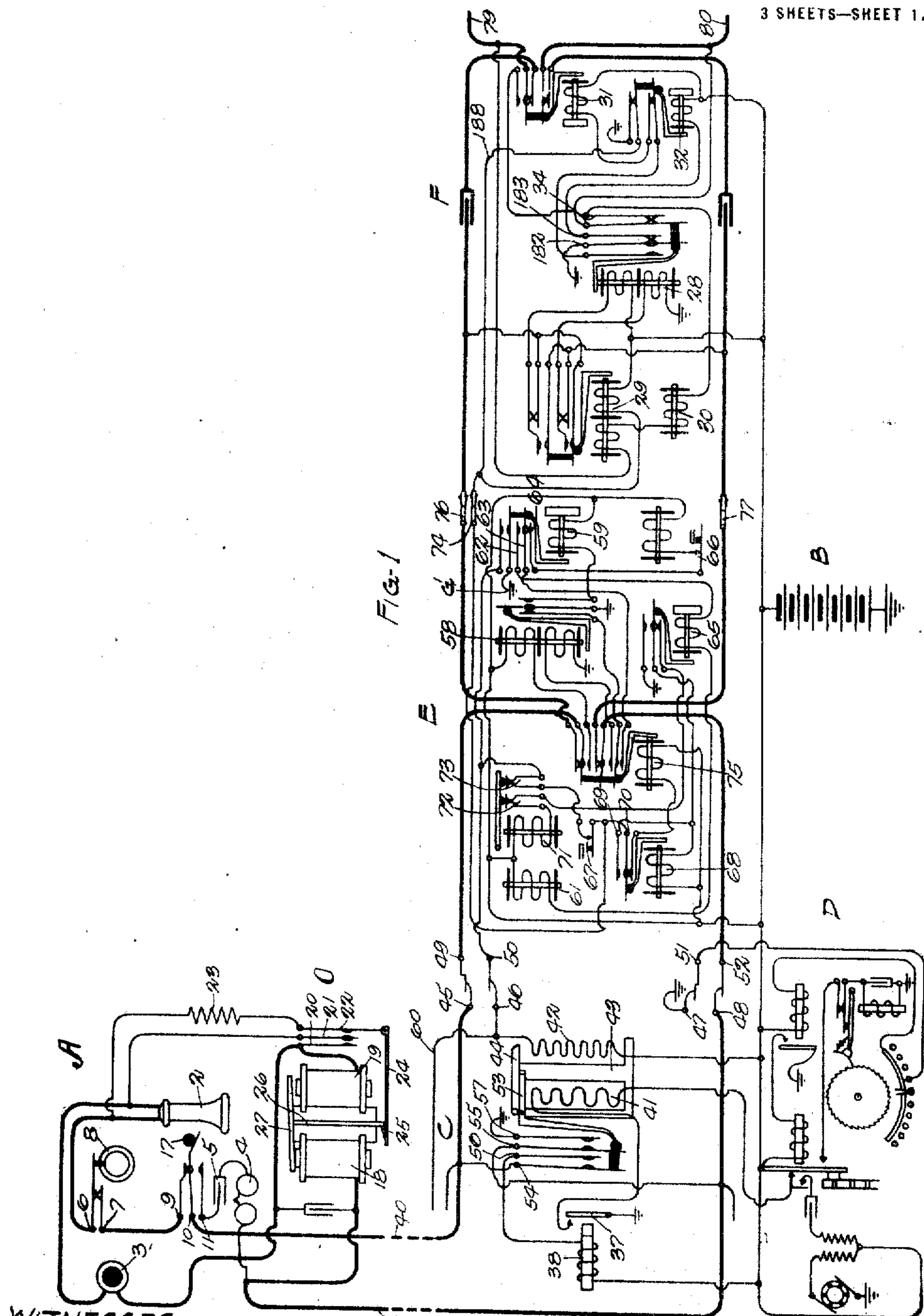


B. D. WILLIS,
SEMI-AUTOMATIC TELEPHONE SYSTEM.
APPLICATION FILED JUNE 27, 1914

1,203,166.

Patented Oct. 31, 1916.

3 SHEETS—SHEET 1.



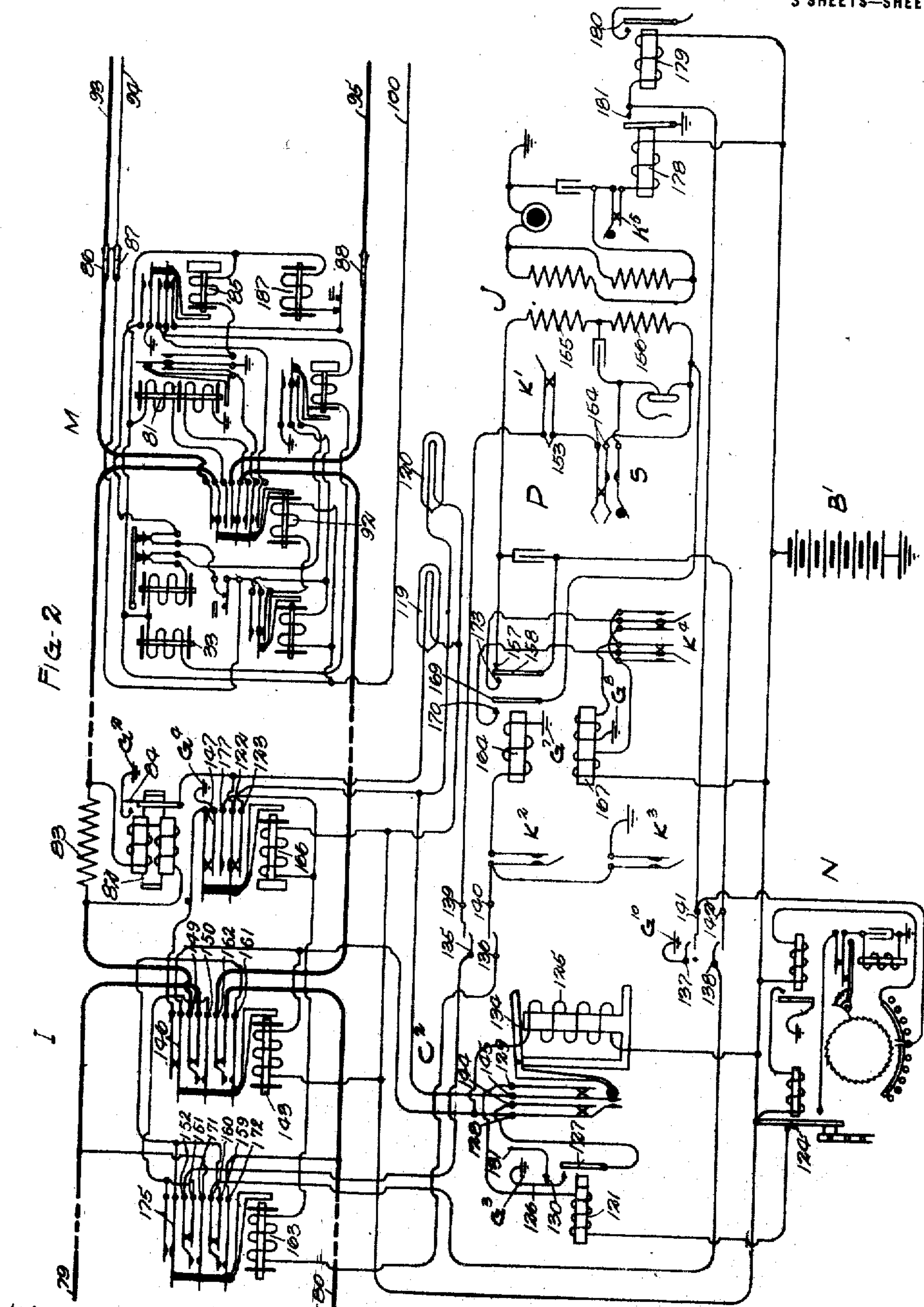
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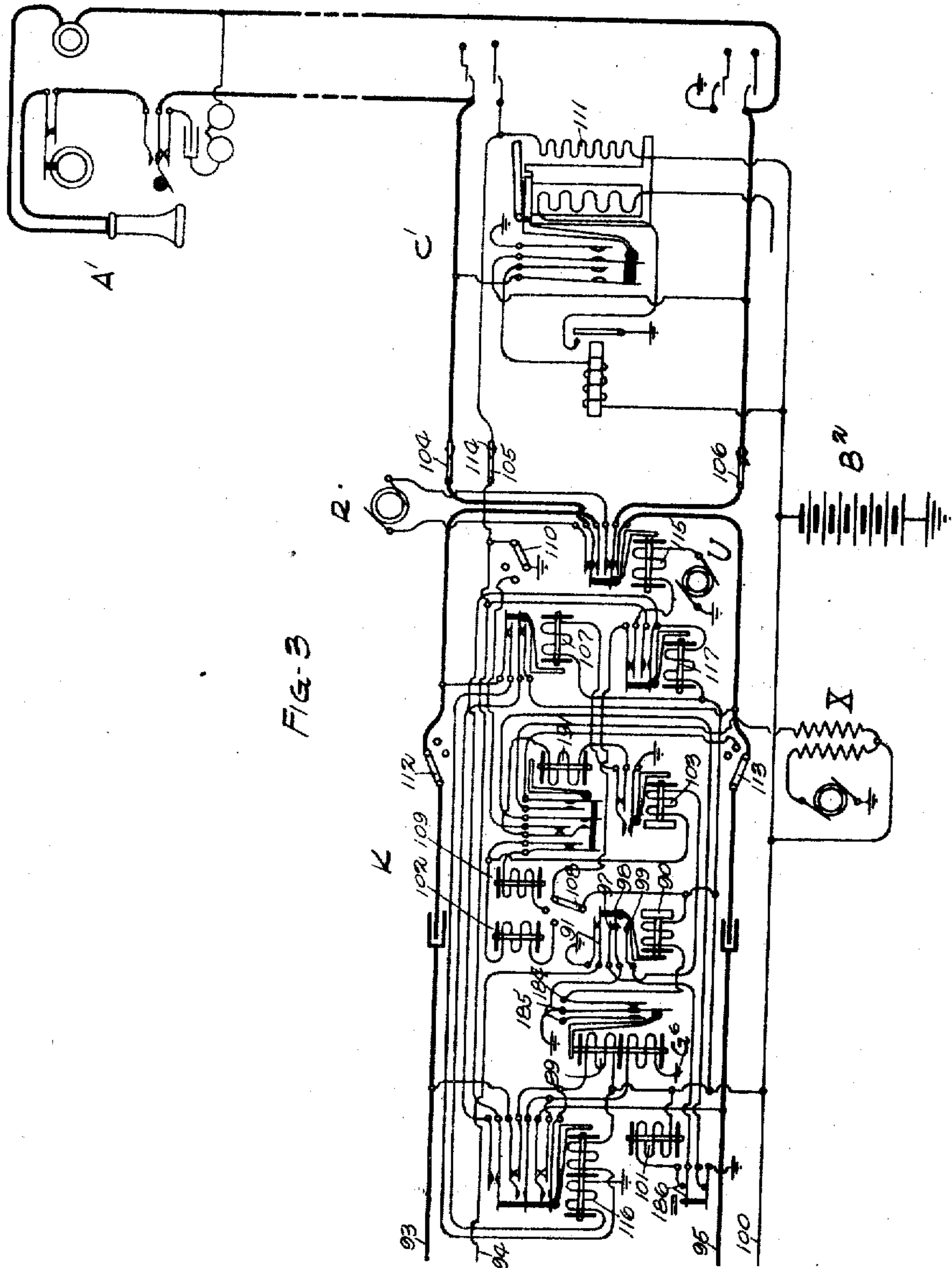
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UNITED STATES PATENT OFFICE.

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SEMI-AUTOMATIC TELEPHONE SYSTEM.

1,203,166.

Specification of Letters Patent.

Patented Oct. 31, 1916.

Application filed June 27, 1914. Serial No. 847,574.

To all whom it may concern:

Be it known that I, BERNARD D. WILLIS, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Semi-Automatic Telephone Systems, of which the following is a specification.

My invention relates to improvements in semi-automatic telephone systems and relates particularly to the means for permitting an operator to supervise a long distance or toll connection.

Heretofore it has been customary for a subscriber in establishing a toll connection to first call the toll operator, who then sets up the connection. By my invention, however, the connection is first set up automatically by the subscriber, and the operator is not brought into the connection until the called subscriber answers, at which time the operator can make a record of the call and make the proper charges against the subscriber.

My invention will be more clearly understood by reference to the accompanying drawings, in which I have illustrated one embodiment of my invention in connection with an automatic system employing switches of well-known types.

In the drawings Figures 1, 2 and 3 taken together and in the order named represent a complete circuit connection between a calling substation A located in one exchange and a called substation A' located in a distant exchange in a system embodying the principles of my invention.

In Fig. 1 there is shown diagrammatically the automatic substation A, the line conductors of which terminate in a line switch C, which is controlled by a master switch D. At E is shown a first selector switch and at F is shown a repeater, which latter is attached to a trunk line leading to a distant exchange.

In Fig. 2 is shown a group of relays I which are associated with the said trunk line. These relays may be located either at the calling exchange, the called exchange or any intermediate point. As shown, the said relays are located at a manual board at a point intermediate the calling and called exchanges. The line switch C² is associated with the said group of relays I and is adapted

when operated to connect the said trunk line to an operator's head set P. The selector switch M is attached to the opposite end of the said trunk line and is located in the distant exchange.

In Fig. 3 is shown a connector switch K and the called subscriber's individual line switch C' and called substation A'.

The subscriber's substation A is of any suitable or approved type and comprises a receiver 2, transmitter 3, ringer 4 and condenser 5. Being an automatic substation it is also provided with an impulse transmitter or calling device, which is herein represented by a pair of impulse springs 6 and 7 and an impulse wheel 8, which latter is assumed to be controlled through the medium of a finger hole dial (not shown) in such a manner that the impulse springs 6 and 7 may be momentarily separated a number of times corresponding to the digit called. When the receiver 2 is withdrawn from the switch-hook the bushing 17 allows the springs 10 and 11 to break contact and the springs 9 and 10 to make contact in a well known manner.

The coin-controlling device O associated with the substation A is of the same general type as disclosed in British patent to W. H. Derriman No. 687 of 1912. The coin-collecting device, as herein represented, consists essentially of a polarized electromagnet, the coils 18 and 19 of which are connected in series with the substation A. The springs 20, 21 and 22 are so arranged that when their contacts are closed, the transmitter 3 is short-circuited and the receiver 2 is shunted by a resistance coil 23. The lower end of the spring 22 carries a swinging arm 24 to which is attached a small lug 25. If the polarized magnet is energized in one direction, the lower end of the arm 26 which is attached to the armature 27 will be tilted to the right and carried behind the lug 25. If the magnets then be energized in the opposite direction, the arm 26 engages the lug 25 and carries the arm over with it, thus causing the springs 20, 21 and 22 to be brought into engagement.

The line switch C is of the general type of line switch shown in British patent to R. W. James No. 26,301 of 1906, the particular form shown, however, being similar to that shown in United States Letters Patent No

1,078,690, issued November 18, 1913, to Frank Newforth, Jr.

The master switch D is of the same general type as that disclosed in the above-mentioned British Patent No. 26,301 of 1906, being, however, of the particular type disclosed in British patent to T. G. Martin No. 1419 of 1910. The function of the master switch, as is well known, is to maintain the plungers of all the idle line switches in position to engage the terminal of an idle trunk line.

The selector switch E is of the general type of selector switch shown in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson, being, however, of the particular type shown in British Patent No. 10,376 of 1912, granted to T. G. Martin.

The repeater F comprises a line relay 28, reverse battery relay 29, impedance coil 30 and the slow acting coils 31 and 32. The function of the repeater, as is well known, is to maintain a holding circuit for the switches back of it, thus obviating the necessity of a three-trunk conductor between exchanges and, in addition, it operates to repeat the impulses received by it from the calling substation over the trunk conductors to the switches in the distant exchange. A further object of the repeater is to supply the talking current to the calling subscriber.

The selector M is similar to the selector switch E.

The line switch C² and the master switch N are similar to the line switch C and the master switch D except that the operating magnet of the line switch C² is furnished with only one winding instead of with two windings, as is the case with the line switch C. Associated with the operator's head set P are various relays and keys, the function of which will be gone into in detail later. The relays I associated with the trunk line 79—80 are only operated when the connection has been extended through to the distant exchange and the called party has answered. The function of these relays will be explained more fully hereinafter.

The connector switch K is similar to the connector switch disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, being, however, of the particular type shown in French Patent No. 466,794 of March 13, 1914.

Throughout the drawings a plurality of batteries B, B', etc., are shown having one terminal grounded. In practice there need be only one battery, but preferably one battery for each exchange. At R is shown a ringing current generator and at X is shown a busy signaling machine.

The subscriber's individual switch C' and substation A' are similar in all respects to

the subscriber's individual switch C' and substation A.

Having given a general description of the apparatus, in order to give a complete understanding of my invention I will now describe how the subscriber at substation A may establish connection with the subscriber at substation A', whose line terminates in a distant exchange.

We will assume that the number of the called substation A' is 2220. In the system shown herein the substation A' is supposed to be located in a distant city and the toll charged for a call from one city to the other is twice the toll charged for local calls. Means are therefore provided at the checking operator's position for supervising the calls. When the calling subscriber removes his receiver preparatory to making a call, the switch-hook causes the springs 9 and 10 to make contact and the springs 10 and 11 to break contact, whereby a bridge consisting of the substation receiver, transmitter and the windings of the coin-collecting device is closed across the conductors 39 and 40. The closing of this bridge across the line completes an energizing circuit through the line relay 38 of the line switch C, thereby attracting the armature 37. At this time the current through the coin-collecting device O is in the direction to attract the armature 27 to the coil 18, thereby carrying the arm 26 behind the lug 25. The armature 37 of the line relay 38, upon being attracted, closes a circuit through the pull-down winding 41 of the magnet 43. The pull-down coil, upon energizing, attracts the plunger arm 44 to force the plunger (not shown) into the bank of contacts 45 to 52, inclusive. It also operates the cut-off armature 53, whereby the springs 54 and 55 are carried out of engagement with the springs 56 and 57, respectively, thus disconnecting the line relay 38 from the line. The armature 37 does not fall back immediately owing to the fact that the relay 38 is slow acting. The armature 37 being slow to fall back allows sufficient time for a holding circuit to be closed in the switch ahead for the cut-off or holding winding 42. The engagement of the springs 45 and 48 with the springs 49 and 52, respectively, extends the subscriber's line to the line relay 58 of the selector E. The line relay 58 of the selector is thereupon energized, closing a circuit through the slow acting relay 59. The relay 59, upon energizing, closes the above-mentioned holding circuit through the cut-off winding 42 of the line switch C. The winding 42, upon energizing, holds the armature 53 and the plunger arm 44 in their operated positions after the circuit of the pull-down winding is broken by the falling back of the armature 37. A guarding potential is supplied to the connector private bank contacts of the call-

ing line over the conductor 60 as soon as the relay 59 energizes. The energization of the relay 59 also prepares a circuit for the vertical magnet 61 by bringing into engagement the springs 62 and 63 and opens the circuit of the release magnet at the springs 63 and 64.

The calling subscriber now operates his calling device for the first digit 2, which momentarily separates the substation impulse springs 6 and 7 twice. Each time these springs are separated the selector line relay 58 deenergizes. Since the relay 59 is slow to deenergize, its armature does not have time to fall back during the momentary interruptions of its circuit by the relay 58. Therefore, each time the relay 58 deenergizes, an impulse is transmitted through the vertical magnet 61 and the relay 65 in series. The vertical magnet receives two impulses over this circuit and operates to raise the switch shaft and wipers two steps to a position opposite the second row or level of bank contacts and at the same time the shaft-controlled contacts 66 and 67 are closed. The slow acting relay 65 is maintained in its energized position continuously while impulses are being transmitted to the vertical magnet through it, and in its energized position closes a circuit through the relay 68. The relay 68, upon energizing, closes a locking circuit for itself through the springs 69 and 70. Upon the deenergization of the relay 65 after the last impulse is delivered to the vertical magnet, the relay 68 remains energized, thus closing a circuit through the rotary magnet 71. The magnet 71, upon energizing, rotates the shaft wipers one step, and, by opening the contacts 72 and 73, disconnects ground G' from itself and from the relay 68.

If the first trunk line of the second level is idle, the relay 68 deenergizes as soon as the springs 73 are opened. If this trunk line is busy, however, the private wiper 74 finds the contact with which it engages provided with a guarding ground potential which is transmitted to the relay 68 through its springs 69 and 70 and thereby prevents it from deenergizing. The magnet 71, however, deenergizes when the spring contact 72 is broken, regardless of whether the relay 68 remains energized or not. If the relay 68 remains energized, the circuit of the rotary magnet will be again closed as soon as its armature drops back far enough to close the contacts 72 and 73. The rotary magnet will therefore operate in a manner similar to that of a buzzer to advance the wipers step by step over the contacts until the non-grounded contact of an idle trunk line is reached by the wiper 74, whereupon the relay 68 deenergizes. The relay 68, upon deenergizing, whether after one or several operations of the rotary magnet, perma-

nently breaks the circuit of the magnet 71 and closes the circuit of the switching relay 75. The relay 75, upon energizing, disconnects the line relay 58 from the line and extends the connection over the heavy conductors shown through the wipers 76 and 77 to the repeater F. The line relay 28 of the repeater thereupon becomes energized and closes a circuit through the slow acting relay 32. The energization of the relay 32 provides a holding ground for the relay 75 of the selector E and the winding 42 of the line switch C to replace the holding ground G' that is removed an instant later when the relay 59 deenergizes and a circuit is also closed through the right hand winding of the relay 29 to battery B. A further result of the energizing of the relay 28 is the bridging of the impedance coil 30 and the left-hand winding of the relay 29 across the trunk conductors 79 and 80, thus energizing the line relay 81 of the selector M in the distant exchange. It will be seen that this circuit includes the polarized relay 82 and its shunt winding 83, but the flow of current is in the wrong direction to cause it to operate to close the contact of springs 84. It will also be seen that both windings of the relay 29 of the repeater F are now carrying current, but the relay is not operatively energized, as the two coils are working in opposition to each other. The energizing of the line relay 81 of the selector M closes a circuit through the slow acting relay 85. Each time the impulse springs 6 and 7 of the calling device at the subscriber's substation are separated for the remaining digits of the called number, the circuit of the line relay 28 of the repeater F is opened. The line relay dropping back in unison with the breaking of the circuit at the calling substation opens the bridge across the conductors 79 and 80 leading to the selector M, thus allowing the line relay 81 to deenergize. Each time the line relay 81 deenergizes, an impulse is transmitted through the vertical magnet 33 in the same manner as described in connection with the selector E. At the first deenergization of the line relay 28 of the repeater F the slow acting relay 31 is energized, and remains energized during the entire time that impulses are being repeated over the trunk conductors 79 and 80 for each digit of the called number. The relay 31, upon energizing, places a shunt around the impedance coil 30 and the left-hand winding of the relay 29, thus bridging the impulse springs 34 directly across the trunk conductors 79 and 80.

The calling subscriber, upon operating his dial for the second digit 2, causes the repeater F to repeat two impulses to the second selector M in the above-mentioned manner, thus causing the selector M to raise its

switch wipers 86, 87 and 88 opposite the second row or level of bank contacts, from which point the selector operates to seek an idle trunk line leading to the connector switch K (Fig. 3) in the same manner as hereinbefore described for the selector E. The selector M, upon extending the connection through to the connector K, causes the line relay 89 to energize, which in turn, upon energizing, closes a circuit through the slow acting relay 90. The relay 90, upon energizing, supplies a holding ground through its contact springs 91 to the switching relay 92 of the second selector M. A further result of the energizing of the relay 90 is the preparing of a circuit for the vertical magnet 102 by the closing of the springs 97 and 98 and the opening of the circuit of the release magnet 101 at the springs 98 and 99.

The calling subscriber now operates his calling device for the third digit 2, in response to which the line relay 28 of the repeater operates to repeat two impulses to the line relay 89 of the connector K. Since the relay 90 is slow acting it does not de-energize during the momentary interruptions of its circuit by the relay 89 of the connector K, so that each time the latter relay is deenergized an impulse is transmitted to the vertical magnet 102 and the relay 103 in series. The vertical magnet receives two impulses over this circuit and operates to raise the switch shaft wipers 104, 105 and 106 to a position opposite the second level of bank contacts. The relay 103, which is included in series with the vertical magnet, remains energized during the entire time that impulses are being transmitted through it to the vertical magnet, and in its energized position it closes a circuit through the private magnet 107. After the last impulse is delivered the relay 103 opens the circuit of the private magnet 107, which, upon deenergizing, allows the side switch to pass from first to second position. The movement of the side switch wiper 108 from first to second position transfers the battery connection from the vertical magnet 102 to the rotary magnet 109. The calling subscriber now operates his calling device for the last digit 0, in response to which the repeater F repeats ten impulses to the line relay 89 of the connector K, which in turn transmits ten impulses to the rotary magnet 109 in series with the series relay 103, whereby the shaft wipers are rotated onto the contacts of the desired line. The relay 103 operates in response to the impulses for this digit in the same manner as for the previous digit to advance the side switch from second to third position. By the engagement of the side switch wiper 110 with its third-position contact point, the bridge-cut-off relay 111 of the line switch

C is energized. By the engagement of the side switch wipers 112 and 113 with their third-position contact points, the connection is completed with the called substation. A guarding potential is supplied to the connector private bank contact 114, which prevents the called line from being seized by some other connector switch. By the engagement of the side switch wiper 108 with its third-position contact point, the circuit of the ringing relay 115 is closed, which relay operates to intermittently bridge the generator R (due to the interrupter U) across the called line to signal the called subscriber.

Upon the response of the called subscriber his line is provided with talking current through the windings of the back-bridge relay 116. The back-bridge relay, upon energizing, closes a circuit through the ringer cut-off relay 117, which, upon energizing, closes a locking circuit for itself independent of the back-bridge relay 116 and opens the circuit of the ringer relay. A further result of the energizing of the back-bridge relay 116 upon the response of the called subscriber is the reversing of the connections of the line relay 89 with the trunk line 93-95, whereby the direction of the current in the trunk line is reversed. The reversing of battery upon the trunk line causes the windings of the relay 29 of the repeater F to assist each other, thus causing it to operatively energize and reverse the connections of the line relay 28 with the trunk line whereby the direction of the current in the calling line is reversed. The reversing of the current in the calling line causes the polarized relay of the coin collector at the substation A to attract its armature in the opposite direction—that is, toward the coil 19. When the armature is attracted in this direction, it carries the arm 24 to the left, forcing the springs 20, 21 and 22 into engagement. The engagement of said springs, as hereinbefore mentioned, renders the calling substation inoperative for talking purposes. This, however, is only momentary, for about the same time or an instant later the group of relays I operate to disconnect the calling line from the called line and connect the called line to the operator's head set P.

A further result of the reversing of the current in the calling trunk is to cause the polarized relay 82 to attract its armature in the opposite direction, which closes the contact of springs 84. The closing of contact springs 84 closes a circuit through the supervisory lamps 119 and 120 and through the line relay 121 of the line switch C² associated with the trunk line 79-80. The circuit for the relay 121 extends from ground G² through the springs 84, springs 122 and 123, springs 145 and 129, line relay

121 and the springs 124 of the master switch N to battery B'. The relay 121, upon energizing, closes a circuit through the winding 125 of the line switch C'. This circuit extends from ground G³ through the springs 126 and 127, springs 144 and 128 and the pull-down coil 125 to battery B'. The separation of springs 126 and 130 removes ground G³ from the conductor 131, which multiples through the springs 126 and 130 of every other line switch (not shown) in the group to which the line switch C' belongs and which are controlled by the master switch N. The pull-down coil 125, upon energizing, attracts the plunger arm 134 to force the plunger (not shown) into the bank of contacts 135 to 142, inclusive. It also operates to disconnect the line relay 121 by opening the contact of springs 129 and 145, forms a new locking circuit for itself and closes a circuit through the relay 143. The circuit closed for the relay 143 extends from ground G² through the contact of springs 84, springs 122 and 123, springs 145 and 128 and the relay 143 to battery B'. The closure of bank springs 137 and 141 causes the master switch N to operate to move the plungers of the idle line switches opposite an idle operator's head set. The relay 143, upon energizing, closes a locking circuit for itself and for the winding 125 through the springs 146. The said circuit for the winding 125 extends from ground G⁴ through the springs 147, springs 146 and the said winding 125 to battery B'. A further result of the energization of the relay 143 is the disconnecting of the calling line from the called line and the bridging of the operator's head set P across the called line, as hereinbefore mentioned. This circuit extends from ground G⁶ through the lower winding of the relay 89, over the conductor 93, wiper 86, polarized relay 82, springs 149 and 150, springs 151 and 152, bank springs 135 and 139 and the springs 153 of the key K', springs 154 of the calling device S, windings 156 and 155 of the repeating coil J, springs 157 and 158, bank springs 142 and 138, springs 160 and 159, springs 161 and 162, wiper 88, trunk conductor 95 and the upper winding of the relay 89 to battery B'. The operator now inquires of the called subscriber his number and tells him to wait a moment, as she has a toll call for him.

The operator next presses the key K² (holding it closed while she is talking with the calling subscriber), closing a circuit from ground G⁷ through the coil 164, springs of the key K², bank springs 140 and 136, relay 163 and the relay 166 to battery B'. The relay 166 being wound with wire made from different material than the windings of the relays 163 and 164, it is not operatively energized over the above-traced circuit. The relay 163, upon energizing,

disconnects the operator's head set from the called line and connects it with the calling line. A further result of the energizing of the relay 163 is the short-circuiting of the conductors 93 and 95 extending to the connector switch K to keep the same from releasing. The energizing of the relay 164 bridges the impedance coil 167 across the conductors of the trunk line 79—80. This circuit extends from ground G⁸ through the right-hand winding of the coil 167, springs of the key K¹, springs 170 and 169, springs 154, springs 153, bank springs 139 and 135, springs 152 and 171, trunk conductor 79, coils 29 and 30 of the repeater I, trunk conductor 80, springs 172 and 160, bank springs 138 and 142, springs 158 and 173, springs of the key K⁴ and the left-hand winding of the coil 167 to battery B'.

The bridge across the conductors 93 and 95 extends from the conductor 93 through the springs 149 and 150 of the relay 143, springs 175 of the relay 163 and the springs 161 and 162 to the trunk conductor 95. The battery current now fed to the calling trunk line is in the direction to cause the reverse battery relay 29 of the repeater to again operatively energize and reverse the battery current upon the calling line, with the same results as hereinbefore mentioned.

The calling subscriber, hearing the operator answer, immediately deposits a coin in his coin-collecting device, thus causing the arm 24 to be released from the arm 26, thereby allowing the springs 20, 21 and 22 to return to normal and the calling substation is rendered operative for talking purposes. The operator now inquires of the calling subscriber his number and the number of the subscriber that he is calling. The operator next operates the key K⁴, thus causing the battery current to be reversed back to normal on the calling line, which causes the polarized relay at the calling substation to attract the armature 27 toward the coil 18 and the arm 26 to again catch behind the lug 25 on the arm 24. The operator now depresses the key K³ and then releases the keys K² and K⁴. The depressing of the key K³ supplies sufficient current to the relay 166 for it to operatively energize in series with the relay 163. The relay 166, upon energizing, opens the circuit of the relay 143 and the winding 125 of the line switch C' at the springs 147 and at the springs 122 and 123, and forms a locking circuit for itself through the springs 177 and 122. The supervisory lamp 120 is also extinguished at this time by the separation of the springs 122 and 123. The line switch C' and the relays 143 and 163 are thus released and returned to normal. The calling line is now connected through to the called line. The current supplied to the calling line is now in the reverse direction, which causes the polarized

relay at the calling substation to again operate, as hereinbefore described, thus necessitating the dropping of another coin by the calling subscriber before conversation can be carried on with the called subscriber. If it is desirable, the operator, after depressing the key K^2 and resetting the toll mechanism at the calling substation A to normal, may immediately release the said key, which causes the battery current to be again reversed on the calling line to render the calling substation inoperative for talking. The operator may next ask the calling subscriber to deposit another coin and wait until he does so, or she may depress the key K^3 immediately and release herself from the trunk line extending between the subscribers.

If the calling subscriber had erred in dialing the called subscriber, or for any reason had obtained connection with the wrong subscriber, the operator, upon finding out that a wrong connection has been completed, will tell the calling subscriber to hold the line for a minute and will then release the key K^2 , thus releasing the relays 163 and 164. The operator then instructs the called party to hang up. The operator next depresses the key K' , opening the bridge across the trunk conductors 93 and 95, which releases the connector switch K and the selector M, as will be hereinafter explained, the line switch C^2 and the coil 143 being held energized from ground G^4 . The operator now operates her calling device S to dial the number of the called subscriber. As soon as the called subscriber answers, the polarized relay 82 will again be energized, thus causing the supervisory lamp 119 to again glow. The operator now handles the call the same as hereinbefore explained. The relay 178 associated with each operator's head set remains energized as long as the operator is at her position, but should the operator leave her position, the key K^5 is thrown and the relay 178 is allowed to deenergize and place a guarding potential upon the master switch bank contact and the relay 179 is caused to energize and close its contacts 180. The relays 179, which are individual to the operator's position the same as the relays 178, are energized only when an operator's position has been seized by a line switch C^2 , or when the busying relay 178 is deenergized. The contacts 180 controlled by the relays 179 form a chain of contacts to operate a supervisory signal. The supervisory signal may be placed at the chief operator's position to notify her that all the operators' positions are busy.

Returning to the completed connection, as soon as the conversation has been completed, the calling subscriber, upon replacing his receiver, causes the hook switch springs 9 and 10 to separate and open the circuit of the line relay 28 of the repeater I, which,

upon deenergizing, opens the bridge across the conductors 79 and 80 at the springs 34 and opens the circuit of the relay 32 at the springs 182 and 183.

The opening of the bridge across the conductors 79 and 80 opens the circuit of the line relay 89 of the connector K, which, upon deenergizing, opens the circuit of the relay 90 at the springs 184 and 185. The relay 90, upon deenergizing, removes the holding ground from the trunk conductor 94 and closes a circuit through the release magnet 101 at the springs 98 and 99. The release magnet 101, upon energizing, releases the connector switch to normal and its own circuit is opened at the springs 186 when the switch shaft reaches its lowest position. The removing of ground from the conductor 94 allows the relay 92 of the selector M to deenergize, which, upon deenergizing, closes a circuit through the release magnet 187, which latter magnet, upon energizing, releases the selector M to normal. Referring to the repeater F, as soon as the relay 32 deenergizes, holding ground is removed from the conductor 188, which allows the relay 75 of the selector E and the winding 42 of the line switch C to deenergize. The relay 75, upon deenergizing, releases the selector E in the same manner as explained for the selector M. The winding 42, upon deenergizing, permits the plunger arm 44 and the relay armature 53 to return to normal.

If the called line is busy, there will be a guarding potential upon the connector private bank contact, just as explained in connection with the line switch C. The connector private wiper 114, upon engaging this guarding contact, and before the side switch wipers have passed to third position, completes an energizing circuit for the busy locking relay 191 and the private magnet 107 in series. The private magnet remains energized and locks the side switch in second position, while the busy relay, upon energizing, transmits a busy signal to the calling subscriber in a well-known manner. The calling subscriber, upon replacing his receiver, releases the connection in a hereinbefore mentioned manner.

If a subscriber whose substation is not equipped with a pay-station (the substation A', for example) wishes to call a subscriber in a distant exchange, the method of procedure and the operation of the automatic switches and apparatus will be the same as hereinbefore explained, with the exception that the operator, instead of having to wait for the calling subscriber to deposit a coin before she can converse with him, will simply make out a ticket charging the call to the calling subscriber. Of course, the operator will not have to operate the battery reverse key K^4 to collect the second toll.

From the foregoing it will be seen that various other methods of operation readily suggest themselves. For example, the toll may be such that the recording operator will
 5 operate the battery reverse key K¹ several times to collect several coins, or, in the second case considered, where the calling substation is not equipped with a pay-station, they may ask to have the charges re-
 10 versed, in which case the operator will confer with the called party and find out if he is willing to pay for the message, or for part of it, and will make out the charge ticket accordingly.

15 While I have illustrated and described one particular embodiment of my invention with a system employing automatic switches of well-known types, it will, of course, be understood that various changes and modifi-
 20 cations can be made without departing from the spirit and intent of my invention.

What I claim as my invention is:—

1. In a telephone system, means by which one subscriber may set up a connection with
 25 another, and means whereby an operator is brought in on such connection after the same has been established.

2. In a telephone system, means by which one subscriber may set up a connection with
 30 another, and means whereby an operator is brought in on such connection by the response of the called subscriber.

3. In a telephone system, means by which one subscriber may set up a connection with
 35 another, and means whereby an operator is brought in on such connection after the same has been established, said operator being provided with means for breaking the con-
 40 nection between the two subscribers and talking to either subscriber to the exclusion of the other.

4. In a telephone system, means by which one subscriber may set up a connection with
 45 another, and means whereby an operator is brought in on such connection by the response of the called subscriber, said operator being provided with means for break-
 50 ing the connection between the two subscribers and talking to either subscriber to the exclusion of the other.

5. In a telephone system, means by which one subscriber may set up a connection with
 55 another, and means whereby an operator is brought in on such connection after the same has been established, said operator being provided with means for rendering the call-
 ing telephone inoperative and means under the control of the calling subscriber for then rendering said telephone operative.

60 6. In a telephone system, means by which one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection by the re-
 65 sponse of the called subscriber, said operator being provided with means for rendering

the calling telephone inoperative and means under the control of the calling subscriber for then rendering said telephone opera-
 tive.

7. In a telephone system, means by which
 70 one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection after the same has been established, means whereby
 75 said operator may eliminate herself auto-
 matically from the circuit, the two subscrib-
 ers being provided with means for there-
 after completing their connection and auto-
 matically releasing the same.

8. In a telephone system, means by which
 80 one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection by the re-
 sponse of the called subscriber, said opera-
 85 tor being enabled to eliminate herself auto-
 matically from the circuit, leaving the two
 subscribers to complete their connection and
 automatically release the same.

9. In an automatic telephone system,
 90 means including a trunk line and a plurality
 of automatic switches for connecting a call-
 ing and a called line, a second trunk line
 extending to an operator's position, and
 means actuated upon the response of the
 95 called subscriber for dividing said first
 trunk line and for connecting the called end
 thereof with said second trunk line.

10. In an automatic telephone system,
 100 means including a trunk line and a plurality
 of automatic switches for connecting a call-
 ing and a called line, a second trunk line
 extending to an operator's position, means
 actuated upon the response of the called sub-
 105 scriber for dividing said first trunk line and
 for connecting the called end thereof with
 said second trunk line, and means controlled
 by the operator for substituting the calling
 end for the called end thereafter.

11. In an automatic telephone system,
 110 means including a trunk line and a plu-
 rality of automatic switches for connecting
 a calling and a called line, a second trunk
 line extending to an operator's position,
 means actuated upon the response of the
 115 called subscriber for dividing said first
 trunk line and for connecting the called
 end thereof with said second trunk line,
 means controlled by the operator for sub-
 120 stituting the calling end for the called end
 thereafter, and additional means controlled
 by the operator whereby the calling and
 called ends of said first trunk line may be
 reconnected.

12. In an automatic telephone system,
 120 means including a trunk line and a plurality
 of automatic switches for connecting a call-
 ing and a called line, a second trunk line ex-
 tending to an operator's position, means ac-
 125 tuated upon the response of the called sub-
 scriber for dividing said first trunk line and

for connecting the called end thereof with said second trunk line, means controlled by the operator for substituting the calling end for the called end thereafter, additional means controlled by the operator whereby the calling and called ends of said first trunk line may be reconnected and the said second trunk line disconnected therefrom.

13. In a telephone system, means for establishing automatic connections between a calling and a called line, said means including a trunk line comprising two normally connected sections, a second trunk line extending to an operator's position, and means actuated upon the response of the called subscriber for separating said sections and for connecting one of them with said second trunk line.

14. In a telephone system, means for establishing automatic connection between a calling and a called line, said means including a trunk line comprising two normally connected sections, a second trunk line extending to an operator's position, means actuated upon the response of the called subscriber for separating said sections and for connecting one of them with said second trunk line, and means controlled by the operator thereafter for substituting the other section for the one so connected.

15. In a telephone system, means for establishing automatic connection between a calling and a called line, said means including a trunk line comprising two normally connected sections, a second trunk line extending to an operator's position, means actuated upon the response of the called subscriber for separating said sections and for connecting one of them with said second trunk, means controlled by the operator thereafter for substituting the other section for the one so connected, and additional means controlled by the operator whereby said sections may be again connected.

16. In a telephone system, means for establishing automatic connection between a calling and a called line, said means including a trunk line comprising two normally connected sections, a second trunk line extending to an operator's position, means actuated upon the response of the called subscriber for separating said sections and for connecting one of them with said second trunk, means controlled by the operator thereafter for substituting the other section for the one so connected, and additional means controlled by the operator whereby said sections may be again connected and said second trunk line disconnected therefrom.

17. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing

said mechanism, and means for then connecting one of said lines with a trunk extending to an operator's position.

18. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing said mechanism, means for then connecting one of said lines with a trunk extending to an operator's position and means for thereafter substituting the other line for the line so connected.

19. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing said mechanism, means for then connecting one of said lines with a trunk extending to an operator's position, means for thereafter substituting the other line for the line so connected, and means whereby the said calling and called lines may be again connected together.

20. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing said mechanism, means for then connecting one of said lines with a trunk extending to an operator's position, means for thereafter substituting the other line for the line so connected, and means whereby the said calling and called lines may be again connected together and the said trunk line removed from the connection.

21. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing said mechanism, and means operable thereafter for placing said lines separately into communication with an operator.

22. In a telephone system, automatic switching mechanism controlled over a calling line to establish connection with a called line, means for breaking said connection thereafter at some point without releasing said mechanism, means operable thereafter for placing said lines separately into communication with an operator, and means whereby said lines may be again connected together to the exclusion of said operator.

23. In a telephone system, means by which one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection after the same has been established, said operator being provided with means for rendering the calling telephone inoperative, and mechanical means under the control of the calling subscriber for then rendering said telephone operative.

24. In a telephone system, means by which one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection by the response of the called subscriber, said operator being provided with means for rendering the calling telephone inoperative, and mechanical means under the control of the calling subscriber for then rendering said telephone
10 operative.

25. In a telephone system, means by which one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection after the same
15 has been established, said operator being provided with means for rendering the calling telephone inoperative, and gravity operated means under the control of the calling sub-

scriber for then rendering said telephone operative.

26. In a telephone system, means by which one subscriber may set up a connection with another, and means whereby an operator is brought in on such connection by the response of the called subscriber, said operator
25 being provided with means for rendering the calling telephone inoperative, and gravity operated means under the control of the calling subscriber for then rendering said telephone operative.
30

Signed by me at Chicago, Cook county, Illinois this 20th day of June, 1914.

BERNARD D. WILLIS.

Witnesses:

GEORGE YANOSCHOWSKI,
HERBERT W. KRACKE.