before each of the multiple line jacks so that any one of a number of operators may answer the call to the exclusion of the others. The magneto line circuit L¹ comprises a cut-off relay CO¹, the drop signal DS, and the line jack J¹. I have shown only one jack J¹ associated with the line circuit L¹, however it is to be understood that a number of multiple jacks and multiple signals will be used, one appearing before each operator. Any of the well-known means of multiplying the line signals may be used.

Referring now to the cord circuit C, it comprises an answering plug AP and a calling plug CP, the two plugs being connected by the heavily marked conductors and having the condensers K and K¹ interposed. At the answering end of the cord circuit, I provide a high resistance test relay TE which is actuated upon the insertion of a plug in a jack of a calling line, the said relay upon actuation connecting the answering sleeve supervisory relay AS to the answering plug of the cord circuit, and this operation of the relay AS connects the operator's set O with the said cord circuit. The relay AS being of low resistance shunts out the relay TE and should another operator attempt to seize the call, the relay AS of the cord circuit C will shunt out the relay TE of the second cord circuit attempting to seize the call, and therefore the operator's set of the

second cord will not be connected, due to the failure of the relay AS of the said second cord circuit to operate. The second operator, not receiving a response, knows that the call has been answered and therefore withdraws her plug. A switching relay SW is provided which is operated upon the actuation of the relay TE to connect the answering tip supervisory relay AT to the strands of the cord circuit. An answering magneto supervisory relay AM is provided adapted to be bridged across the tip and ring conductors of the cord circuit to permit a calling magneto subscriber to give a disconnect signal. A disconnect magnet DM is associated with the relay AM and is energized to efface the supervisory signal AL after a calling magneto subscriber has given the disconnect signal. The relay DM upon energization also restores the armature of the relay AM to normal. A link disconnect relay LD is also associated with the answering end of the cord circuit C, and operates to immediately restore a calling common battery subscriber's line circuit when the subscriber replaces his receiver, so that he can recall prior to the removal of the plug from the connected jack. The relay LD is also operated when a magneto subscriber replaces his receiver and operates the hand generator to give a disconnect signal, so that his associated line circuit is immediately restored to allow him to recall prior to the removal of the plug from its connected jack. At the calling end of the cord circuit I provide a calling tip supervisory relay CT, and a calling sleeve supervisory relay CS, the two relays controlling the circuit of the combined calling and ringing supervisory lamp CL. A party-line ringing key RK is shown for connecting one of a plurality of generators to the common generator lead 130 and for starting the automatic signaling of a common battery substation. A ringing control relay RD is also provided which is energized when any one of the ringing key plungers is actuated, the relay RD controls the energization of an interrupter relay RI, which relay is intermittently energized and de-energized through the medium of an interrupter I. Manual ringing is also provided for signaling a called magneto substation, each time a ringing key plunger is fully depressed, the relays RD and RI energize and apply ringing current to the called line. Automatic listening and disconnect is provided when connection is established between two common battery subscribers, that is the operator's set O is connected to the cord circuit through the contacts of the relay AS when connection is made with a calling line and disconnected therefrom by the operation of the relay CS when connection is made with a called line. I also provide a manual listening key LK for use when con-

nection is established between two local battery lines or between a local battery and a common battery line. The listening key LK is used for connecting the operator's head set to the strands of the link circuit in answering calls from calling or from recalling magneto telephone lines. A relay SW¹ associated with the calling end places the relay CT in operative relation with the cord circuit C when connection is extended to a called common battery subscriber's line.

The relays CM¹ and DM¹ perform the same functions at the calling end of the cord circuit as do relays AM and DM at the answering end of the cord circuit. The cord circuit C may be used for extending trunking connections and also may be used for directly interconnecting local battery and common battery lines, that is, the calling plug CP may be used to directly establish connection with a subscriber's line equipment.

The trunk circuit D as illustrated, is arranged to cooperate with the cord C for extending trunking connections to a second operator's board. The trunk jack TJ associated with the said trunk circuit is one of a plurality of like jacks which appear before an operator's position. The opposite end of the trunk circuit D terminates in a trunk calling plug TCP for directly connecting to the multiple jacks of a called subscriber's line equipment. The trunk circuit D is also provided with a supervisory lamp GL and a number of quick and slow acting relays, the functions of which will be fully described hereinafter when a detailed operation of the equipment will be given.

To the right of the drawing I have shown a called common battery substation E terminating in the line equipment L². The substation E and its associated line equipment is similar in all respects to the substation A and its associated line equipment.

Having described in a general way the apparatus in the general embodiment of the preferred form of my invention, I will now describe more in detail the operation of the system as illustrated.

Assuming now that the subscriber at the substation A initiates a call, the removal of the receiver at the substation operates the line relay LR to bring about the lighting of the line signal S. The operator noting the lighted signal inserts the answering plug AP into the jack J of the calling line completing an energizing circuit for the high resistance test relay TE through the cut-off relay CO. This circuit extends from battery through the winding of said test relay, the normal contact 1 of the relay LD, the sleeve contacts of the connected plug and jack and through the winding of the cut-off relay CO to ground. Upon the energization of the relay TE a multiple energizing circuit for

the sleeve answering supervisory relay AS and the switching relay SW is established. This circuit extends from battery through the windings of said relays, alternate contact 2 of relay TE, normal contact 1, sleeve contacts of the connected plug and jack, through the winding of the cut-off relay CO to ground. The cut-off relay CO energizing over this circuit effaces the line lamp S.

Due to the low resistance path brought about by including the relay AS in circuit the high resistance test relay TE is shunted out and returns to normal. Should another operator attempt to seize the call, the answering sleeve supervisory relay of the cord circuit C prevents the test relay TE of the second cord circuit from operating to allow the energization of the relay AS of the second cord and thus prevents the second operator from communicating with the calling subscriber. The relay AS upon energizing, closes a locking circuit for itself traced from battery through relay AS, its alternate contact 3, contact 1, sleeve contacts of the plug and jack, through the relay CO to ground. A circuit for relay SW is also established when relay AS energizes traced from battery through the winding of the said relay, alternate contact 3, normal contact 1, sleeve contacts of the plug and jack and through the winding of relay CO to ground. The switching relay SW, upon energizing closes a circuit for the relay AT traced from battery through the lower winding of said relay, alternate contact 44, ring contacts of the connected plug and jack, through the substation, tip contacts of the plug and jack, alternate contact 45, through the upper winding of AT to ground, energizing the said relay to prevent the premature lighting of the answering supervisory lamp AL.

The closing of the alternate contacts 4 and 5 of the relay AS connects the operator's set O to the cord circuit through the said alternate contacts, normal contacts 6 and 7 of the sleeve calling supervisory relay CS. The operator now being connected to the cord circuit C ascertains the wants of the calling subscriber and assuming that it is the subscriber at the substation E that is wanted the connected operator now operates an order-wire key, (not shown, but well understood in the art) to communicate with the operator associated with the trunk circuit D and repeats the number of the called subscriber to the operator associated with the said trunk circuit. The trunk operator now inserts the trunk calling plug TCP into the multiple jack J² of the wanted line and then assigns a trunk to the operator associated with the cord circuit C. Assuming that it is the trunk associated with jack TJ, the operator at O then makes the usual busy test and if the called line is idle she inserts the calling plug CP into the assigned trunk jack TJ. The insertion of the plug TCP into the jack J² closes a series energizing circuit for the cut-off relay CO² of the line circuit L² and the high resistance supervisory relay SR of the trunk circuit D. This circuit extends from battery through the high resistance relay SR, the normal contact 8 of switching relay SW², normal contact 9 of relay 100, normal contact 11 of relay 12, the sleeve contacts of the connected plug and jack through the winding of the cut-off relay CO² to ground. The energization of the relay SR closes a circuit for the guard lamp GL traced from battery through the said lamp, to ground at alternate contact 13 of relay SR. The guard lamp GL remains lighted in case the operator at the cord circuit C inserts the calling plug CP into a trunk jack other than the one which has been assigned by the operator at the trunk circuit D. Upon inserting the calling plug CP into the assigned trunk jack TJ, an energizing circuit is established for the switching relay SW², traced from battery through the winding of the said relay, conductor 14, to ground at alternate contact 15 of the trunk jack TJ. The energization of the relay SW² opens the energizing circuit of the relay SR at contact 8, relay SR deenergizing opens the circuit of the guard lamp GL at contact 13 and the effacement of the said signal notifies the operator associated with the trunk circuit D that the assigned trunk jack has been seized. A series energizing circuit for the cut-off relay CO² and the sleeve supervisory relay CS of the cord circuit C, is also closed upon the insertion of the plug CP into the jack TJ. This circuit extends from battery through the winding of the relay CS, the sleeve contacts of the connected plug CP and trunk jack TJ, conductor 16, the sleeve contacts of the connected plug TCP and jack J², through the winding of the cut-off relay CO² to ground. Upon the energization of relay CS its normal contacts 6 and 7 are interrupted to disconnect the operator's set O from the cord circuit C. The relay SW² upon energizing closes a circuit for the relay 10 traced from battery through the winding of the said relay to ground at alternate contact 46 of relay SW². The relay 10 upon energizing closes a locking circuit for itself traced from battery through the said relay, its alternate contact 47 to ground at normal contact 48.

A further result of the energization of the relay CS of cord circuit C is the closing of an energizing circuit for the switching relay SW¹, traced from battery through the winding of said relay, to ground at alternate contact 17 of the relay CS. The switching relay SW¹ upon energizing places the calling tip supervisory relay CT into operative relation with the cord circuit C to be energized upon the response of the called

subscriber. A circuit for the supervisory lamp CL is also closed upon the energization of the relay CS, traced from battery through said lamp, normal contact 18 of relay RD, normal contact 19 of relay CT, alternate contact 20 of relay AS to ground at alternate contact 17. The glowing of the calling lamp CL notifies the operator at the cord circuit C that the trunk operator has inserted the trunk plug TCP into the jack of the called line and also notifies her that she should now depress one of the ringing key plungers to signal the called subscriber. The operator at the cord circuit C next depresses the proper ringing plunger of the ringing key RK to ring the call-bell of the called subscriber at the substation E. When the ringing key RK is in its fully depressed position the common contact springs 21 and 22 of the ringing key assume their alternate position closing an energizing circuit for the ringing control relay RD, traced from battery through the winding of the said relay to ground at alternate contact 21 of the said springs. When the pressure is released from the depressed plunger it assumes an intermediate position allowing the springs 21 and 22 to assume their normal position but keeping the selected generator connected to the common conductor 130. The ringing control relay upon energizing, closes a locking circuit for itself independent of springs 21. This circuit extends from battery through the winding of said relay, conductor 23, alternate contact 24 of the relay SW¹, alternate contact 25 of relay RD, normal contact 26 of relay LD, conductor 27, normal contact 19 of relay CT, alternate contact 20 of relay CS to ground at alternate contact 17. A further result, due to the energization of the relay RD, is the effacing of lamp CL and the closing of an energizing circuit for the interrupter relay RI. The circuit for the interrupter relay RI extends from battery through the interrupter I, normal contact 22 of the common springs, the winding of the said relay RI, alternate contact 18 of relay RD, normal contact 19 of relay CT, alternate contact 20 to ground at alternate contact 17 of relay CS. The relay RI is thus intermittently energized and deenergized causing ringing current to be applied to the called line through its alternate contact 30. The circuit for the said ringing current extends from the ungrounded pole of the generator, closed contact of the ringing key, alternate contact 30 of relay RI, tip contacts of the connected plug and jack, conductor 31, tip contacts of the connected plug TCP from the jack J², through the condenser and call bell of the called substation E, the ring contacts of the jack J² and plug TCP, conductor 32, ring contact of the jack TJ and plug CP through the alternate contact 33 of relay RI to

ground. The call bell at the called substation is thus intermittently rung until the called subscriber answers. The subscriber at the called substation E in response to the call signal removes his receiver from the switch-hook thus closing an energizing circuit for the calling tip supervisory relay CT traced from battery through the lower winding of the relay CT, alternate contact 35 of relay SW¹, normal contact 33, the ring contacts of the connected plug CP and jack TJ, conductor 32, ring contacts of the connected plug TCP and jack J² through the substation, the tip contacts of the connected plug and jack, conductor 31, tip contacts of the jack TJ and plug CP, normal contact 30, alternate contact 36 of relay SW¹ through the upper winding of the relay CT to ground. The energizing of the relay CT opens the locking circuit for the relay RD at its normal contact 19 causing the deenergization of the said relay RD, which relay upon energizing, opens the circuit of the relay RI thereby preventing ringing current from being applied to the called line. The subscriber at the calling substation A and the subscriber at the called substation E may now carry on conversation over the heavily marked talking conductors.

Assuming now that the subscribers have finished conversation, the subscriber at substation A replaces his receiver upon the switch-hook opening the energizing circuit for the relay AT at the switch-hook contacts thereby allowing the said relay to deenergize and restore to normal. The closing of the normal contact 37 of the relay AT, establishes an energizing circuit for the answering supervisory lamp AL, traced from battery through the said lamp, normal contact 37, alternate contact 38 of relay SW, conductor 39, alternate contact 40 of relay AS to ground at alternate contact 17 of relay CS. A further result of the deenergizing of relay AT is the closing of an energizing circuit through the link disconnect relay LD traced from battery through the winding of the said relay, normal contact 37 of relay AT, alternate contact 38 of relay SW, conductor 39, alternate contact 40, conductor 41 to ground at alternate contact 17 of relay CS. The closing of alternate contact 1 of relay LD maintains the energizing circuit for the relay AS and SW, the circuit for relay AS being traced from battery through the said relay, alternate contact 3 of said relay, alternate contact 1 of relay LD, alternate contact 40 of relay AS to ground at alternate contact 17 of relay CS and the energizing circuit for relay SW is traced from battery through the relay SW alternate contact 3 of relay AS, alternate contact 1 of relay LD, alternate contact 40 of relay AS to ground at alternate contact 17. The energization of the link

disconnect relay LD opens the circuit for the cut-off relay CO of the line circuit L at the contact 1 of the said relay LD allowing the cut-off relay to restore to normal to place the line circuit L in condition for immediate recall. The replacing of the receiver at the called substation E opens the energizing circuit for the calling tip supervisory relay CT allowing it to deenergize and close its normal contact 19 thereby closing an energizing circuit for the calling supervisory lamp CL traced from battery through the said lamp, normal contact 18 of relay RD, normal contact 19 of relay CT to ground at alternate contact 17. The operator noting the two lighted supervisory signals AL and CL knows that conversation has terminated and withdraws plug AP from the jack J and the calling plug CP from the trunk jack TJ.

Should the calling subscriber wish to recall before the answering and calling plugs have been removed from their respective jacks, the subscriber removes his receiver which again brings about the energization of relay LR to light the line signals S in the same manner as hereinbefore described. The call may now be seized by any idle operator and extended in the same manner as hereinbefore described. Returning now to the removal of the answering and calling plugs AP and CP from their respective jacks, the removal of the calling plug CP from the trunk jack TJ allows the calling supervisory relay CS to deenergize. The deenergizing of relay CS opens the circuits of relays LD, SW and AS and of the supervisory lamp AL at the spring 17, thus allowing the equipment at the answering end of the cord circuit to be restored to normal. The switching relay SW¹ is restored to normal by the opening of its circuit at the contact springs 20 when the relay CS deenergizes thus restoring to normal the equipment associated with the calling end of the cord circuit. The removal of the plug CP from the trunk jack TJ also opens the energizing circuit for the switching relays SW² of the trunk circuit D at the normal contact 15 of said trunk jack. The relay SW², upon deenergizing, closes an energizing circuit for the relay 100 traced from battery through the winding of the said relay and alternate contact 50 of the relay 10 to ground at normal contact 46. Upon the energization of the relay 100 an energizing circuit for the relay 12 is established, traced from battery through the winding of the said relay to ground at alternate contact 51 of relay 100. The relay 12 upon energizing closes a locking circuit for itself, traced from battery through the winding of the said relay, its alternate contact 11, the sleeve contacts of the connected plug TCP and jack J² through the winding of the cut-

off relay CO² to ground. Relay 12 upon energizing, causes the combined guard and supervisory lamp GL to again glow due to the closure of the alternate contact 48 to ground, thus notifying the operator that the connected plug of the cord circuit C has been removed from the trunk jack TJ. The relay 12 is of comparatively high resistance, and therefore allows the cut-off relay CO² to deenergize which allows the line circuit L² to restore to normal. The operator noting the lighted lamp CL removes the plug TCP from the jack J² allowing the relay 12 to restore. The restoration of the relay 12 effaces the lamp GL by opening the contact 48, the apparatus of the trunk circuit D being restored to normal places the said trunk circuit in condition to set up other connections. Should the subscriber at E wish to recall he may do so even though the operator has neglected to remove the plug from the connected jack due to the deenergization of relay CO² of line circuit L² which allows the line circuit L² to restore to normal. The removal of the receiver at the substation will light the line signal S².

Assuming now that the subscriber at the magneto substation B wishes to initiate a call, the subscriber thereat will operate his hand generator to operate the drop signal DS of the line circuit L¹ and then remove his receiver from its switch-hook. The operator noting the actuated drop signal inserts the answering plug AP into the jack J¹ of the calling line, thus closing a series energizing circuit for the high resistance test relay TE and the cut-off relay CO¹. This circuit extends from battery through the winding of relay TE, normal contact 1 of relay LD, the sleeve contacts of the connected plug and jack through the winding of cut-off relay CO¹ to ground. The operation of relay TE and the closing of its contact 2 connects the relays AS and SW in series with relay CO¹ but because of the comparatively high resistance of the said relay CO¹, the relays AS and SW are prevented from operating. The failure of relay AS to operate prevents the operator's set O from being connected to the cord circuit, the operator's listening key LK must be operated to connect the operator's set O to the cord circuit to ascertain the wants of the calling magneto line. The failure of the switching relay SW to operate prevents the connection of the relay AT to the answering end of the cord circuit. Now assuming, that it is the subscriber at the common battery substation E that is wanted, the operator presses an orderwire key, (not shown), to communicate with the operator associated with the trunk circuit D. The number of the called subscriber is repeated to the operator associated with the trunk D and the operator thereat assigns a trunk as previ-

ously described. The operator at C now plugs into the assigned trunk jack and actuates the ringing key RK. The operation of the apparatus of the cord circuit C at its calling end and that of the apparatus of the trunk circuit D is the same as that described in connection with the description of the operation in completing a connection between the subscriber at the substation A, and the subscriber at substation E.

After the subscriber at the substation B and the subscriber at the substation E have finished conversation, the subscriber at the substation B now replaces his receiver and operates his hand generator thereby energizing the relay AM. This circuit extends from the generator at the substation, the tip contacts of the connected plug and jack, the normal contact 52 of relay LD, normal contact 45 of relay SW through the winding of the relay AM, normal contact 44 of relay SW, normal contact 53 of relay LD, ring contacts of the connected plug and jack, back to the generator. The disconnect current energizes the relay AM and causes the attraction of its armature 54 causing the locking contact 55 to hold the armature 54 in its attracted position and to close the alternate contact 55 thus bringing about the lighting of the answering supervisory lamp AL, traced from battery through the lamp to ground at alternate contact 54. A further result due to the operation of the relay AM is the operation of the link disconnect relay LD, traced from battery through the winding of the said relay to ground at alternate contact 55. The operation of the link disconnect relay LD opens its normal contact 1 thus bringing about the deenergization of the cut-off relay CO¹ and the test relay TE. The cut-off relay CO¹ upon deenergizing again places the drop signal DS of the line circuit L¹ in condition to be again operated by current from the hand generator of the substation B. The lighted signal AL notifies the operator of the cord circuit C that the subscriber at the substation B has finished conversation. The subscriber at the called substation E having replaced his receiver, brings about the operation of the apparatus at the calling end of the cord circuit as previously described to light the calling supervisory lamp CL and the operator noting the two lighted signals knows that the two subscribers have finished conversation. Should the subscriber B wish to recall he simply operates his hand generator the same as before thus causing the drop DS to operate. The closing of the contact 55 of relay AM having lighted the signal AL and the signal CL having been lighted by the replacing of the receiver at the called substation, the operator noting the two signals removes the plugs AP and CP from the connected jacks. The removal of the plug

CP brings about the restoration of the apparatus associated with the calling end of the cord circuit and with the trunk circuit D as previously described. The removal of the plug AP does not affect the relay LD or lighted signal AL; therefore the operator momentarily operates the listening key LK closing the contact 60 which establishes an energizing circuit for the disconnect magnet DM being traced from battery through the said magnet to ground at contact 60. The magnet, upon energizing, attracts its armature 61 and the extension 62 of the armature 61 lifts the contact 55 out of locking engagement with the armature 54 thereby opening the circuit for the relay LD and effacing the signal AL. The apparatus of the cord circuit C is now at normal and the said cord is available for other connections.

We will now assume that the subscriber at substation B desires connection with another local battery substation, not shown, but similar to substation B. The subscriber at B operates the drop signal DS the same as hereinbefore described and the operator plugs into the jack J¹ with the answering plug AP and operates the listening key LK to learn the wishes of the calling subscriber. The operator upon learning the subscriber desired, takes the calling plug CP and plugs into a jack similar to jack J¹ (not shown) and operates her ringing key to signal the called subscriber. Upon inserting the plug CP into the jack of the called subscriber a circuit is closed through the calling supervisory relay CS in series with the cut-off relay of the called line. The resistance of the called cut-off relay is such that it does not permit sufficient current to flow to operate the calling supervisory relay CS. The operator next signals the called subscriber by operating the ringing key RK. Each time the springs 21 and 22 make contact with their alternate contacts, circuits are closed through the ringing contact, relay RD and then through the ringing relay RI. The circuit for the ringing control relay RD extends from battery through the said relay to ground at contact 21. The circuit for the ringing relay RI extends from battery through the resistance 161, alternate contact springs 22, winding of relay RI and alternate contact 18 of relay RD to ground at alternate spring 21. The relay RI, upon energizing connects ringing current to the called line.

After the conversation has terminated the calling subscriber replaces his receiver and operates the hand generator causing the same operations to take place at the answering end of the cord circuit as hereinbefore described. The called subscriber replaces his receiver and operates his hand generator, thus causing the calling magneto supervisory relay CM¹ to be operated. The

relay CM¹, upon operating closes a circuit through the calling supervisory lamp CL and its own armature 162 is mechanically locked by the armature of the disconnect magnet DM¹. The operator upon noticing both supervisory lights glowing presses the listening key LK, thus connecting her head set to the strands of the cord circuit C and at the same time closing circuits through the disconnect magnets DM and DM¹ at the springs 60. The disconnect magnets DM and DM¹ upon energizing unlock the armatures of magneto supervisory relays AM and CM¹ respectively thus causing the supervisory lamps AL and CL to cease glowing. The operator then removes the plugs AP and CP from their respective jacks and the apparatus of the cord circuit is returned to normal in readiness for further calls.

While I have not fully described the operation of the apparatus that takes place when the cord circuit C is used to establish direct connections between a calling local battery or a calling common battery subscriber and a called common battery subscriber it is readily seen that the operation of the apparatus of the cord circuit C is practically the same as when it is used for establishing trunking connections.

While I have shown the line circuit L¹ as that of an individual subscriber, it is apparent that it may be the line apparatus associated with an incoming toll line from a distant toll board, and that the cord circuit C may be used for directly connecting together toll lines or toll subscribers and may also be used for extending connections from toll lines to local operators' positions by means of trunking circuit D, the local operator then completing the connection with the called subscriber by inserting the tip calling plug TCP into the jack of the called subscriber.

In working out my invention I have employed preferred circuit arrangements all of which go to make an efficient operating system, but it is to be understood that I contemplate other circuit arrangements. Furthermore many changes or modifications of the system illustrated will readily occur to those skilled in the art and therefore I do not desire to be limited to the arrangement shown and described but 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 as new and desire to secure by United States Letters Patent is:

1. A telephone system including local battery and common battery lines, connecting terminals for said lines, a universal link circuit for interconnecting said lines, a test relay associated with the answering end of said link circuit, and means including said

test relay and said answering terminal for determining whether a call initiated over one of said common battery lines is in an answered or an unanswered condition.

2. A telephone system including local battery and common battery lines, connecting terminals for said lines, universal link circuits having manually controlled answering terminals for connection with said connecting terminals when answering calls initiated over said lines, and means for preventing the operative association of more than one of said answering terminals with the terminals of any one of said common battery lines at the same time when answering a call therefrom.

3. A telephone system including a plurality of common battery and local battery lines, a plurality of terminals for said lines located at the central office, operators' universal link circuits for interconnecting said lines, and means whereby any one of the said link circuits may be connected to one of said common battery lines as a calling line to the exclusion of the remaining link circuits.

4. A telephone system including common battery and local battery lines, a universal cord circuit provided with terminal plugs for interconnecting said lines, means whereby when a calling one of said lines signals for disconnection the line is rendered available for recall even though the answering plug of said cord circuit has not been removed from the jack of the calling line.

5. A telephone system including local battery and common battery telephone lines, a universal cord circuit provided with an answering terminal adapted to be connected with the line jack or any one of said lines, and means controlled by the subscriber at a calling substation for operatively disassociating the said cord circuit from the said calling line.

6. A telephone system including common battery and local battery lines, an operator's universal link circuit provided with a terminal for use in interconnecting said lines, means for operatively disassociating the terminal of said link circuit from the line circuit of a called one of said lines even though the said terminal remains in the jack of the line.

7. A telephone system including common battery and local battery lines, a universal cord circuit provided with a terminal for interconnecting said lines, means for operatively disassociating a called line from the said terminal so that the called line may immediately recall even though the said terminal remains connected to the jack of the said called line.

8. A telephone system including common battery and local battery subscribers' lines, a universal cord circuit for interconnecting

said lines, automatic means in said cord circuit for operatively connecting and disconnecting an operator's circuit to said cord circuit when connection is extended between
 5 lines of one of said characters, and means for rendering the said connecting and disconnecting means inoperative when connection is extended between lines of a different one of said characters.

- 10 9. A telephone system including lines of different character such as local battery and common battery lines, a universal cord circuit for interconnecting said lines, automatic means in said cord circuit for connecting
 15 and disconnecting an operator's circuit when said cord circuit is employed to connect lines of one of said characters, means for rendering said connecting and disconnecting means inoperative when a connection is be-
 20 tween lines of a like character but of a different one of said characters, and means for rendering said connecting means inoperative when connection is between a line of one character and a line of another char-
 25 acter.

10. A telephone system including common battery and local battery lines, a universal cord circuit for interconnecting said lines, an operator's listening key for said cord
 30 circuit, automatic means in said cord circuit for connecting and disconnecting an operator's circuit and for rendering the said listening key inoperative when connection is extended between lines of one of said char-
 35 acters, and means for rendering the said connecting and disconnecting means inoperative and for rendering said listening key operative to connect said operator's circuit when connection is extended between lines
 40 of a like character but of a different one of said characters.

11. In combination with a calling two-conductor magneto telephone line connected to a plug ended cord circuit at the central
 45 exchange, means whereby when the subscriber signals for disconnection the said line circuit is available for recalling before the plug is removed from the said line.

12. A telephone system including local
 50 battery and common battery lines, a universal cord circuit provided with a plug end adapted to interconnect the said lines, and means controlled by a calling one of said subscribers when said plug is connected to
 55 said calling line for operatively disassociating the said plug and said line so that the said subscriber may recall.

13. A telephone system including common battery and local battery telephone lines,
 60 connecting terminals for said lines located at a central office switchboard, operator's universal link circuits including means whereby any one of said link circuits may be connected to a terminal of a calling one
 65 of said common battery lines when answer-

ing a call therefrom to the exclusion of the remaining link circuits.

14. A telephone system including common battery and local battery lines, connecting terminals for said lines, universal link cir-
 70 cuits for interconnecting said lines, manually operated answering terminals for said link circuits for connection with the said line terminals, and means to prevent operative association of more than one answer-
 75 ing terminal with the connecting terminals of any one of said common battery lines.

15. A telephone system including common battery and local battery lines, an operator's universal link circuit provided with a termi-
 80 nal for use in interconnecting said lines, means for operatively disassociating the terminal of said link circuit from the line circuit of a calling one of said lines even though the said terminal remains in the
 85 jack of said calling line.

16. A telephone system including common battery and local battery telephone lines, an operator's universal link circuit for interconnecting said lines, a manually con-
 90 trolled answering terminal for said link circuit, means for operatively disassociating the said link circuit from the line circuit of a calling one of said lines prior to the re-
 95 moval of said answering terminal from the jack of said line.

17. A telephone system including common battery and magneto telephone lines, a uni-
 100 versal link circuit for interconnecting said lines, a manually controlled answering terminal for said link circuit for connection with answering terminals of said lines, means for disassociating said link circuit from the line circuit of a calling one of said
 105 lines prior to the disconnection of said link circuit terminal from the answering terminal of said line.

18. The combination with a two con-
 110 ductor calling magneto telephone line connected to a plug ended link circuit at a central exchange, of means controlled over the two conductors of the telephone line in series when the subscriber signals for dis-
 115 connection for rendering the line circuit available for recall prior to the disconnection of the plug from the said line.

19. A combination with a calling magneto telephone line connected to a plug ended link circuit at the exchange, of means whereby
 120 when the substation upon said line operates the magneto for disconnection the line is available for recall prior to the withdrawal of the link plug.

20. A telephone system comprising a two-
 125 conductor magneto telephone line terminating in a connecting jack at the central office switchboard, an operator's link circuit having a manual answering terminal for extending the circuit of said line by way of
 130 said jack, and means responsive to an oper-

ation of the magneto at the substation of said line for operatively disassociating said link circuit from said line.

21. The combination with a magneto telephone line connected to a plug ended link circuit at the central exchange, of means whereby when the substation on the said line signals for disconnection the said link circuit is operatively disassociated from the line, and operator controlled means for permitting a reassociation of the link circuit and the line prior to the withdrawal of said link plug.

22. The combination with a two-conductor magneto telephone line connected to a plug ended link circuit at the exchange, of means whereby when the substation on said line signals for disconnection the link circuit is operatively disassociated from the conductors of the telephone line, and means for again uniting the said telephone line and the said link circuit prior to the withdrawal of the said link plug.

23. In a telephone system, a subscriber's magneto telephone line, a plug ended link circuit adapted to be connected to said line, and means responsive to an operation of the magneto at the substation of said line for operatively disconnecting the said line and link circuit prior to a withdrawal of said link circuit plug.

24. In a telephone system, a subscriber's magneto telephone line, a plug ended link circuit adapted to be connected to said line, means responsive to an operation of the magneto at the substation of said line for operatively disconnecting the said line and link circuit, and means for connecting said line and link circuit prior to the withdrawal of said plug.

25. A telephone system including common battery and magneto telephone lines, a universal link circuit for interconnecting said lines, means under the control of the substation of one of said common battery lines for disassociating said link circuit from the said line whereby the line is rendered available for recall, and means for permitting a second plug ended link circuit to seize a recall from said line before the withdrawal of the answering plug of said first link circuit.

26. A telephone system including common battery and magneto telephone lines, universal link circuits for interconnecting said lines, answering terminals for said link circuits, and means for preventing the operative connection of more than one of said link circuits to the line circuit of a calling one of said common battery lines when said line signals for connection.

27. A telephone system including a two-conductor magneto telephone line, a link circuit provided with a terminal for connection to said line, and means responsive

to an operation of the magneto at the substation of said line for operatively disassociating said line from said link circuit, by energizing a relay to disconnect the strands of said link circuit from said telephone line while maintaining said terminal in association with said line.

28. A telephone system including local battery and common battery telephone lines, a universal cord circuit provided with an answering terminal for connection with said lines as calling lines, and means controlled by the subscriber at the substation of one of said calling lines for operatively disassociating said calling line from said cord circuit.

29. A telephone system including both local battery and common battery telephone lines, a universal link circuit provided with an answering terminal for connection to said lines as calling lines for extending connections therefrom, and substation controlled means controllable from the substation of a calling one of said lines for operatively disassociating said line from said link circuit.

30. A telephone system including both local battery and common battery telephone lines, a universal link circuit provided with an answering terminal for connection to said lines as calling lines for extending connections therefrom, and substation controlled means controllable from the substation of a calling one of said lines for operatively disassociating said line from said link circuit prior to the disconnection of said answering terminal from said line.

31. A telephone system including a two-conductor magneto telephone line, a link circuit provided with a terminal for connection to said line, inductive means for said link circuit, a relay for operatively disassociating said link circuit from said telephone line by opening up the strands of said link circuit between said terminal and said inductive means, and means responsive to an operation of the magneto at the substation to operate said relay.

32. A telephone system including a two-conductor local battery telephone line, a link circuit provided with a terminal for connection to said line, inductive means for said link circuit, a relay for operatively disassociating said link circuit from said line by disconnecting said terminal from said inductive means, means controlled over said local battery telephone line for operating said relay to cause said disassociation.

33. A telephone system including a magneto telephone line provided with a terminal, a link circuit provided with a terminal for connection to said telephone line via said terminals, and a relay for said link circuit under substation control for operatively disassociating said link circuit from

said subscriber's telephone line while permitting said terminals to remain connected.

34. A telephone system including a two-conductor magneto telephone line, a link circuit provided with a connection plug for connecting said telephone line to said link circuit, electromagnetic means for said link circuit under substation control for operatively disassociating said link circuit from said telephone line while permitting said connection plug to remain connected to a jack of said subscriber's line.

35. A telephone system including a two-conductor magneto telephone line, a link circuit provided with a plug for connection to said telephone line, inductive means in

the strands of said link circuit, electromagnetic means for said link circuit responsive to an operation of the magneto at the substation of said telephone line for operatively disassociating said telephone line from said link circuit by opening up the strands of the link circuit between said inductive means and said plug.

Signed by me at Chicago in the county of Cook and State of Illinois, in the presence of two witnesses.

JOHN E. HILBISH.

Witnesses:

G. A. YANOWSKI,
B. O'BRIEN.