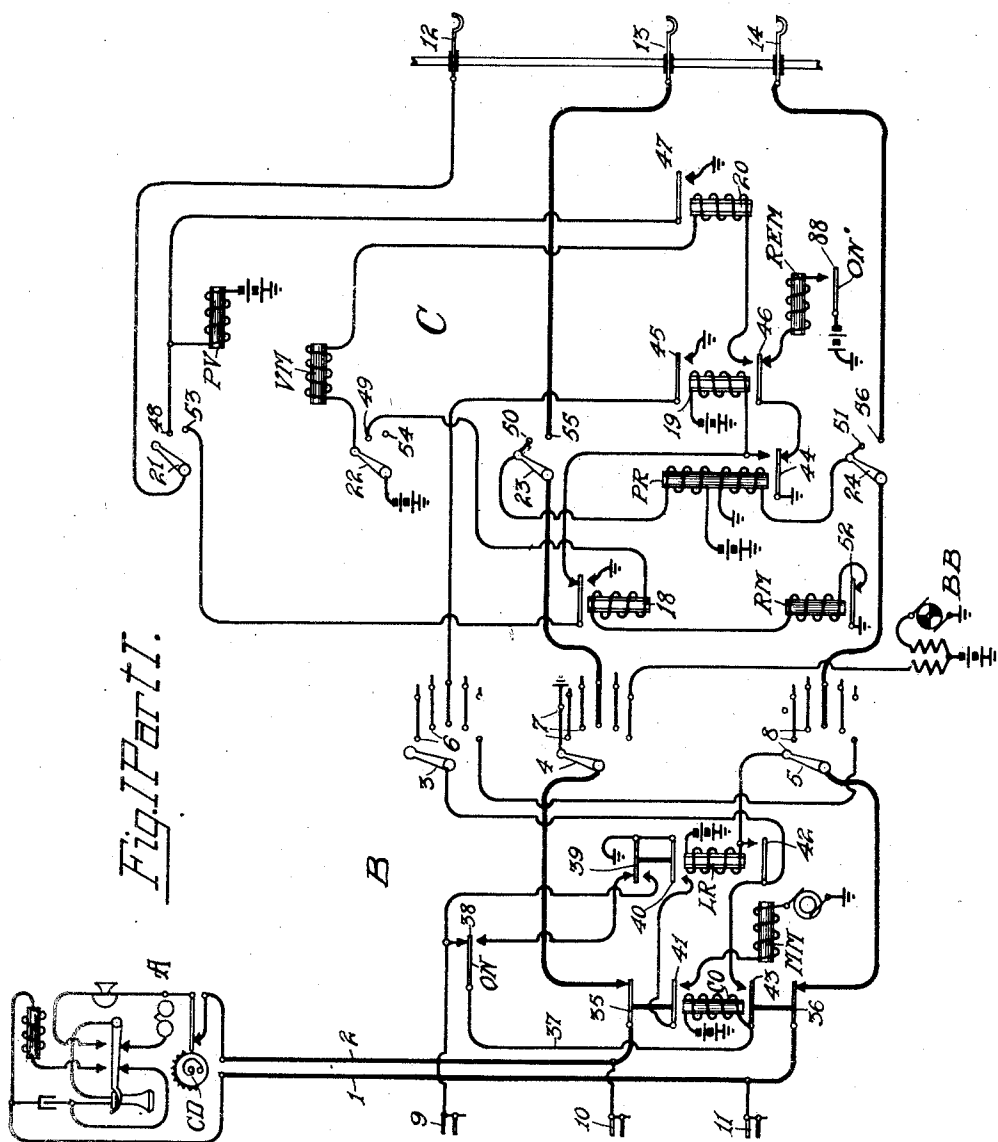


1,344,195.

2 SHEETS—SHEET 1.



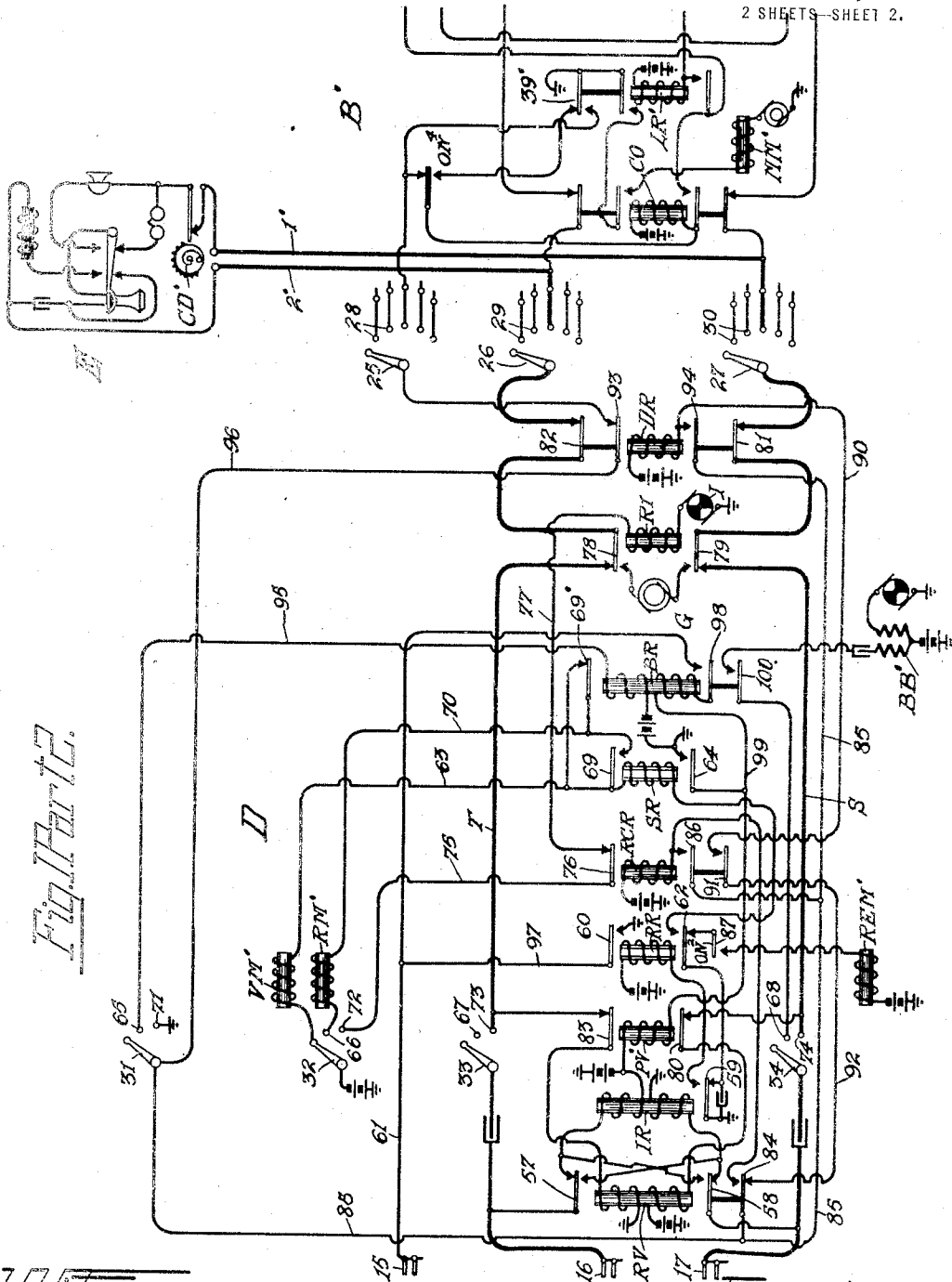
Wm Berghahn
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Attorney.

1,844,195.

Patented June 22, 1920.

2 SHEETS—SHEET 2.



Witnesses:

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By Curtis Blamp.
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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.

1,344,195.

Specification of Letters Patent. Patented June 22, 1920.

Application filed March 25, 1916. Serial No. 86,549.

To all whom it may concern:

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

My invention relates to telephone exchange systems of the kind in which automatic switches are employed at the exchange or central office for establishing connections between calling and called lines. My invention relates more particularly to systems of the two-wire automatic type in which the calling subscriber at the termination of conversation controls the restoration of the switches used in establishing connection between his line and the called subscriber's line.

In systems of the above character it often happens that a calling subscriber is negligent or slow in replacing his receiver upon its switch-hook, thus tying up or isolating the called subscriber's line and preventing his line from being called or selected by another calling party, and preventing him from initiating a call as a calling subscriber as long as the above condition exists.

A feature of my invention is the provision of means in the connector switch circuits of an automatic system whereby as soon as a connected called subscriber replaces his receiver upon the switch-hook the said means is actuated to disconnect the called line from the connector switch which selected the said called line and to render the multiple contacts of the selected contacts selectable by other connectors even though the connector wipers are still in engagement with the selected contacts. The actuated means also removes the busy potential from the associated private bank contacts of all the connector switches which have access to the said called line and also restores the individual apparatus of the called line to normal so that the line is immediately available for selection by other calling lines or to initiate a call as a calling line.

For a better understanding of my invention reference is to be had to the accompanying drawing in which all the apparatus is shown at normal and in which Figure 1 comprising parts 1 and 2, is a diagrammatic

illustration of an automatic telephone system embodying the features of my invention.

Referring now in general to my invention as illustrated in Fig. 1 part 1, it comprises an automatically equipped calling substation A containing the usual apparatus including the calling device CD. The substation A is connected by the line limbs 1 and 2 to the central office, and terminates thereat in an individual switch B. The individual switch B comprises a line relay LR, cut-off relay CO and a motor magnet MM. Said motor magnet MM actuates to step the wipers 3, 4 and 5 over the bank contacts 6, 7 and 8 to select an idle first selector as C. A busy back BB is shown which sends a busy signal to the calling subscriber in the event that all the first selectors with which the line switch B is associated are busy. I also show the off-normal contacts ON which assume their alternate position upon the first step of the wipers off normal. Access to the line of substation A is provided by means of the multiply connected contacts 9, 10, and 11, the said contacts being the bank contacts of the connector switches such as D which have access to the line of substation A. For a better understanding of the mechanical structure of line switch B, reference is made to an application for Letters Patent S. N. 631,480 filed June 5th, 1911, by Wm. Kaisling, now Patent No. 1,210,386, granted December 26, 1916.

The selector switch shown at C is of the Strowger type operating in connection with the two-wire system in which the central office apparatus is controlled over the two sides of the line in series. The first selector C comprises wipers 12, 13, 14 mounted upon a shaft which has a vertical motion controlled by a vertical magnet VM to step the wipers vertically to a row of contacts and a rotary motion controlled by the rotary magnet RM, to step the wipers over contacts 15, 16, 17 of the selected row to select a set of contacts leading to an idle connector as D. The calling subscriber A controls the operation of the switch C through the medium of the double wound primary relay PR. The release of the selector is brought about by means of the release magnet REM. Off-normal springs ON¹ are shown and assume their alternate position upon the first step of the

switch off normal. The relays 18, 19 and 20 are slow acting relays, the functions of which will be more fully described in the detail description of the system. A private relay PV is also provided which controls the side switch which comprises the wipers 21, 22, 23 and 24 the said wipers being stepped to their different positions by means of the said relay PV in a well-known manner. The release magnet restores the said wipers to normal.

The connector switch D is also of the Strowger type and is illustrated in Fig. 1 part 2. It comprises an interrupter line relay IR, a secondary relay SR and the vertical magnet VM¹ which is energized and deenergized by the operation of the relay IR to step the wipers 25, 26, and 27 of the connector D in a vertical direction to select a row of contacts. A rotary magnet RM¹ is provided which is energized by the last set of impulses to step the wipers 25, 26 and 27 in a horizontal direction to select the contacts 28, 29, 30 of the called line in the selected group. A busy relay BR is associated with the connector to connect the busy back BB¹ in case the called line is busy. A ringing relay RI is intermittently energized and deenergized by an interrupter I to connect the ringing generator G to ring the called line and a ringing control relay RCR is energized when the called subscriber answers to disconnect the ringing generator G from the called subscriber's line. A release relay RR and a release magnet REM¹ are associated with the connector, magnet REM¹ being energized upon the deenergization of a release relay RR to release the switch mechanism. Off-normal contacts ON² are associated with the connector and assume their off-normal position upon the first step of the wipers off normal. Side switch wipers 31, 32, 33, 34 are provided and are controlled by a private relay PV¹, the said wipers being stepped to their different positions by the private magnet PV¹ in a well-known manner and are returned to normal by the release magnet. A reversing relay RV is provided which is energized upon the response of the called subscriber and a disconnect relay DR which is energized when the called subscriber replaces his receiver, the functions of relays RV and DR will be more fully described in the ensuing specification. As two dimension switches of the character above described are well known in the art, it is thought unnecessary to give a full description of their mechanical construction. As my invention is wide in its application and may be applied to other types of switches than those described, I do not wish to be limited to the type herein described.

An automatically equipped substation E is also shown to the right of Fig. 1 part 2,

being similar to that of A, the said substation also terminating in a line switch B¹ similar to B.

Having described in general the apparatus associated with my invention, a detailed operation of the system as illustrated will now be described.

Assuming a subscriber at the substation A desires connection with the subscriber E whose number we will assume is 234, the subscriber at substation A removes his receiver from its switch-hook thereby closing a circuit for the line relay LR of the line switch B traced from grounded contact 7 through wiper 4, normal contact 35 of relay CO, conductor 2, the closed contacts of the switch-hook at substation A returning over conductor 1, normal contact 36 of relay CO, wiper 5, bank contact 8 and through the winding of the line relay LR to battery. Relay LR upon energizing, closes a circuit for the cut-off relay CO traced from battery through the relay CO, conductor 37, normal contact 38 of off-normal spring ON to ground at alternate contact 39 of the line relay LR. The closing of contact 39 places a ground upon multiple contacts 9 of connector switches associated with the calling line thereby preventing any connector from connecting to the line of substation A. Upon an energization of the relay CO a circuit for motor magnet MM is established traced from ground through the alternate contact 40 of relay LR alternate contact 41 of relay CO and through the winding of magnet MM to the generator or interrupter. Magnet MM is thus energized and deenergized to step the wipers 3, 4 and 5 into engagement with the first set of contacts 6, 7 and 8 and if these contacts lead to a busy first selector C, the test contact 6 will be connected to ground from the busy switch C thus closing a locking circuit for the relays CO and LR extending from grounded contact 6 through wiper 3, alternate contact 42 of relay LR and the winding of said relay LR to battery and also extending through the alternate contact 43 of relay CO and through said relay CO to battery. Upon the first step of the wipers off normal, off-normal contacts ON assume their alternate position opening the initial circuit of CO, but as a substitute circuit has been established from the grounded busy contact 6 the relay CO remains energized. Magnet MM thus steps the wipers 3, 4 and 5 to the next set of contacts and if busy the magnet MM steps the wipers 3, 4 and 5 to the next set of contacts and so on until an idle set of contacts is found. Assuming that the third set of contacts are idle, an ungrounded contact 6 will be encountered by wiper 3, thus opening the locking circuits for relays LR and CO thereby bringing about the deenergization of the relay CO, but relay LR

being slow to release remains in its energized position until another locking circuit is established for it as will be hereinafter described. The opening of contact 41 of relay CO opens the circuit of magnet MM, thus preventing the further advancement of wipers 3, 4, 5. A further result due to the deenergization of relay CO is the closing of a circuit for primary relay PR of selected first selector switch C, traced from battery through the upper winding of the relay PR, side switch wiper 23, bank contact 7, wiper 4, normal contact 35 of relay CO through the calling substation and back through normal contact 36 of relay CO, wiper 5, bank contact 8, side switch wiper 24 and through the lower winding of relay PR to ground. The relay PR, upon energizing, closes its alternate contact 44 establishing a circuit for relay 19, said circuit extending from battery through the winding of the said relay 19 to ground at alternate contact 44 of relay PR. Relay 19, upon energizing closes its alternate contact 45 thereby placing ground upon the private contact 6, to hold the line relay LR energized and also make this particular selector C busy against selection by any other individual switch B. The subscriber at the substation A now operates his calling device CD to send two impulses of current thereby interrupting the energizing circuit of the primary relay PR of the first selector C twice. The relay 19 being slow acting does not deenergize due to its circuit being momentarily broken by the deenergizations of the relay PR. Therefore the closing of normal contact spring 44, upon deenergization of relay PR, alternate contact 46 of relay 19 being closed, completes a circuit through the vertical magnet VM extending from battery through the switch wiper 22, winding of magnet VM, then through the winding of relay 20 and alternate contact 46 of relay 19 to ground at normal contact 44. The vertical magnet VM energizes and deenergizes twice due to the operations of line relay PR, and operates to lift the shaft wipers 12, 13, and 14 two steps in a vertical direction opposite the second row or level of bank contacts. The relay 20 energizes upon the first impulse but being slow acting, does not deenergize until the last impulse is sent. In its energized position the relay 20 completes a circuit through the private magnet PV over a circuit extending from battery through the winding of the magnet PV to ground at alternate contact 47 of the relay 20. As soon as the relay 20 deenergizes the circuit of the private magnet PV is broken which in turn deenergizes and permits the side switch wipers 21, 22, 23 and 24 to pass to their second position to engage contacts 48, 49, 50 and 51. The passing of the side switch wiper 22 to its second position in engagement with contact 49 shifts the battery connection from the vertical to the rotary magnet RM. The wiper 21 engaging its associated contact 48 in its second position connects the private wiper 12 with the private magnet PV. As soon as the battery is shifted to the rotary magnet RM, a circuit is closed extending from battery through the side switch wiper 22, contact 49, winding of relay 18, winding of the rotary magnet RM and its normal contact 52 of its interrupter springs to ground. The rotary magnet RM energizes over this circuit and rotates the shaft wipers one step in a rotary direction. The energization of the magnet RM opens its own normal contact 52 bringing about its deenergization. If the first contact is idle the armature of the private magnet PV will return to normal position, thereby permitting the side switch wipers 21, 22, 23 and 24 to pass to their third position to engage contacts 53, 54, 55 and 56. If, however, the first contact is busy, the first private bank contact 15 will have a guarding ground upon it as will be explained later. The private wiper 12, upon engaging this grounded contact, completes a circuit extending from the said bank contact through the private wiper 12, side switch wiper 21, its associated contact 48 and through the winding of the private magnet PV to battery. Thus it is evident that the side switch wipers remain in their second position and consequently the rotary magnet RM continues to energize and deenergize to rotate the wipers 12, 13, 14 to seek an idle set of contacts 15, 16, 17 of an idle connector as D. An idle set of contacts having been selected the circuit of the private magnet PV is opened stepping the said side switch wipers to their third positions, thus extending the calling line to the idle selected connector D. If the first contact engaged by the private wiper 12 is idle the rotary magnet RM operates to place the side switch in a position to step the side switch wipers to third position in a well known manner. The extending of the subscriber's line to the connector switch closes a circuit for the interrupter relay IR from battery through the upper winding of relay IR, normal contact 57 of relay RV, contact 16, wiper 13, contact 55, side switch wiper 23, bank contact 7, wiper 4, normal contact 35, through the substation and back through normal contact 36 of relay CO, wiper 5, bank contact 8, side switch wiper 24, contact 56, wiper 14, contact 17, normal contact 58 of relay RV and through the lower winding of relay IR to ground. The energization of the relay IR closes an energizing circuit for the release relay RR traced from battery through the winding of the said relay to ground at alternate contact 59 of relay IR. The energization of the relay RR

closes alternate contact 60 thereby placing ground upon the private contact 15, thus making this particular connector busy against selection by any other first selector switch. A further result due to the energizing of relay RR is the closing of a substitute circuit for relay 19 of the selector C over a readily traced circuit. The connector D having been selected, the subscriber at the calling substation A now operates the calling device CD to interrupt the line circuit three times, thereby interrupting the circuit of the interrupter relay three times.

Upon the first deenergization of the relay IR a series energizing circuit for secondary relay SR and vertical magnet VM is established extending from ground at normal contact 59 of relay IR, through alternate contact 62 of relay RR, winding of relay SR, conductor 63 and through the winding of the vertical magnet VM¹ to battery at side switch wiper 32. The relays SR and RR being slow acting relays remain energized during the rapid interruptions of their circuits by the relay IR, but the vertical magnet VM¹ being quick acting is responsive to the said impulses and steps the wipers 25, 26, and 27 of the connector D to the third level of switch contacts. The closure of the alternate contacts 64 of relay SR establishes an energizing circuit for the private relay PV¹ traced from battery through the winding of the said relay to ground at alternate contact 64 of relay SR to maintain the armature of the relay PV¹ attracted. After the last of the second set of impulses have been transmitted, the relay PV¹ deenergizes, having its circuit opened at alternate contact 64 of relay SR which in turn has its circuit interrupted at normal contact 59 of relay IR, to mechanically step the side switch wipers 31, 32, 33, 34 to their second position to engage contacts 65, 66, 67 and 68. The side switch arm 32 engaging the contact 66 places the rotary magnet RM¹ in series circuit with the relay SR to receive the next set of impulses. The subscriber at the substation A now actuates the calling device CD to send four impulses to cause four interruptions of the interrupter relay IR. Upon the first deenergization of the relay IR, the relay SR and the rotary magnet RM¹ which are connected in series are energized over a circuit extending from normal contact 59 of relay IR, through the alternate contact 62 of relay RR, winding of relay SR, the normal contact 69¹ of relay RR, conductor 70, through the winding of the magnet RM¹, contact 66 and the side switch wiper 32 to battery. The rotary magnet RM¹ being quick acting is responsive to the quick interruptions of the relay IR and steps the wipers 25, 26, and 27 to the fourth set of contacts 28, 29 and 30 of the third level which are the contacts of the wanted

line. The off-normal contacts ON² assume their alternate position upon the first step of the switch off normal.

Called line idle.

After the last set of impulses the private relay PV¹ again deenergizes having had its circuit opened by the deenergization of relay SR to step the side switch wipers 31, 32, 33 and 34 to their third position to engage the contacts 71, 72, 73 and 74. The wiper 32 engaging contact 72 closes an energizing circuit for the ringing relay RI traced from battery through the side switch wiper 32, contact 72, conductor 75, normal contact 76 of the ringing control relay RCR, conductor 77 through the winding of relay RI and through interrupter I to ground. The relay RI is energized and deenergized to connect the ringing generator G to the alternate contacts 78 and 79 of the relay RI to intermittently ring the call bell at the called substation E. A further result due to the stepping of the side switch wipers to third position is the closing of a circuit through the cut-off relay of the called subscriber's line over a circuit extending from ground at 71 through the side switch wiper 31, normal contact 93 of relay DR, private wiper 25, bank contact 28, off normal contact ON⁴ and through the cut-off relay CO¹ to battery. The relay CO¹ energizing removes the control of the subscriber's line switch B¹ from the called subscriber. When the subscriber at substation E removes his receiver from its switch-hook in response to the call bell, the reversing relay RV operates by current over the called line, its circuit being traced from battery through the lower winding of the relay RV, normal contact 80 of relay PV¹, conductor S, normal contact 79 of relay RI normal contact 81 of disconnect relay DR, wiper 27 bank contact 30, line limb 1¹, through the called substation, line limb 2¹, bank contact 29, wiper 26, normal contact 82 of relay DR, normal contact 78 of relay RI, conductor T, normal contact 83 of magnet PV¹ and through the upper winding of relay RV to ground. The operation of the reversing relay RV reverses the original flow of battery to the calling line and this reversal of battery may be used in systems in which the subscribers' stations are equipped with coin collecting devices in a well-known manner. The operation of the reversing relay RV also closes an energizing circuit for ringing control relay RCR traced from battery through the winding of the relay RCR, alternate contact 84 of the relay RV, conductor 85, side switch wiper 31 to ground at contact 71 of the side switch. The energization of the said relay RCR opens the circuit of the ringing relay RI at contact 76, the ringing relay RI thereby deenergizing thus cutting off the ringing cur-

rent from the called line. The relay RCR closes a locking circuit for itself traced from battery through the winding of the relay RCR, its alternate contact 86, conductor 85 to ground at side switch contact 71 the relay remaining locked up during conversation.

Release.

10 After conversation has been completed the subscribers at the substations A and E replace their receivers upon their respective switch-hooks. The calling subscriber replacing his receiver opens the energizing circuit of the interrupter relay IR which de-
15 energizes and opens the circuit of the release relay RR. The release relay RR deenergizing closes an energizing circuit for the release magnet REM¹ traced from battery through the winding of the said release magnet, the closed contact 87 of the off-normal springs ON² the normal contact 62 of relay RR to ground at normal contact 59 of relay IR. The energization of magnet
20 REM¹ restores the connector switch to normal and upon reaching its normal position the off-normal springs ON² restore opening the circuit of the magnet REM¹. Upon the restoration of the relay RR of the connector switch D, its alternate contact 60 is opened interrupting the energizing circuit of relay
30 19 of the first selector C which upon deenergizing closes its normal contact 46 to establish an energizing circuit for the release magnet REM of the first selector C traced from battery through closed contact 88 of the off normal springs ON¹ to ground at normal contact 44 of the relay PR. The magnet REM upon energizing mechanically
40 restores the first selector C to normal. Upon the said switch reaching its normal position the off-normal springs ON¹ assume their normal position opening the circuit of the magnet REM. The opening of alternate
45 contact 45 of relay 19 opens the locking circuit for the line relay LR of the line switch B and the restoration of the relay LR of line switch B closes an energizing circuit for the cut-off relay CO traced from battery
50 through the said cut-off relay, alternate contact 38 of the off normal springs ON to ground at normal contact 39 of the line relay LR. Relay CO in an energized position and line relay LR in a deenergized position
55 brings about the mechanical restoration of the individual switch B. Upon the said switch reaching normal the off normal springs ON assume their normal position opening the circuit of the relay CO. The
60 apparatus used in establishing the above traced circuits is now at normal and available for establishing other connections.

Should the calling subscriber fail to restore his receiver immediately after the termination of conversation, this act upon the

part of the calling subscriber, does not in any way tie up the called subscriber's line, but on the contrary, the called subscriber frees his line immediately upon replacing his receiver. Let us assume that the called subscriber replaces his receiver first, in response to this act the circuit of the reversing relay RV is opened at the switch-hook contacts, and the relay RV deenergizes closing its normal contact 84 thereby establishing an energizing circuit for the disconnect relay DR traced from battery through the winding of the said relay DR, conductor 90, alternate contact 91 of relay RCR, which remains in its energized position until the switch restores, the conductor 92, normal contact 84 of relay RV, conductor 85 and side switch wiper 31 to ground at contact 71. The relay DR, upon energizing, opens its normal contacts 81 and 82 and 93, the opening of the said contact 93 opens the circuit of the cut-off relay CO¹ of the line switch circuit B¹ associated with the called line and removes the busy from the multiple private contacts 28 of the called line making them available for selection by other calling parties and also restores the associated line switch circuit B¹ so that the called subscriber may now initiate a call as a calling subscriber. The closing of alternate contact 94 of the relay DR establishes a locking circuit for relay DR traced from battery through winding of relay DR, its alternate contact 94 and conductor 85 to ground at side switch contact 71. With this circuit arrangement as above described in connection with the connectors, the called line is not isolated due to the failure of the calling subscriber to replace his receiver but the replacing of the receiver at the called substation brings about the above circuit changes to place the called substation in a position for immediate reselection or immediate recall. The opening of contacts 81 and 82 of relay DR disconnects the line wipers from the strands of the connector switch.

Should the calling subscriber later replace his receiver the apparatus used in establishing the connection will be restored as previously described in connection with the release including restoration of the disconnect relay DR which restores upon the restoration of the ring control relay RCR.

Called line busy.

Should the called subscriber's line be busy the operation is the same as previously described up to and including the sending of the last set of impulses. Assuming that the calling subscriber has operated his calling device CD to send the last set of impulses to select the wanted line of the called substation. And further assuming that the said called substation is busy, a ground appears at the private contact 28 from the alternate

contact 39¹ of the relay LR¹ of the individual switch B¹. This ground will establish an energizing circuit for the busy relay BR traced from battery through the upper winding of the relay BR, conductor 95, the side switch contact 65, side switch wiper 31, conductor 96, normal contact 93 of relay DR, wiper 25, contact 28, to ground at alternate contact 39¹ of the relay LR¹. Of course if the wanted line was busy from being called, ground would be placed upon a multiple of contact 28 by the connector switch used in the first connection. The busy relay BR locks up from ground at alternate contact 60 of relay RR, over a circuit extending from ground at said contact through conductor 97, conductor 61, alternate contact 98 of relay BR, through the lower winding of the relay BR, conductor 99 and through the winding of the relay PV¹ to battery. Due to the relay SR being a slow acting relay it remains energized momentarily preventing the private relay PV¹ from releasing until another circuit is established for it in series with the lower winding of the relay BR. The magnet PV¹ remaining energized does not step the side switch wipers to third position but they remain in their second position. The energization of the relay BR connects the busy back BB¹ through the alternate contact 100 of said relay BR, side switch contact 68, side switch wiper 34 and over the lower heavily marked conductor to the calling substation A notifying the calling subscriber thereof of the busy condition of the called line. The replacing of the receiver at the calling substation after hearing the busy signal brings about the release of the apparatus used in this attempt to establish connection with the called subscriber to normal as before described.

While I have described my invention operating in connection with a well-known system, I do not wish to be limited to this exact disclosure as my invention may be applied to other systems without departing from the spirit of the invention and I therefore do not wish to be limited to this exact disclosure 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 a calling subscriber's line and a called subscriber's line, multiple contacts for the called line at the exchange, a connector switch provided with adjustable terminals, a relay individual to said connector switch and controlled over the two sides of the calling line in series for electrically adjusting said switch to move said terminals into connection with contacts of the called line, mechanism responsive to currents controlled at the substation of said

called line to free said called line without altering the selective position of said connector switch, self-locking means for maintaining said mechanism in its operated position, and a slow-acting relay controlled by said first relay for controlling the release of said connector switch.

2. A telephone system including subscribers' lines, multiple contacts for said lines at the exchange, an electrically adjustable step-by-step switch provided with a line relay adapted to be connected in series with a calling one of said lines and responsive to interruptions of said line to extend a connection to a called one of said lines, mechanism associated with said switch and responsive to called substation control to render the said called line idle without altering the selective position of said step-by-step switch, and self-locking means for maintaining said mechanism in its operated position.

3. A telephone system including a calling subscriber's line and a called subscriber's line, multiple terminals for said called subscriber's line, a connector switch provided with adjustable terminals for connection with terminals of said called line, automatic directly controlled mechanism controllable over the two sides of the calling line in series for connecting the said calling line with the said connector switch, a relay individual to the said connector switch and controllable over the two sides of the calling line in series for adjusting said connector switch to cause said adjustable terminals to connect with terminals of said called line thereby rendering said called line busy, mechanism responsive to currents controlled at the substation of said called line to render said line idle without altering the selective position of said connector switch, whereby said called line may be immediately used as a calling or a called line, self-locking means for maintaining said mechanism in its operated position, and a release circuit for said connector switch controllable by said first relay.

4. A telephone system including a calling subscriber's line and a called subscriber's line, multiple terminals for said called subscriber's line, a connector switch provided with adjustable terminals for connection with terminals of said called line, automatic directly controlled mechanism controllable over the two sides of the calling line in series for connecting the said calling line with the said connector switch, a double wound relay adapted to be connected in series with the calling subscriber's line for adjusting said connector switch to cause said adjustable terminals to connect with terminals of said called line thereby rendering said called line busy, mechanism associated with said connector controllable over the two

sides of the called line in series for rendering said called line idle without disconnecting the connector terminals from the terminals of said called line whereby said called line may be immediately used as a calling or as a called line, self-locking means for said mechanism, and means controlled by said calling subscriber for thereafter releasing said connector switch.

- 5 10 5. A telephone system including a pair of telephone lines, multiple contacts for the called one of said lines at the exchange, a connector switch provided with a double wound line relay controllable over the two
15 sides of the calling one of said lines in series, electrically adjustable terminals for said connector switch for connection with contacts of the called line, rendering said called line busy, self-locking mechanism responsive to currents controlled at the sub-
20 station of the called line to render said called line idle while maintaining said connector in its antecedent progressive position and release means for said connector switch
25 controllable by said double wound line relay.

6. A telephone system including a pair of telephone lines, multiple contacts for the called one of said lines at the exchange, a
30 connector switch provided with a relay controllable over the two sides of the calling one of said lines in series, electrically adjustable terminals for said connector switch for connection with contacts of the called
35 line, rendering said called line busy, and mechanism responsive to currents controlled at the substation of the called line to render said called line idle while maintaining said connector in its antecedent progressive position, locking means for maintaining said
40 mechanism in its actuated position until the time of release, and release means including said first relay and a slow-acting relay responsive to currents controlled at
45 the substation of the calling line to restore the said connector to normal.

7. A telephone system including a calling subscriber's line and a called subscriber's line, multiple contacts and an automatic
50 trunk selecting switch individual to said called line, a connector switch for use in establishing a connection from said calling subscriber's line to said called subscriber's line, means responsive to such connection for
55 rendering said individual switch inoperative when the called subscriber responds, means controlled at the substation of said called line for rendering said individual switch responsive to substation control while maintaining the said connector in its antecedent
60 progressive position, a locking circuit for said last means, and a slow-acting relay for said connector switch controllable by the calling subscriber for releasing said connector switch.

8. A telephone system including a calling subscriber's line and a called subscriber's line, multiple contacts and an automatic trunk selecting switch individual to said called line, a connector switch for use in
70 establishing a connection from said calling subscriber's line to said called subscriber's line, means responsive to such connection for rendering said individual switch inoperative when the called subscriber responds, means
75 controlled at the substation of said called line for rendering said individual switch responsive to substation control without disconnecting said connector switch from the contacts of the called line, a locking
80 circuit for said last means, and means including a slow-acting relay controlled at the substation of the calling line for releasing said connector switch and for opening said locking circuit.

9. A telephone system including a calling subscriber's line and a called subscriber's line, multiple contacts and a trunk selecting switch individual to the called subscriber's line, a connector switch provided with electrically adjustable terminals for connection
90 with contacts of the called line, a cut-off relay for said individual switch responsive to the connection of the terminals of the connector switch with the contacts of the called line for removing the control of said individual switch from the substation of the
95 called line, means controlled at the substation of the called line for deenergizing said cut-off relay whereby said individual switch is again rendered responsive to substation control while maintaining the connector switch terminals in connection with contacts of the called line, said last means including a relay provided with a locking
100 circuit including a contact thereof and a slow-acting release relay for said connector switch controllable by the calling subscriber for releasing the said connector switch.

10. A telephone system including a called subscriber's line provided with multiple terminals, a connector switch provided with electrically adjustable terminals for connection with terminals of said called line, a line relay individual to said connector switch for
110 controlling the adjustment of said electrical terminals, and through which talking current is supplied to a calling subscriber's line, means for rendering said called line busy responsive to such connection, a double wound battery supply relay for said connector for supplying talking current to the substation of the called line, means controlled at the substation for deenergizing
115 said relay when disconnection is desired, and means controlled by said relay for rendering said line idle without altering the selective position of said connector.

11. A telephone system including a called subscriber's line provided with multiple ter- 130

minals, a connector switch provided with electrically adjustable terminals for connection with terminals of said called line, means for rendering said called line busy responsive to such connection, a relay individual to said connector switch for supplying the calling subscriber's line with talking current, a double wound battery supply relay for said connector for supplying talking current to the substation of the called line, means controlled at the substation for deenergizing said double-wound relay when disconnection is desired, and means controlled by said double-wound relay for rendering said line idle while permitting said connector terminals to remain in connection with the terminals of the called line.

12. A telephone system including a called subscriber's line, multiple contacts and a trunk selecting switch individual to the called subscriber's line, a connector switch provided with electrically adjusted terminals for connection with contacts of the called line, means responsive to such connection for rendering said line busy, a double wound battery supply relay for feeding talking current to the substation of said called line, means controlled at said substation for deenergizing said relay when disconnection is desired, means controlled by said relay for rendering said individual switch responsive to substation control when said called subscriber recalls prior to the disconnection of said connector terminals from said called contacts, and a quick-acting line relay and a slow-acting release relay for said connector switch for controlling the release thereof.

13. A telephone system including a called subscriber's line provided with multiple contacts, a connector switch provided with electrically adjustable terminals for connection with said called contacts, a line relay and a slow-acting relay for said connector switch, a disconnect relay for electrically disconnecting said adjustable terminals from said contacts while maintaining said connector switch in its antecedent progressive position, a circuit for said disconnect relay provided with a pair of normally open and a pair of normally closed contacts, a double-wound relay responsive to substation control for closing said normally open contacts and for directly opening said normally closed contacts and for subsequently closing said normally closed contacts whereby said disconnect relay is operated, and a release circuit for said connector switch controllable by said line and slow-acting relays.

14. A telephone system including a called subscriber's line provided with line terminals and with private terminals, a connector switch provided with electrically adjustable terminals for connection with said called terminals and for placing a busy potential

upon said private terminals, a line relay and a slow-acting relay for said connector switch, a disconnect relay for electrically disconnecting the called subscriber's line from said connector switch while maintaining said connector in its antecedent progressive position, a circuit for said disconnect relay provided with a pair of normally open and a pair of normally closed contacts, a double-wound battery supply relay under the control of the substation on the said called line for closing the normally open contacts and for directly opening the normally closed contacts and for thereafter directly closing the normally closed contacts whereby said disconnect relay is operated, an automatic trunking switch individual to the called subscriber's line, a release circuit for said connector switch adapted to be closed when both said line and slow-acting relays deenergize.

15. A telephone system including a called subscriber's line provided with line terminals and with private terminals, a connector switch provided with electrically adjustable terminals for connection with said called terminals and for placing a busy potential upon said private terminals, a line relay for said connector switch adapted to remain energized after said electrically adjustable terminals have been placed in connection with said called terminals, a disconnect relay for electrically disconnecting the called subscriber's line from said connector switch while maintaining said connector in its antecedent progressive position, a circuit for said disconnect relay provided with a pair of normally open and a pair of normally closed contacts, means under the control of the substation on the said called line for indirectly closing the normally open contacts and for directly opening the normally closed contacts and for thereafter directly closing the normally closed contacts whereby said disconnect relay is operated, and an automatic trunking switch individual to the called subscriber's line rendered responsive to substation control upon operation of said disconnect relay.

16. In a telephone system the combination with an automatic connector switch connected to a called subscriber's line, of a double-wound battery supply back-bridge relay for said connector switch, a ringing cut-off relay for said connector switch, and a self-locking disconnect relay for operatively disassociating said connector switch from said called subscriber's line controllable directly by said other two relays.

17. In a telephone system the combination with an automatic connector switch connected to a called subscriber's line, of a double-wound battery supply relay individual to said connector switch controllable by the called subscriber for reversing the talking current fed to a calling subscriber's line from

the connector switch, a disconnect relay for operatively disassociating said subscriber's line and said connector switch, and a circuit for said disconnect relay passing through contacts directly controllable by said reverse battery relay.

18. A telephone system including a calling subscriber's line and a called subscriber's line, a line switch individual to the calling subscriber's line and an automatic connector switch for connecting said calling subscriber's line to said called subscriber's line, a relay for said connector switch controllable over the called subscriber's line for reversing the talking current supplied to the calling subscriber's line, a relay for operatively disassociating said connector switch from said called subscriber's line, and a circuit for said relay having contacts controllable by said reversing relay.

19. A telephone system including subscribers' lines, a connector switch provided with a relay operable over the two sides of a calling one of said lines in series to extend a connection to a called one of said lines, a relay associated with said connector switch and responsive to called substation control to render said called line idle without altering the selective position of said connector switch, and a locking circuit for said relay for removing it from the control of the called subscriber.

20. A telephone system including a calling and a called subscriber's telephone line, a connector switch provided with a line relay controllable over the two sides of the said calling line in series to extend a connection to the said called line, a relay for said connector switch operable to disassociate said connector switch from said called subscriber's line without altering the selective position of said switch, a second relay for said connector switch under substation control for energizing said first relay, and a locking circuit for said first relay for removing it from control of said second relay.

21. A telephone system including subscribers' telephone lines, multiple contacts for said lines at an exchange, a connector switch provided with a line relay controllable over the two sides of a calling one of said lines in series to extend a connection to a called one of said lines, said line relay adapted to remain energized during conversation and to control the release of the connector switch when deenergized, a ringing device for said connector switch for signaling said called line, mechanism associated with said connector switch and responsive to called substation control for rendering the said called line idle without altering the selective position of said connector switch and for controlling said ringing device.

22. A telephone system including a calling and a called subscriber's line, a connector

switch for extending a connection to said called line, a line relay for said connector switch adapted to be connected in series with the calling subscriber's line and responsive to interruptions of said calling subscriber's line for operating said connector switch, ringing apparatus associated with said connector switch for signaling the called subscriber, a relay for said connector switch under substation control for disconnecting the ringing apparatus for said called line, and mechanism associated with said connector switch including part of said ringing apparatus responsive to called substation control to render the said called line idle without altering the selective position of said connector switch.

23. A telephone system including a pair of telephone lines, multiple contacts at the exchange for the called one of said lines, a connector switch for extending a connection from a calling one of said lines to the called one of said lines, a line relay for said connector switch adapted to be connected in series with the calling one of said subscribers' lines, a slow-acting control relay for said connector switch, and means controllable by said relays for controlling the operation and the release of said connector switch, automatic means for signaling the calling substation, a relay controlled by the called subscriber for rendering said automatic means inoperative, mechanism responsive to currents controlled at the substation of the called line to render said called line idle while maintaining said connector in its progressive position, and a locking circuit for said mechanism.

24. A telephone system including a called subscriber's line provided with an individual progressively movable switch, a vertical and a rotary motion connector switch having an individual line relay controlled over the two sides of the calling line in series and operable in two intersecting planes for connecting with the called subscriber's line, and self-locking means associated with said connector switch for operatively disassociating said connector switch and said called line.

25. A telephone system including a calling subscriber's line and a called subscriber's line, a progressively movable switch individual to said calling subscriber's line, a first selector switch, a connector switch, and means including said three switches for extending a connection from said calling subscriber's line to said called subscriber's line, said connection being free of all bridges at said first two switches and being supplied with talking current from bridges at said connector switch, and self-locking means controlled by the called subscriber for rendering the said called line idle without altering the selective position of said connector switch.

26. A telephone system including a calling subscriber's line and a called subscriber's line, automatic switches including a progressively movable switch individual to the line, a first selector switch and a connector switch for connecting said lines in conversational circuit, bridges at said individual switch and the said first selector switch disconnected from the talking conductors during conversation, relays for said connector switch for supplying current to the calling and called subscribers' lines, and self-locking mechanism associated with said connector switch and responsive to called substation control to render said called line idle without altering the selective position of said connector switch.

27. In a telephone exchange system, a plurality of stations, means including an automatic switch for interconnecting a calling and a called station, side switch wipers and shaft wipers for said automatic switch, and a cutoff relay for disconnecting said called station from said calling station and for placing said called station in condition to establish a connection to a third station, said relay being also adapted to disconnect the side switch wipers from the shaft wipers.

28. In a telephone exchange system, a plurality of lines, means including an automatic switch for interconnecting a calling and a called line, side switch wipers and shaft wipers for said automatic switch, a cutoff relay arranged to disconnect said called line from said calling line and to place said called line in condition to establish a connection to a third line, said relay also adapted to disconnect the side switch wipers from the shaft wipers of the switch, and means controlled by the called party for operating said relay.

29. A telephone system including a called subscriber's line, a progressively movable switch individual thereto, a connector switch for establishing connection to said called line via said individual switch, means responsive to such connection for rendering said individual switch unresponsive to the response of the called subscriber, means for automatically disconnecting said called subscriber's line from said connector switch but permitting said connector switch to remain

in its antecedent progressive position, and a pair of relays for controlling said means, one of said relays adapted to operate when the called subscriber responds and the other of said relays adapted to cause the operation of said means when the called subscriber replaces his receiver.

30. A telephone system including a called subscriber's line, a connector switch provided with a line relay individual thereto and controllable over the two sides of the calling line in series, motor mechanism for said connector switch controllable by said relay effective to establish connection with said called line, electromagnetic means for disconnecting said called line from said connector switch while permitting the latter to remain in its antecedent progressive position, and a pair of relays for controlling said electromagnetic means, one of said relays adapted to be energized when the called subscriber responds and the other of said relays adapted to be operated when the called subscriber replaces his receiver to effect the operation of said electromagnetic means.

31. A telephone system including a called subscriber's line, a connector switch provided with a line relay controllable over the two sides of a talking circuit in series, means controllable by said line relay for establishing connection between said connector switch and said called line, electromagnetic means for interrupting said connection while maintaining said connector switch in its advanced position, and a pair of relays for controlling said electromagnetic means, one of said relays adapted to close a contact in the circuit of said electromagnetic means when the called subscriber removes his receiver and the other of said relays adapted to close a contact in the circuit of said electromagnetic means when the called subscriber replaces his receiver.

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

GEORGE A. YANOCHOWSKI.

Witnesses:

B. O'BRIEN,

M. R. ROCKFORD.