

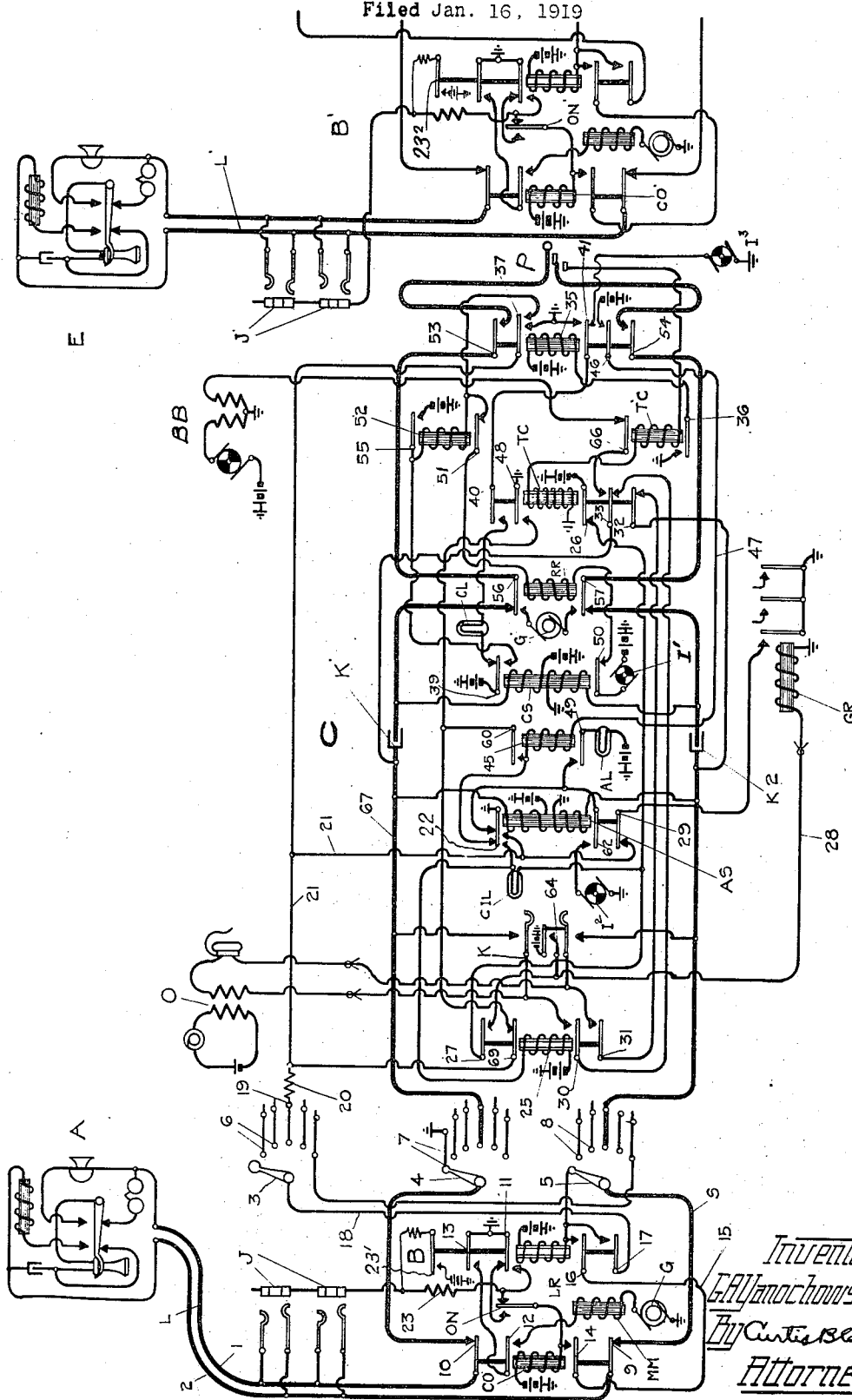
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G. A. YANOCHOWSKI

1,456,172

TELEPHONE SYSTEM

Filed Jan. 16, 1919



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UNITED STATES PATENT OFFICE.

GEORGE A. YANOCHOWSKI, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE SYSTEM.

Application filed January 16, 1919. Serial No. 271,386.

To all whom it may concern:

Be it known that I, GEORGE A. YANOCHOWSKI, a citizen of the United States of America, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telephone Systems, of which the following is a specification.

In general my invention relates to call distributing systems and is more particularly directed to improved apparatus and circuits for the connecting links used in such systems.

A feature of my invention is the provision of means whereby after a subscriber has operated his individual switch mechanism to extend a connection to an idle operator's circuit and the operator has extended the connection in the direction of the called subscriber, the replacing of the receiver at the calling substation and the removal thereof again operates to automatically flash a supervisory signal of the operator's connecting circuit to notify the operator that a recall is desired. If the calling subscriber should replace his receiver before the operator has extended the connection in the direction of the called subscriber's line, the subscriber's individual switch mechanism will be released from connection with the operator's connecting circuit when he replaces his receiver.

Another feature of my invention is the provision of a testless operator's circuit whereby the operator after receiving the number of the wanted line connects the calling plug of the link circuit directly to a jack of the wanted line without first testing to determine whether or not the called line is busy. I also provide means, associated with the said calling plug, to either automatically signal the called subscriber or to transmit an audible busy signal to the calling subscriber and to flash a cord circuit supervisory signal, depending upon the idle or busy condition of the line connected with.

A further feature of my invention is the provision of means for automatically connecting the operator's telephone set to the calling subscriber's line in response to a con-

nection of the calling subscriber's line to an idle link circuit. I also provide means for preventing a connection from being extended to an operator's position if the operator at said position is engaged in answering another call. A recall key is provided to associate the operator's set with the cord circuit and to operate a group busy relay.

These and other features of my invention will be more fully described in the ensuing specification and pointed out in the appended claims. For a more complete understanding of my invention, reference may be had to the accompanying drawing which diagrammatically illustrates my invention.

Referring now more in general to my invention as illustrated, it comprises a substation A connected by line conductors L to multiple jacks J and to an individual line switch B at the central office, there being one such individual switch B associated with each of the substations. The switches B have access to a plurality of connecting circuits or link circuits C. The link circuits C terminate in plugs in different operators' positions and are distributed and grouped in any desirable manner to efficiently handle the traffic. At the right of the sheet of drawings I have illustrated a called substation E connected by line conductors L' to apparatus similar to that connected to the substation A. In general the system operates as follows:

General operation of system.

The subscriber A removes his receiver from the switch hook, which act starts the individual line switch wipers 3, 4 and 5 stepping around to select an idle cord or link circuit C at an idle operator's position. The selection of an idle link circuit C by the line switch B automatically connects the operator's set O to the calling subscriber's line and renders the remaining trunks leading to the selected operator's position unselectable to other individual switches. The operator is then informed by the calling subscriber the number of the wanted line. The operator next inserts the calling plug P into a jack J' of the wanted line, and the called subscriber is either rung automati-

cally or the calling subscriber is supplied with a busy signaling current, dependent upon the idle or busy condition of the called line. After the conversation is finished the subscribers restore their respective receivers on the switch hooks, lighting the supervisory lamps, and the operator disconnects the plug P from the jack of the called line. The individual switch B is restored to normal and is now available for use in extending other connections. Before proceeding with a more detailed description of the circuits, I will refer to the selector switch mechanism of the individual switch B.

Description of apparatus.

The switch referred to in the preceding paragraph in general comprises sets of bank contacts 6, 7 and 8, preferably ten, and co-operating wipers 3, 4 and 5 which are mounted upon a central shaft carrying a ratchet wheel adapted to be driven by the motor magnet MM. Two check pawls are employed, one of the check pawls being normally in engagement with the ratchet and the other being normally out of engagement with the ratchet. For a better understanding of the check pawl arrangement, reference may be had to Patent No. 1,210,386, granted December 26, 1916. The check pawl normally in engagement with the ratchet is controlled by the cut-off relay CO, and the other check pawl is controlled by the line relay LR. In the operation of this switch, upon the initiation of the call by the removal of the receiver from the switch hook the line relay LR is energized, thus causing its associated pawl to engage the ratchet wheel and thereafter the cut-off relay CO is energized, causing its associated pawl to disengage the ratchet wheel. Thereafter the motor magnet MM advances the wipers over the bank contacts, followed by the de-energization of cut-off relay CO, but relay LR is maintained energized so that both pawls are now in engagement with the ratchet wheel. To release the switch B, line relay LR is de-energized, thus withdrawing its pawl from engagement with the ratchet, and thereafter cut-off relay CO is again energized moving its pawl out of engagement with the ratchet, allowing the wipers to be restored by a suitable coil spring. On the first step, off-normal contacts ON assume their alternate position and are maintained so until the wipers are restored, whereby said contacts ON are again moved to their normal position. It is understood that various other types of line switches may be used with the cord circuit of my invention. For example, a line switch as shown in my Patent No. 1,314,453, dated August 26, 1919, may be used, or a line switch of the character shown in my copending application

243,292, filed July 5, 1918, may be used. My invention in this application does not relate to the type of line switch; therefore, I have merely represented a line switch of the prior art in this application. I could have just as well illustrated a line switch of either of the types above referred to.

Referring now more in detail to the apparatus employed and illustrated in my invention, it comprises the well-known Kellogg type of substation apparatus A connected by the line L, including two conductors, to the individual switch B and multiple jacks at the central office. The individual switch B, as before described, is provided with line wipers 4 and 5 and a private wiper 3 for engagement with the bank contacts 7, 8 and 6, respectively. A line relay LR, a cut-off relay CO, a motor magnet MM and the necessary contact springs and circuit connections are also provided for the individual switch B.

The connecting or link circuit C terminates at its one end in bank contacts in the individual switches B and at its other end in a plug P for use in establishing connection with called subscribers' lines via their multiple jacks J'. The link circuit C is also provided with an answering supervisory relay AS and a calling supervisory relay CS for assisting in the control of answering supervisory lamp AL and calling supervisory lamp CL. A call initiating lamp CIL is also provided. An operator's recall key K is provided as well as automatic ringing apparatus including the necessary interrupters and generators, etc. A pair of test control relays TC and T'C are provided for use in testing the called line as to its idle or busy condition. A group relay GR, common to the operator's position, is provided and is energized when a subscriber's line is connected to an idle link circuit C at the operator's position. This relay upon energizing renders all the remaining idle trunks at the operator's position artificially busy to all incoming calls until the first connection has been extended to the called subscriber's line. A busy back BB and other necessary apparatus are provided and will be more fully hereinafter described.

The called substation E and individual switch B' are similar to the calling substation A and its individual switch B.

Having described in general the apparatus of my invention, I will now describe in detail the operation of the same.

Operation of system.

Assuming that the subscriber at substation A wishes to converse with the subscriber at substation E, the subscriber at substation A removes his receiver from the switch hook, this act causing the energization of line relay LR over a circuit traced

from battery through the winding of relay LR, wiper 5, conductor S, normal contact 9 of the cut-off relay CO, conductor 2, through the substation A, conductor 1, normal contact 10 of the cut-off relay CO and wiper 4 to ground at contact 7. Upon the energization of relay LR an energizing circuit for the cut-off relay CO is established from battery through the winding of cut-off relay CO, the normal contact of off-normal contacts ON, to ground at alternate contact 11 of relay LR, energizing the cut-off relay CO. Relay CO therefore closes its alternate contact 12 which establishes an energizing circuit for the motor magnet MM, traced from ungrounded pole of alternating current generator G through the motor magnet MM, alternate contacts 12, 13 to ground. The motor magnet MM energizes stepping the wipers 3, 4 and 5 around and if the first contacts are busy the motor magnet continues to step the wipers around until an ungrounded test contact 6 is encountered. Upon the first step of the wipers, the off-normal switch ON assumes its alternate position opening the energizing circuit for cut-off relay CO but assuming that the first contact is busy, another circuit for relay CO is established from battery through the winding of CO, alternate contact 14, conductor 15, alternate contacts 16, 17 of relay LR, conductor 18, wiper 3, contact 6, conductor 19 to ground at another cord selector associated with the busy contact. When the private wiper 3 finds an ungrounded contact, relay CO de-energizes interrupting the circuit of the motor magnet MM and rendering the wipers 3, 4 and 5 inert. Relay LR places a busy potential upon the sleeves of multiple jacks J. When the individual switch B has selected an idle cord circuit C, the answering supervisory relay AS of cord circuit C is energized over a circuit traced from battery through the upper winding of said relay AS, through bank contact 7, the wiper 4, out over the calling line, through the calling substation, back over conductor 2 of the calling line, through wiper 5, bank contacts 8 and the lower winding of the relay AS to ground. Upon energization of relay AS a holding circuit for the line relay LR of the switch B is established extending from battery through the winding of line relay LR, its alternate contacts 16 and 17, private wiper 3, bank contact 6, resistance 20 and conductor 21 to ground at alternate contact 22 of relay AS. A further result due to the energization of relay AS is the closing of a circuit for the call initiating lamp CIL and slow-acting relay 25 in multiple. The circuit for the call initiating lamp CIL extends from battery through normal contact 26 of relay TC, lamp CIL and alternate contact 22 to ground. The

circuit for relay 25 extends from battery through the winding of said relay and through alternate contact 22 of relay AS to ground. Relay 25 upon energizing closes an energizing circuit for group relay GR over a path traced from battery through normal contact 26 of relay TC, alternate contact 27 of relay 25, conductor 28 and through the winding of relay GR to ground.

The relay GR upon energizing places a ground upon the test conductor of each idle link circuit associated with the operator's position, through normal contact 29 of the answering supervisory relays AS of the idle cord circuits. Relay 25 upon energizing connects the operator's set O through alternate contacts 30 and 31 and through normal contacts 32 and 33 of relay TC, over the talking conductors of the cord circuit C and over the telephone line to the calling substation. The operator is now in conversational circuit with the calling subscriber and is apprised of which cord circuit the calling subscriber A has selected by the glowing of the call initiating lamp CIL.

The operator now inquires of the calling subscriber the number of the called substation desired. If, at this time, the calling subscriber should replace his receiver, the opening up of the circuit of the answering supervisory relay AS at the substation would de-energize the same and remove the holding ground from the private conductor 21, thereby releasing the individual switch B to normal and also releasing the group relay GR and slow-acting relay 25, thus returning all the apparatus to normal. Assuming, however, that the calling subscriber does not replace his receiver, but on the contrary that the operator places the plug P of the cord circuit C into a multiple jack J' of the called substation E. The connection of the said plug P to the jack J' of the substation E causes the cut-off relay CO' of the line switch B' to be energized in series with the test control relays T'C and TC, providing that the substation E is idle, over a circuit traced from battery through the winding of relay CO', sleeve contact of jack J' and sleeve contact plug P, through the windings of relays T'C and TC to ground. The cut-off relay CO' energizing removes the control of the switch B' from the substation E. The relay TC energizes whether or not the line of the called subscriber is busy, while the relay T'C only energizes when the connection is established with the line of an idle subscriber. The relay TC is provided with a higher resistance winding than the winding T'C and energizes whether or not ground is connected to the multiple jacks J' through a resistance, while the relay T'C will not energize if a ground potential through a

resistance is found upon the test contact of the multiple jacks J'. Ground may be placed upon the test contact and jacks either through the relays of the cord circuit connected with a multiple jack, or through the resistance 23 of line switch B if line switch B is used for calling purposes. In case line switch B is used, battery is connected to the sleeve of the multiple jacks J, through contact 23', when the line switch is used for calling purposes, and through the cut-off relay CO when it is used for called purposes. Relay TC' upon energizing establishes a circuit for relay 35, extending from battery through the winding of said relay and alternate contact 36 of relay T'C to ground. Relay 35 upon energizing places ground upon private conductor 21 through its alternate contact 37 and extends the talking conductors of the cord circuit through to the line of the called subscriber. Relay TC upon energizing establishes an energizing circuit for calling supervisory lamp CL traced from battery through normal contact 39 of relay CS, through the filament of said lamp CL, alternate contact 40 of relay TC and alternate contact 41 of relay 35 to ground. The relay TC upon energizing also removes the battery connection from group relay GR and lamp CIL by opening its contact 26. Relay GR de-energizing removes ground from the private bank contacts 6 of the cord circuits associated with this particular operator's position. If the calling subscriber should replace his receiver at this time, a circuit for relay 45 would be established traced from battery through alternate contact 46 of relay 35, over conductor 47, through the winding of said relay 45, and through normal contact 22 to ground. Relay 45 energizing locks itself to ground at alternate contact 48 of relay TC and closes a circuit for supervisory lamp AL through its alternate contact 49. In this instance, the subscriber A does not release his individual switch B as it is locked up over conductor 21 to ground at alternate contact 37 of relay 35.

A further result due to the energization of relay 35 was the closing of circuit for ringer relay RR, traced from battery through the interrupter I', normal contact 50 of relay CS, winding of said relay RR, normal contact 51 of relay 52 and alternate contact 37 of relay 35 to ground. The relay RR upon energizing connects ringing current from the generator G' to the called substation E, through alternate contacts 53 and 54 of relay 35. Through the medium of interrupter I', relay RR is intermittently energized and de-energized to alternately connect ringing current to the said called line. The removal of the receiver from the called subscriber's switch hook closes a path

for calling supervisory relay CS extending through normal contacts 56 and 57 of relay RR, alternate contacts 53 and 54 of relay 35, through the plug and jack connections and through the substation E. The relay CS upon energizing opens the energizing circuit of relay RR, opens the circuit of calling supervisory lamp CL at its normal contact 39, and closes a circuit for relay 52 through its alternate contact 39. Relay 52 upon energizing closes a locking circuit for itself through its alternate contact 55, independent of alternate contact 39 of relay CS, and opens the circuit of relay RR at its contact 51, thereby preventing further applications of ringing current to the called line until the plug P has been removed from the jack of the called line. The subscribers may now carry on a conversation over the heavily marked conductors shown in the drawing including condensers K' and K².

The subscribers at substations A and E having finished conversation replace their receivers upon their respective switch hooks, opening energizing circuits for the relays AS and CS. Relay AS de-energizing closes a circuit for relay 45 over a path extending from battery through alternate contact 46 of relay 35, winding of said relay 45, and normal contact 22 to ground. The relay 45 upon energizing closes a locking circuit for itself through its alternate contact 60 to ground at alternate contact 48 of relay TC, and also closes a circuit for answering supervisory lamp AL, traced from battery, through the filament of said lamp, alternate contact 49 of relay 45 to ground at normal contact 22 of relay AS. The relay CS de-energizing closes a circuit for calling supervisory lamp CL, traced from battery through normal contact 39 of relay CS, the said lamp CL, alternate contact 40 of relay TC to ground at alternate contact 41 of relay 35. The operator, observing the two lights glowing, knows that the subscribers have replaced their receivers, and removes the plug P from the jack J'. This act opens the series circuit of relays TC, T'C and CO'. The relay T'C de-energizing opens the energizing circuit of relay 35. Relay 35 de-energizing opens the holding circuit for relay LR of the switch B. A further result due to the de-energization of relay 35 is the opening of the locking circuit for relay 45 which now de-energizes and opens the circuit of supervisory lamp AL. The relay TC de-energizing opens the circuit of lamp CL at its contact 40, thereby effacing the said lamp CL. The lamp CL also has its circuit opened at contact 41 of relay 35 and the relay 45 also has its locking circuit opened at contact 48 of relay TC. The relay LR of the switch B de-energizing closes its normal contact 11, thereby establishing an energizing circuit for relay

CO, which is traced from battery through the winding of said relay CO, alternate contact ON to ground at normal contact 11 of relay LR. Relay CO attracting its armature withdraws its check pawl from engagement with the ratchet on the shaft of switch B, and as LR is de-energized, its pawl is withdrawn from the said ratchet wheel, thereby restoring wipers 3, 4 and 5 to normal. Upon restoration of the wipers, off-normal contact ON assumes its normal position opening the energizing circuit of relay CO, restoring it and now the switch being at normal, the line of substation A is available for further use. The relays of the cord circuit C all having returned to normal, the link circuit C is now available for further use.

Assuming that the calling subscriber A had desired to make a recall immediately before the operator had removed the link circuit plug P from the jack of the called subscriber's line, the replacing of the receiver at the calling substation operates to energize relay 45 and closes a circuit for lamp AL. The subsequent removal of the receiver at the substation A again energizes relay AS, thereby connecting interrupter I² in circuit with the supervisory lamp AL over a path extending from battery through the said lamp AL, alternate contact 49 of relay 45 and alternate contact 62 of relay AS to ground at interrupter I². The interrupter I² thus intermittently flashes the supervisory lamp AL to notify the operator that the calling subscriber desires to make a recall. The operator now actuates her listening key K to connect her telephone set O across the conductors of the link circuit and converses with the calling subscriber. The operation of the key K closes an energizing circuit for group relay GR, thereby energizing the same and rendering all the idle link circuits at the operator's position busy to incoming calls. The circuit for group relay GR extends from battery through contact 64 of key K and through the winding of said relay GR to ground. The operator after inquiring the wants of the calling subscriber removes the plug P from the jack or the called line, if it is a different subscriber that the calling subscriber desires, restores her key K to normal and establishes the recall connection as she did the previously described connection.

Assuming now that the line of the called subscriber E was busy when the plug P was connected to the jack J', of the called line, the relay TC will energize, as before mentioned, but the relay T'C will fail to energize. The relay TC energizes over a circuit extending from ground through the winding of said relay TC, winding of relay T'C, sleeve contacts of plug P and jack J', and through relay CO' to battery. Battery

is to be found upon the sleeve of the jacks J, either through the winding of the cut-off relay CO or through the contacts 23² of the relay LR'. The battery potential causes the relay TC in the cord circuit C to always energize, whether the connected-with called line is busy or idle, while the relay T'C only energizes when the connected-with called line is idle. The failure of relay T'C to energize prevents the energization of relay 35, thereby preventing the application of ringing current to the called subscriber's line. The relay TC energizing opens the energizing circuit for group relay GR, removes battery from the calling lamp CIL, disconnects the operator's set from the link circuit and closes a busy signaling circuit, extending from the busy back BB through normal contact 66 of relay T'C, alternate contact 33 of TC to talking conductor 67, and out through the calling substation A and back over the other conductor to ground. A further result due to the energization of relay TC is the closing of a circuit for calling lamp CL extending from battery through normal contact 39 of relay CS, through said lamp CL, alternate contact 40 of relay TC and through normal contact 41 of relay 35 to ground through the interrupter I³. The interrupter I³ operates to alternately flash the calling supervisory lamp CL to notify the operator that the called subscriber is busy. The calling subscriber now replaces his receiver in response to the busy signal and causes the de-energization of relay AS. Relay AS de-energizing removes ground from the slow-acting relay 25 and also removes ground from the holding conductor 21. The removal of ground from conductor 21 permits the relay LR of the line switch B to de-energize and restore the line switch B to normal before the slow relay 25 has had time to de-energize and close its normal contact 69. The closure of normal contact 69 places a guarding potential upon the private contact 6 of the individual switches B to prevent the cord circuit C from being selected before the operator removes the plug P from the jack J' of the called line. This guarding potential extends from ground at alternate contact 48 of relay TC, through normal contact 69 of relay 25 to the said private contact 6. The operator in response to the flashing of the calling supervisory lamp CL removes the plug P from the jack of the called subscriber's line, thereby permitting relay TC to de-energize and restore the apparatus of the cord circuit C to normal.

While I have referred to a particular type of line switch, I do not desire to be limited to the particular line switch shown, as other forms of such switches may be desired. Neither do I desire to be limited to the exact circuits shown. For these reasons I aim to

cover all such changes and modifications as come within the spirit and scope of the appended claims.

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

1. A telephone system including calling and called subscribers' lines, a link circuit, an automatic switch for connecting said calling subscriber's line and said link circuit, manually controlled means for connecting said link circuit to said called subscriber's line, a source of signaling current, a source of busy current, automatic means responsive to the connection of said link circuit to said called subscriber's line to either connect the signaling current to the called subscriber's line or the busy current to the calling subscriber's line dependent upon the idle or busy condition of the called subscriber's line, a supervisory lamp for said link circuit, and means for automatically flashing said supervisory lamp responsive to a single actuation of the switchhook at the calling substation.

2. A telephone system including a calling and a called subscriber's line, a link circuit, an automatic switch for connecting said calling subscriber's line to said link circuit, manually controlled means for connecting said link circuit to said called subscriber's line, a supervisory signal, a source of busy current, automatic means responsive to the connection of said link circuit to said called subscriber's line, if said called subscriber's line is busy, to connect said busy current to said calling subscriber's line, and to intermittently operate the said supervisory signal, a second supervisory lamp and substation-controlled means for intermittently closing a circuit through said second supervisory lamp to cause the same to intermittently flash to denote a recall.

3. A telephone system including calling and called subscribers' lines, a link circuit, an automatic link selecting switch provided with movable contacts capable of assuming a plurality of selective positions, means including said automatic switch and said link circuit for connecting said lines in conversational circuit, a supervisory signaling device associated with said link circuit, and means associated with the link circuit and controlled by the restoration of the switch hook at one of the connected substations to cause the continuous operation of said supervisory device to furnish a disconnect signal and by the subsequent removal of the receiver to alter the continuous operation of the device and thereafter cause the intermittent operation of the signaling device to furnish a recall signal.

4. A telephone system including a calling and a called subscriber's line, a plurality of link circuits, an automatic switch for connecting said calling subscriber's line to an

idle one of said link circuits, an operator's telephone set, means common to said link circuits for rendering all idle ones of said link circuits busy, a relay for said link circuit for automatically connecting said operator's set to said link circuit and for operating said common means, means for connecting said link circuit and said called subscriber's line, a second relay for said link circuit for disconnecting said operator's set from said link circuit and for restoring said common means, and automatic means for intermittently signaling the subscriber at the called substation.

5. A telephone system including a calling and a called subscriber's line, a link circuit provided with a manually-controlled terminal, automatic means including a progressively movable switch for connecting said calling subscriber's line to said link circuit, means for said link circuit responsive to such connection for automatically connecting the operator's telephone set to said link circuit, manually controlled means for connecting said link circuit to said called subscriber's line, and means responsive to such connection for automatically disconnecting said operator's telephone set from said link circuit and for automatically intermittently signaling the called subscriber.

6. A telephone system including a calling and a called subscriber's line, a link circuit provided with a manually controlled terminal, automatic means including a progressively movable switch for connecting said calling telephone line to said link circuit, an operator's telephone set, automatic means responsive to such connection for connecting said operator's telephone set to said link circuit, automatic testing means for said link circuit responsive to the connection of said link circuit to said called line for either furnishing the called subscriber's line with ringing current or for transmitting busy signaling current to the calling subscriber's line, and means responsive to such connection for disconnecting said operator's telephone set from said link circuit.

7. A telephone system including a calling and a called subscriber's line, a link circuit, automatic means for connecting said calling subscriber's line to said link circuit, means for connecting said link circuit to said called subscriber's line, an operator's telephone set, automatic means for connecting and disconnecting said operator's telephone set and said link circuit, and a group relay for said link circuit responsive to the connection of said calling telephone line to said link circuit for rendering all of the remaining idle link circuits at an operator's position busy.

8. A telephone system including a calling subscriber's line and a called subscriber's line, link circuits, automatic means for con-

necting said calling subscriber's line and an idle link circuit, means for connecting said link circuit to said called subscriber's line, an operator's telephone set, automatic means
 5 for connecting and disconnecting said operator's set and said link circuit, means common to said link circuits operated responsive to the connection of said calling subscriber's line and said link circuit for rendering the other link circuits busy, and an
 10 operator's key for subsequently operating said common means.

9. A telephone system including a calling subscriber's line and a called subscriber's
 15 line, a link circuit, automatic means for connecting said calling subscriber's line to said link circuit, means for connecting said link circuit to said called subscriber's line, automatic test means for said link circuit for determining the idle or busy condition of said
 20 called subscriber's line, a supervisory signaling device for said link circuit, and means associated with the link circuit and controlled from a connected station for causing the supervisory signaling device to operate
 25 continuously to furnish a disconnect signal and intermittently to furnish a recall signal.

10. A telephone system including a calling subscriber's line and a called subscriber's
 30 line, a link circuit for connecting said lines in conversational circuit, automatic test means for said link circuit for either supplying the called subscriber's line with ringing current or the calling subscriber's line with
 35 signaling current, and automatic disconnect means for said last circuit operable if the called line is busy and controlled by the calling subscriber for disconnecting said calling line from said link circuit, said disconnect means being ineffective if the called
 40 line is idle.

11. A telephone system including a calling subscriber's line and a called subscriber's
 45 line, a link circuit provided with a manual terminal and an automatic switch for use in connecting said lines, automatic test means for said link circuit operable to supply the called subscriber's line with ringing current or the calling subscriber's line with busy signaling current dependent upon the idle or
 50 busy condition of the connected called line, subscriber-controlled means for releasing said automatic means to disconnect said calling line from said link circuit if said called subscriber's line tests busy, and a supervisory
 55 signal adapted to be flashed to denote the busy condition of the called line.

12. A telephone system including a calling subscriber's line and a called subscriber's
 60 line, a link circuit and an automatic switch for use in connecting said lines, automatic test means for said link circuit operable to supply the called subscriber's line with ringing current or the calling subscriber's line
 65 with busy signaling current dependent upon

the idle or busy condition of the connected called line, and subscriber-controlled means for releasing said automatic means to disconnect said calling line from said link circuit if the called line tests busy, said last
 70 means being ineffective if said called subscriber's line tests idle.

13. A telephone system including a calling and a called subscriber's line, a plurality of
 75 link circuits, an automatic switch for connecting said calling subscriber's line to an idle one of said link circuits, an operator's telephone set, means common to said link circuits for rendering all idle ones of said link circuits busy, a relay for said link circuit for automatically connecting said operator's set to said link circuit and for operating said common means, a second relay for said link circuit for disconnecting said operator's set from said link circuit and for restoring said common means, and automatic testing means for said link circuit for either supplying the called subscriber's line with ringing current or the calling subscriber's line with busy signaling current.
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14. A telephone system including a calling and a called subscriber's line, a plurality of
 95 link circuits, an automatic switch for connecting said calling subscriber's line to an idle one of said link circuits, an operator's telephone set, means common to said link circuits for rendering all idle ones of said link circuits busy, a relay for said link circuit for automatically connecting said operator's set to said link circuit and for operating said common means, a second relay for said link circuit for disconnecting said operator's set from said link circuit and for restoring said common means, automatic testing means for said link circuit for either supplying the called subscriber's line with ringing current or the calling subscriber's line with busy signaling current, and a signal adapted to be intermittently operated if busy signaling current is transmitted to the calling line.
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15. A telephone system including a calling and a called subscriber's line, a link circuit provided with a manual terminal, automatic means including a progressively movable
 115 switch for connecting said calling subscriber's line to said link circuit, means for said link circuit responsive to such connection for automatically connecting the operator's telephone set to said link circuit, manually controlled means for connecting said link circuit to said called subscriber's line, means responsive to such connection for automatically disconnecting said operator's telephone set from said link circuit, and automatic testing means for said link circuit for either supplying the called subscriber's line with ringing current or the calling subscriber's line with busy signaling current.
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16. A telephone system including a calling 130

and a called subscriber's line, a link circuit, automatic means for connecting said calling subscriber's line to said link circuit, means for connecting said link circuit to said called
5 subscriber's line, an operator's telephone set, automatic means for connecting and disconnecting said operator's telephone set and said link circuit, a group relay for said link circuit responsive to the connection of said
10 calling telephone line to said link circuit for rendering all of the remaining idle link circuits at an operator's position busy, and automatic testing means for said link circuit for either supplying the called subscriber's line with ringing current or the calling sub- 15 scriber's line with busy signaling current.

Signed by me at Chicago, county of Cook and State of Illinois, this 14th day of January, 1919.

GEORGE A. YANOWSKI.