F. LUBBERGER.

AUTOMATIC PARTY LINE TELEPHONE SYSTEM.

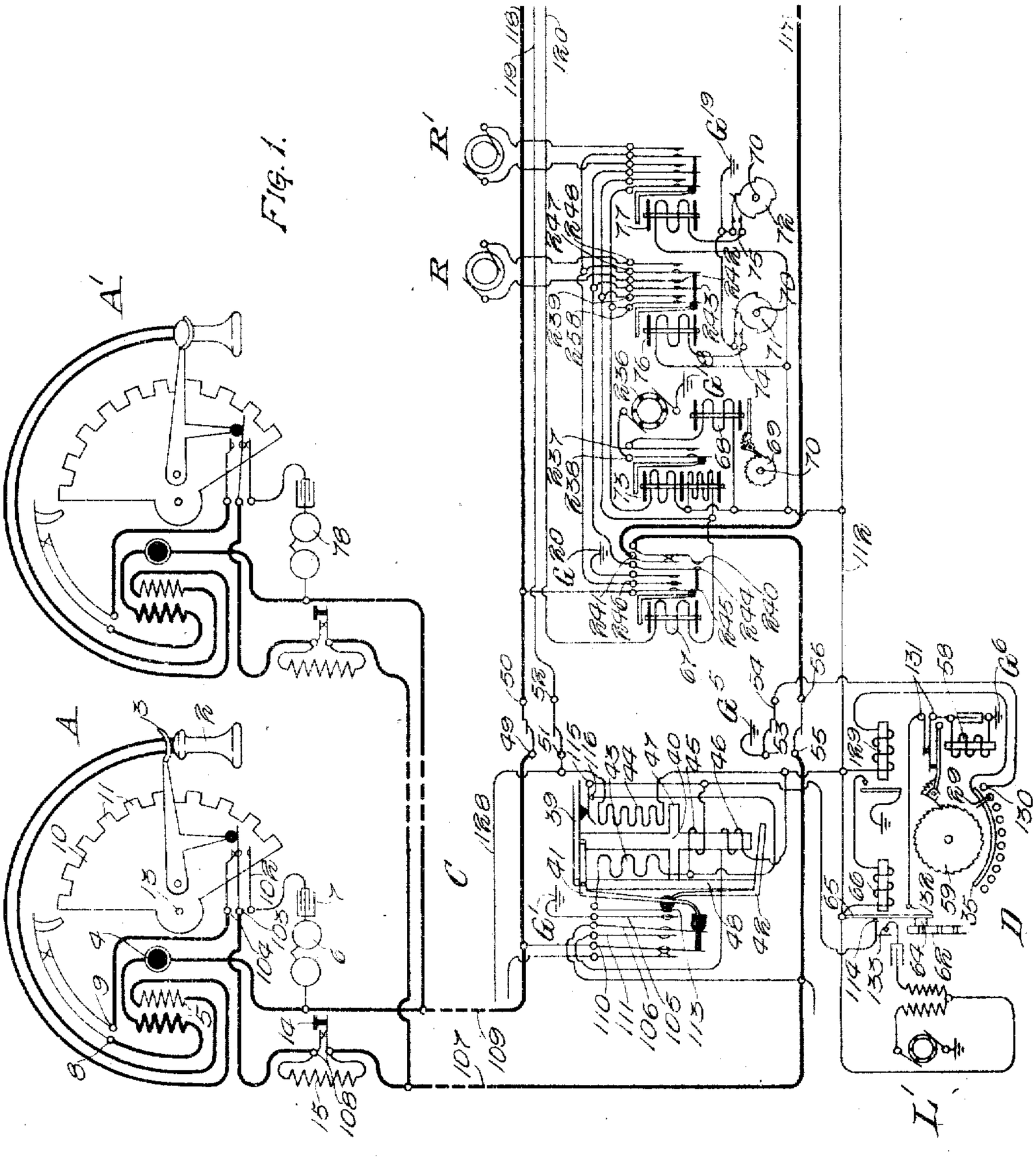
APPLICATION FILED JUNE 16, 1910.

1,242,458.

Patented Oct. 9, 1917

5 SHEETS—SHEET 1.

FIG. 1.



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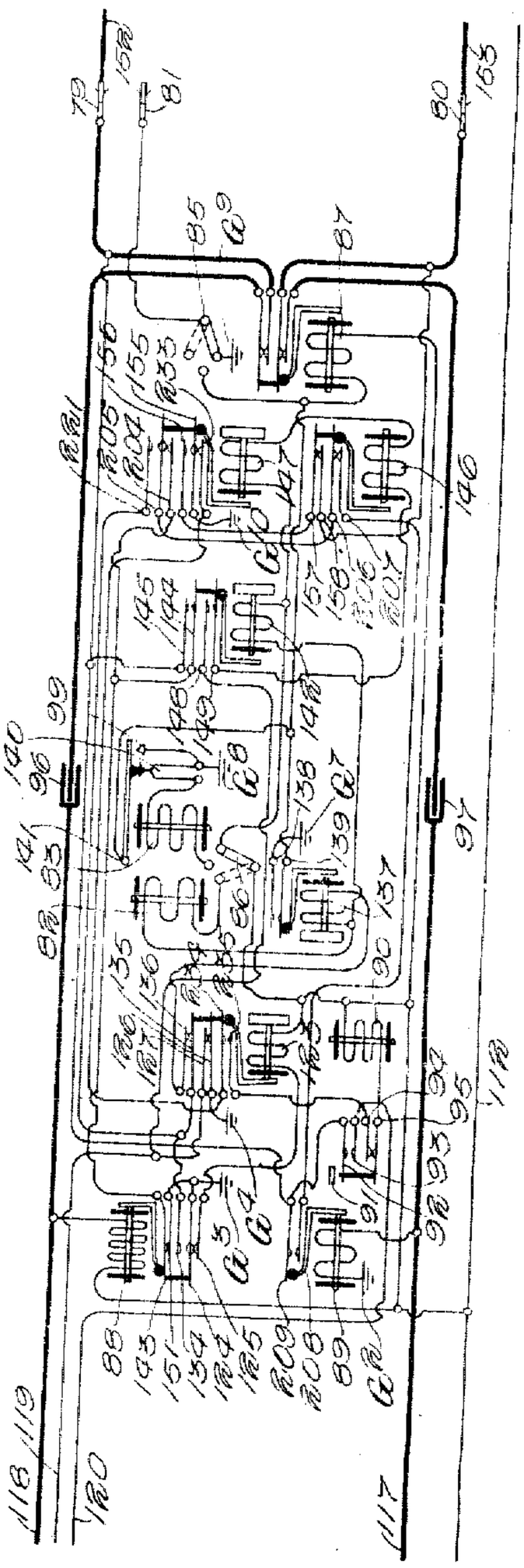
5 SHEETS—SHEET 2.

FIG. 2.



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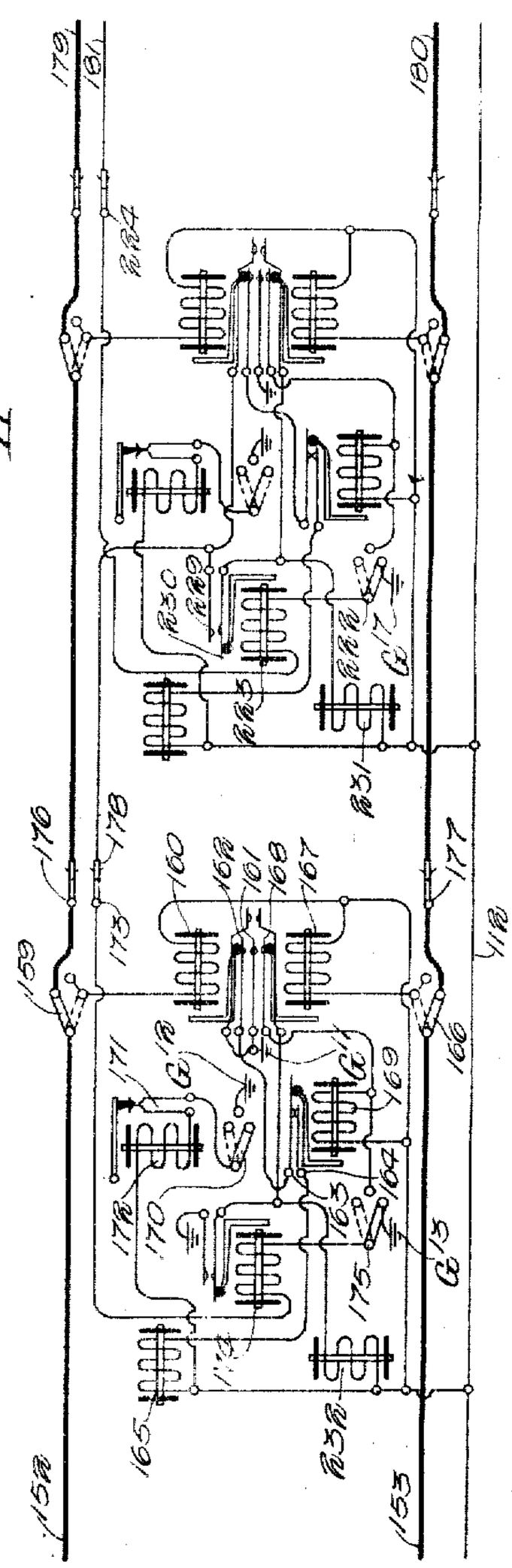
5 SHEETS—SHEET 3.

Fig. 3.



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5 SHEETS--SHEET 4.

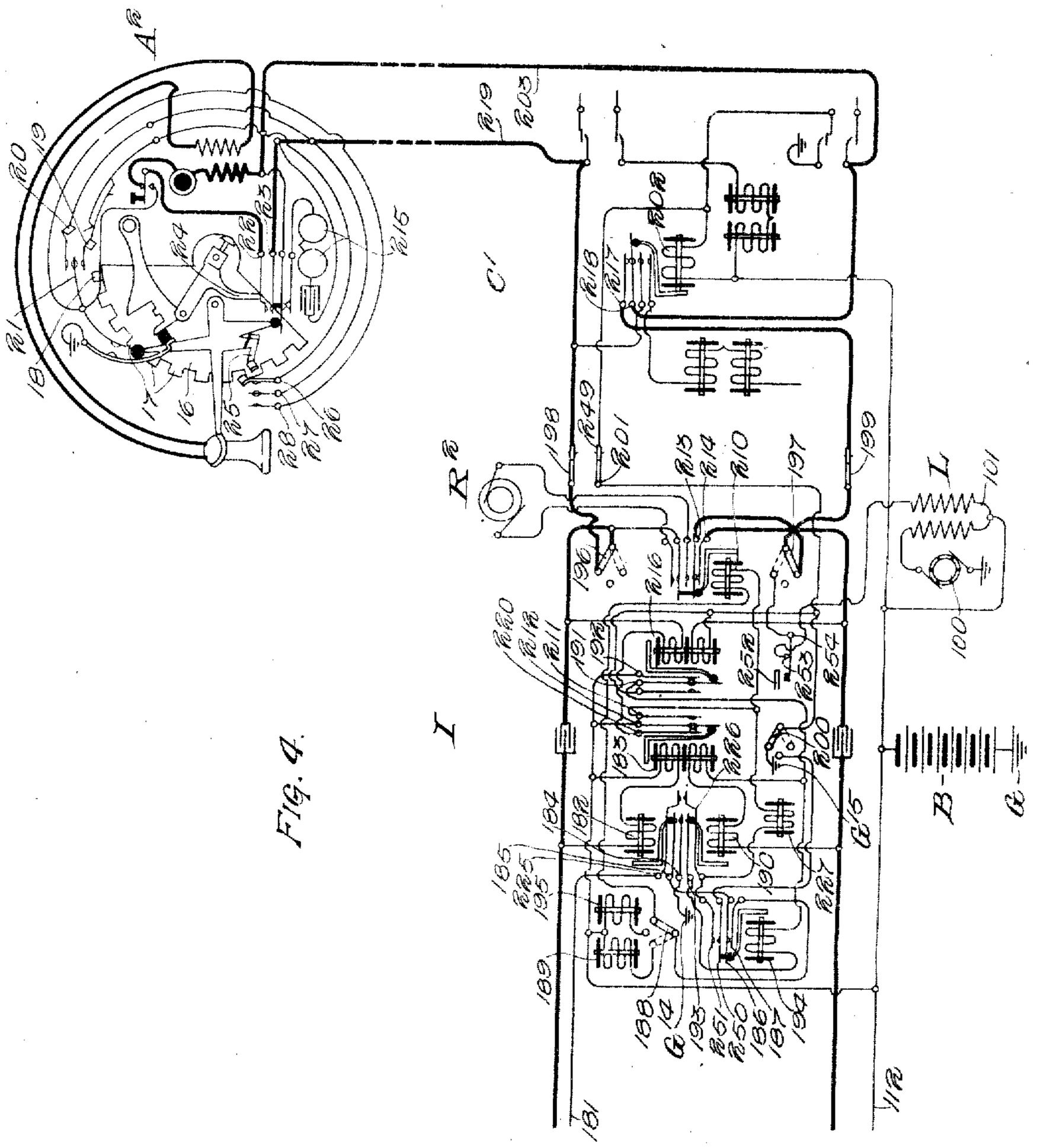

FIG. 4.

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5 SHEETS—SHEET 5.

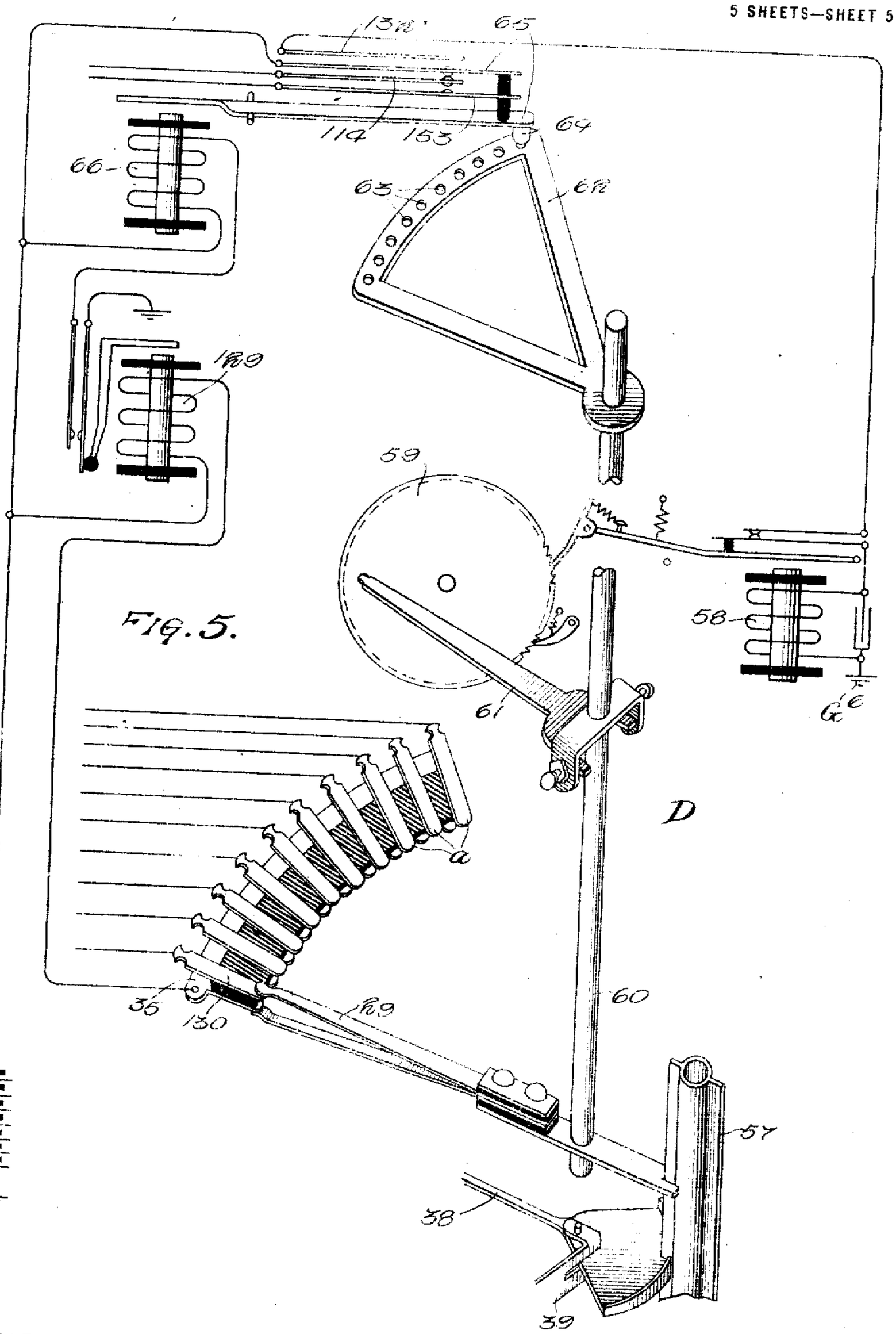

FIG. 5.

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UNITED STATES PATENT OFFICE.

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AUTOMATIC PARTY-LINE TELEPHONE SYSTEM.

1,242,458. Specification of Letters Patent. Patented Oct. 9, 1917.

Application filed June 16, 1910. Serial No. 567,299.

To all whom it may concern:

Be it known that I, FRITZ LUBBERGER, a subject of the Emperor of Germany, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Automatic Party-Line Telephone Systems, of which the following is a specification.

My invention relates to telephone exchange systems in which party-lines are employed. It relates more particularly to automatic exchanges of that type ordinarily known as three-wire systems, to-wit, systems in which a ground is employed at the substations for controlling the automatic switches at the central station. More especially, however, it relates to a three-wire system of this kind in which the party-lines are operated on the two-wire principle—that is to say, by controlling the automatic switches over the two sides of the calling line in series. This, it has been found, is an advantage, as interference between subscribers on the same line is more easily prevented and guarded against in a two-wire system than in a three-wire system. Thus a three-wire automatic system in which the party-lines are operated on the two-wire principle is less complicated and more efficient than a system in which the party-lines are also operated on the three-wire principle.

The object of my invention is to provide an improved arrangement whereby a party-line subscriber in a system of the foregoing character may signal another subscriber on the same line without first operating the calling mechanism at the substation of the calling subscriber, and by simply operating a push button after the removal of the receiver at the calling substation, thus enabling the party-line subscribers in a system of this kind to intercommunicate in a very simple and satisfactory manner, as will hereinafter more fully appear.

To this and other useful ends my invention consists in matters hereinafter set forth and claimed.

In the accompanying drawings Figures 1, 2, 3 and 4 taken together represent diagrammatically a complete connection established between a calling party-line substation A (Fig. 1) and a called straight line substation A^2 in a system embodying the principles of my invention. In Fig. 1 there is represented diagrammatically two party-line substations A and A′ to the line conductors of which there is allotted at the central office an individual or line switch C. At D there is shown a master switch for controlling a group of line switches, such as the one shown at C. The line switches of this group have common access to a number of trunk lines which lead to so-called selector-repeaters E (Fig. 2). A number of these selector-repeaters have access to a number of second selectors F (Fig. 3), which latter selectors in turn have access to a number of third selector switches H. These third selectors H in turn have access to a number of connector switches I (Fig. 4) by means of which connection may be completed to subscribers' lines.

Fig. 5 is a diagrammatic view of a portion of the central office apparatus, showing the essential features of the master switch D (Fig. 1).

The automatic substations with which I have chosen to illustrate my invention are of two types. The substations A and A′ are of that type in which the central office apparatus is controlled over the two sides of the line in series. The substation A^2 is of the character in which the substation apparatus is controlled by ground impulses over the two sides of the line separately. The substation A comprises the usual receiver 2, switch hook 3, transmitter 4, induction coil 5, ringer 6 and condenser 7. Since it is an automatic substation it is also provided with the impulse springs 8 and 9 and an impulse wheel 10 which carries upon its periphery a number of impulse teeth 11 and is secured to a shaft 13 to which there is also secured a dial (not shown) provided with finger holes. The substation is also provided with a push button 14 which, when depressed, removes a short-circuit from around the resistance 15. The teeth 11 on the impulse wheel 10 are so arranged that as they are rotated forward to call any digit the springs 8 and 9 are not affected, but as the impulse wheel is returned to normal position the springs 8 and 9 are separated by the teeth 11 a number of times corresponding to the digit called.

In the substation A^2 (Fig. 4) the impulse wheel 16 is provided with ten so-called vertical impulse teeth 17 and one rotary impulse tooth 18. These teeth are so arranged that as the impulse wheel is rotated forward through the medium of the dial the rotary

tooth 18 forces the so-called rotary impulse spring 19 into engagement with the ground spring 21. As the wheel 16 returns to normal position the vertical impulse spring 20 is forced into engagement with the ground spring 21 a number of times corresponding to the digit called, after which the rotary spring 19 is once more forced into contact with the spring 21 by the tooth 18. While the impulses are being transmitted the connection between the two sides of the line is broken between the springs 22 and 23, which come into engagement when the receiver is removed from the switch hook, but are permitted to disengage by the dog 24 whenever the dial is out of normal position. As the switch hook descends the arm 25 momentarily presses the springs 26, 27 and 28 into engagement.

The line switch C (Fig. 1), which is individual to the line of substations A and A′, and the master switch D are modified forms of the general types of line and master switches disclosed in British Patent No. 26,301 of 1906, and in the *American Telephone Journal* of New York, N. Y., of June 6, 1908. As herein represented, the line switch C comprises, among other details, a plunger 38 (Fig. 5) attached to the end of a so-called plunger arm 39 which is controlled by the magnet 40. The magnet 40 also controls the relay armatures 41 and 42, and is composed of four windings, namely, a pull-in winding 43, a holding or cut-off winding 44, line winding 46 and an auxiliary winding 45. The core of the magnet is provided near the center of its length with a lateral projection 47 by means of which the magnet is mounted upon the bracket 48, upon which latter the armatures 39, 41 and 42 are pivoted. With this method of mounting the magnet the magnetic circuit of the windings 43 and 44 is maintained separate from that of the windings 45 and 46, so that the armatures on one end of the magnet are not affected by the energization of the windings upon the other end. Of the two windings upon the upper end of the magnet only the winding 43 is strong enough to attract the plunger arm 39 from its normal position. The winding 44 is not strong enough to thus operate the plunger arm, but will hold it in an operated position after it has been drawn down by the winding 43. When the plunger arm 39 is attracted by the magnet 40 the plunger of the switch is forced into a bank of contact springs, forcing springs 49, 51, 53 and 55 into engagement with springs 50, 52, 54 and 56, respectively. Although only one set of springs 49—56 is shown, each line switch C is provided with a number of such groups of springs, each group forming the terminal of a trunk line leading to a selector E. Each trunk line is multipled through the corresponding springs of all the line switches of the group which is controlled by the master switch D. The plungers of the line switches of this group normally engage the plunger shaft 57 (Fig. 5), and through the medium of the master switch D are normally maintained opposite the terminal of an idle trunk line. The master switch consists essentially of a motor magnet 58 for rotating the ratchet wheel 59. The ratchet wheel 59 is connected with the shaft 60 by means of a link 61 in such a manner that a rotary motion of the ratchet wheel is transmitted to the plunger shaft 57, imparting to it an oscillatory motion about the shaft 60, so as to move the idle plungers back and forth in front of their trunk terminals. To the shaft 60 there is secured a locking plate 62 provided near its outer edge with a number of openings 63 which are adapted to be engaged by the pin 64 upon the end of the armature 65 of the relay 66. The openings in the plate 62 are so spaced that the pin 64 can engage one of them only when the plungers that are in locking engagement with the plunger shaft are directly in front of the corresponding trunk terminal. The master switch is also provided with a bank of contacts comprising a common segment 35 and one individual segment *a* for each trunk to which the line switches have access. The wiper 29 always keeps the common segment in electrical connection with the individual segment corresponding to the trunk line before which the idle plungers are being held by the master switch.

Associated with each trunk line which leads from the line switches C to the selectors E there is a relay 67. Common to a number of these trunk lines there is a ringing interrupter mechanism comprising a motor magnet 68 and a ratchet wheel 69 which is secured to a shaft 70 to which are secured the two interrupter wheels 71 and 72. These wheels 69, 71 and 72 are shown separated for convenience of illustration. The circuit of the motor magnet is controlled by the double-wound relay 73. The wheels 71 and 72 control the two pairs of springs 74 and 75, respectively. These springs are so controlled that as the wheels revolve the two pairs will be permitted to engage alternately and in such a manner that one pair is disengaged before the next pair is permitted to come into engagement. The pairs of springs 74 and 75 control the circuits of the relays 76 and 77, respectively, which in turn control the connections of the ringing current generators R and R′. These generators generate ringing current of different frequencies. The ringers at each of the substations A and A′ are adapted to respond to current furnished by only one of these generators. For instance, the ringer 6 at substation A may be made to respond only to current furnished by generator R,

while the ringer 76 at substation A′ will only be affected by current from generator R′.

The selector-repeater E is of the general type of selector switch disclosed in United States Letters Patent #815,321, granted March 13, 1906, to Keith, Erickson & Erickson, being modified, however, to operate by impulses which are delivered from a calling substation over the two sides of the line in series. Besides performing the function of a selector, the selector E is provided with means whereby, after it operates to place its wipers in connection with an idle trunk line, said selector may then receive impulses from a calling substation over the two sides of the line in series, and repeat impulses over the two sides of the trunk separately to operate switches of the so-called three-wire type. Among other details the selector-repeater E comprises a set of wipers 79, 80 and 81 carried upon a shaft (not shown) which has a vertical and rotary motion controlled by the vertical magnet 82 and rotary magnet 83. The usual side switch comprising the wipers 85 and 86 is controlled by the private magnet 87 in the usual manner. The operation of the switch is controlled by the calling subscriber through the medium of the relays 88 and 89. Means for restoring the switch to normal position is provided in the release magnet 90. The selector-repeater E is released immediately upon the energization of the release magnet, rather than by its deënergization, as shown in said selector patent. An arm 91 is attached to the switch shaft and holds spring 92 in engagement with spring 93, and spring 95 out of engagement with spring 94, as long as the switch shaft is in its lowest or normal position. The talking circuit through the selector includes the two condensers 96 and 97. The armature of the rotary magnet 83 has no finger for controlling the armature of the private magnet 87, as shown in said selector patent, but the private magnet is controlled by the rotary magnet electrically through the medium of the grounded contact point 99. The selectors F and H are also of the type disclosed in the said selector Patent No. 815,321, but are not modified to operate over the two sides of the line in series, or to repeat impulses.

The connector I (Fig. 3) is of the general type of connector switch disclosed in United States Letters Patent #815,176, granted March 13, 1906, to Keith, Erickson & Erickson, its circuits being modified somewhat in order to adapt it for operation in a common battery system. The line switch C′ is of the type disclosed in the British Patent #26,301 of 1906, and the *American Telephone Journal* referred to above. The line switch C′ has access to trunk lines which lead to three-wire selectors similar to the selectors F and H, Fig. 3.

At R^2 there is shown a ringing current generator, and at L a busy signaling apparatus consisting of a current interrupter 100 and induction coil 101 is shown. At B there is shown a battery which furnishes current for operating the central office switches and for talking purposes.

Having given a general description of the apparatus illustrated herein, I will now describe in detail the various operations by means of which one subscriber may signal and obtain connection with another. It will first be explained how a subscriber at the party line substation A may call substation A^2 (Fig. 4), the number of which is assumed to be 22220. The removal of the receiver at the substation A preparatory to making a call allows the spring 103 to disengage spring 102 and engage spring 104, whereby the circuit of the ringer 6 is opened, and a circuit is closed through the line winding 46 of the line switch C. This circuit extends from ground G′ through springs 105 and 106, line 107, push button springs 108, springs 103 and 104, springs 9 and 8, primary winding of induction coil 5, transmitter 4, line 109, springs 110 and 111 and winding 46 to battery lead 112. The energization of the winding 46 serves to attract the armature 42, which operates to force the spring 113 into engagement with spring 105, whereby a circuit is closed through the pull-in winding 43. This circuit extends from ground G′ through springs 105 and 113, windings 43 and 45, contact point 114 and armature 65 to battery lead 112. The winding 43, upon energizing, attracts the armature 41 and plunger arm 39. The armature 41, upon being attracted, operates to disconnect the line winding 46 and ground G′ from the calling line. The armature 42 does not fall back immediately upon the deenergization of the winding 46, but remains held up by current flowing in the winding 45 until the plunger arm 39 forces spring 115 into contact with spring 116, whereby the winding 45 is short-circuited and caused to deënergize slowly to hold the armature 42 in its operated position for an instant longer. Before the armature 42 is restored sufficiently to break the circuit of winding 43 a circuit is closed through the winding 44 in the following manner: When the springs 49 and 55 are forced into contact with springs 50 and 56, respectively, by the plunger of the line switch C, a circuit is closed through the line relays 88 and 89 of the selector-repeater E. This circuit extends from ground G^2 through relay 89, trunk conductor 117, springs 241 and 240, springs 56 and 55, thence over the heavy conductors to and through substation A and back over the other side of the line and through relay

88 to the battery lead 112. The relay 88, upon energizing, operates to close a circuit through the relay 123, said circuit extending from ground G^3 through springs 124 and 125 and relay 123 to battery lead 112. The relay 123, upon energizing, operates to close the circuit of the holding winding 44 of the line switch C, said circuit extending from ground G^4 through springs 126 and 127, conductor 119, springs 52 and 51 and winding 44 to the battery lead. The current in this winding serves to hold the plunger arm 39 and armature 41 in their operated positions after the winding 43 has been deënergized. The energization of the relay 123 at the selector E also extends a guarding potential from ground G^4 over conductor 128 to the connector private bank contacts of the calling line.

When the springs 53 and 54 are forced into contact by the plunger of the line switch a circuit is closed through the master switch relay 129. This circuit extends from ground G^5 through springs 53 and 54, contact point 130, wiper 29, segment 35 and relay 129 to battery lead 112. The relay 129, upon energizing, operates to close a circuit through the relay 66. The relay 66, upon energizing, operates to withdraw the pin 64 from the plate 62 and to close the circuit of the motor magnet 58. This circuit extends from ground G^6 through magnet 58, interrupter springs 131, contact point 132 and armature 65 to battery lead 112. As long as the armature 65 engages contact point 132 the magnet 58 operates in a manner similar to that of a buzzer to rotate the ratchet wheel 59 step by step to advance the idle line switch plungers away from the trunk just seized. After the plungers have been advanced a short distance the wiper 29 leaves the contact point 130 and allows the relays 129 and 66 to deënergize. The armature 65 does not fall back immediately upon the deënergization of relay 66, but remains in contact with contact point 132 until the next opening in the plate 62 passes under the pin 64. When the next opening does pass under the pin 64 the armature 65 falls back, forcing the pin into this opening to lock the plunger shaft, and breaking the circuit of the motor magnet 58. The foregoing is the operation of the master switch in case the next trunk line after the one seized by the switch C is idle. If, however, this next trunk is busy the wiper 29 finds the corresponding contact in the master switch bank grounded, and consequently the relays 129 and 66 remain energized while the next opening is passing under the pin 64 and the plungers are carried past the busy trunk to an idle one. As long as the master switch is operating the armature 65 is disengaged from the spring 114, and spring 114 engages spring 133, whereby the pull-in windings of all the idle line switches are disconnected from the battery and connected to the busy signaling machine L'. With this arrangement no line switch can be operated while its plunger is being moved from one trunk to another, and any subscriber who attempts to make a call at that time will receive the busy signal, due to the inductive relation between the line winding 46 and the winding 45, which is then connected to the busy signaling machine L'.

The foregoing are the operations which take place immediately upon the removal of the receiver at the calling substation. The calling subscriber now operates his dial for the first digit 2 of the desired number. As the wheel 10 returns to normal position after being rotated for this digit, the impulse springs 8 and 9 are separated twice momentarily. Each time these springs are separated the energizing circuit of the relays 88 and 89 of the selector E is broken. The deënergization of relay 89 in response to these impulses is without function. Since the relay 123 is slow acting it does not have time to deënergize during the momentary interruption of its circuit by the deënergization of relay 88. Thus each time relay 88 deënergizes a circuit is closed from ground G^3 through springs 124 and 134, springs 135 and 136, slow acting private magnet relay 137, vertical magnet 82 and side switch wiper 86 to battery lead 112. Since the digit called is 2 the vertical magnet receives two impulses over this circuit and operates to raise the switch shaft two steps. The relay 137, being slow acting, is energized by the first impulse through it in series with the vertical magnet and remains in its operated position until the last impulse is delivered. In its energized position the relay 137 operates to close a circuit from ground G^7 through springs 138 and 139 and private magnet 87 to battery lead 112. The relay 137 deënergizes shortly after the last impulse is delivered to the vertical magnet and breaks the circuit of the private magnet 87, which in turn deënergizes to permit the side switch to pass from first to second position. The movement of side switch wiper 86 from first to second position disconnects the battery from the vertical magnet and closes a circuit through the rotary magnet 83. This circuit extends from ground G^8 through interrupter springs 140, rotary magnet 83 and side switch wiper 86 to battery lead 112. Since this circuit includes the interrupter springs 140 the rotary magnet 83 operates in a manner similar to that of a buzzer to rotate the switch shaft and wipers step by step as long as the side switch remains in second position. When the rotary magnet is energized the first time a circuit is closed from ground G^8 through contact point 99,

armature 141 and private magnet 87 to battery lead 112. If the first trunk upon which the wipers of the selector are rotated is idle, the private magnet deënergizes as soon as the armature of the rotary magnet falls back. This energization and deënergization of the private magnet permits the side switch to pass to third position, thereby breaking the circuit of the rotary magnet 83 and leaving the wipers resting upon the contacts of the first trunk line. If, however, the first trunk upon which the selector wipers are rotated is busy, the private wiper 81 finds the contact which it engages provided with a guarding ground. Thus a locking circuit is completed from said guarding ground through shaft wiper 81, side switch wiper 85 and private magnet 87 to battery lead 112. The private magnet thus remains energized and locks the side switch in second position after the rotary magnet deënergizes the first time. The rotary magnet 83 then continues to advance the wipers step by step until the private wiper 81 engages a non-grounded contact of an idle trunk, whereupon the private magnet deenergizes and permits the side switch to pass to third position, as described above. Besides breaking the circuit of the private magnet, the passage of the side switch provides a guarding potential for the selector private bank contacts of the seized trunk. This guarding potential extends from ground G^9 through side switch wiper 85 and shaft wiper 81 to said private bank contacts.

The relays 88 and 89 of the selector-repeater E operate in response to the impulses for the second digit 2 in the same manner as for the first digit. Since, however, the side switch of the switch E is in third position the deënergization of the relay 88 serves to close a circuit through the relay 142 instead of the vertical magnet 82. This circuit extends from ground G^3 through the springs 124 and 134, springs 135 and 136, relay 137, relay 142 and side switch wiper 86 to the battery lead 112. The relay 142 is slow acting and consequently is energized by the first impulse through it, and remains in its energized position until all the impulses for the digit are delivered. In its energized position the relay 142 extends a connection from the spring 143 of the relay 88 through the springs 144 and 145 and shaft wiper 79 to the vertical trunk conductor 152, and also closes a circuit through the relays 146 and 147. This circuit extends from ground G^4 through the springs 126 and 127 of the relay 123, springs 148 and 149, relays 146 and 147 and side switch wiper 86 to the battery lead 112. The energization of these relays is without direct effect at this time. Since the trunk conductor 152 is connected with the spring 143 of the relay 88 during the time the relay 88 is operating in response to the impulses for the second digit, it follows that each time the relay 88 energizes, a ground impulse is transmitted from ground G^3 through the springs 151 and 143, springs 144 and 145 to the vertical trunk conductor 152. Since the digit called is 2 the relay 88 is deënergized and energized twice, thereby transmitting two such ground impulses to the conductor 152. The last impulse continues until the relay 142 deënergizes after its circuit is broken by the return of the relay 88 to its energized position after it has deënergized for the last time. When the relay 142 deenergizes it also breaks the circuits of relays 146 and 147. The relay 146, being quick acting, deënergizes immediately and completes a connection from ground G^{10} through springs 155 and 156, springs 157 and 158 and shaft wiper 80 to the rotary trunk conductor 153. The slow acting relay 147 deënergizes after a moment and disconnects this ground from the rotary trunk. It is thus evident that when the substation calling device is operated for the second digit 2 the selector-repeater E operates to transmit two ground impulses to the vertical trunk conductor 152 and one impulse to the rotary trunk conductor 153. During the time these impulses are being repeated the circuit of the private magnet is maintained by the relay 137. The side switch has passed out of control of the private magnet, so that its energization at this time simply serves to open up the connection between the calling line and the trunk line while the impulses are being repeated.

The two impulses which are repeated to the trunk conductor 152 pass through the side switch wiper 159 and vertical line relay 160 of the selector F (Fig. 3) to battery lead 112. This relay, upon energizing, completes a circuit from ground G^{11} through springs 161 and 162, springs 163 and 164 and vertical magnet 165 to battery lead 112. The vertical magnet operates in response to the two impulses over this circuit to raise the shaft and wipers two steps. The impulse transmitted to the rotary side of the trunk by the switch E then passes through side switch wiper 166 and rotary line relay 167 of the selector F to the battery lead. The relay 167 then operates to send one impulse from ground G^{11} through springs 161 and 168 and private magnet 169 to the battery lead. The private magnet, upon energizing and deënergizing, permits the side switch to pass to second position, whereby a circuit is closed through the rotary magnet. This circuit extends from ground G^{12} through side switch wiper 170, interrupter springs 171 and rotary magnet 172 to battery lead 112. As in the selector E, the rotary magnet operates to rotate the

wipers step by step as long as the side switch remains in second position. When the rotary armature is attracted it presses down the armature of the private magnet 169. If the first trunk is idle the private magnet armature falls back the first time the rotary magnet deënergizes and allows the side switch to pass to third position. If, however, the first trunk is busy the private wiper 173 finds a ground potential and closes an energizing circuit through the private magnet, which causes the side switch to be locked in second position. This circuit extends from said grounded private bank contact through wiper 173, relay 174, side switch wiper 175 and private magnet 169. The relay 174 does not receive sufficient current over this circuit to be operatively energized. After an idle trunk is found the side switch passes to third position just as in the selector E, whereby the line connection is extended through side switch wipers 159 and 166 and shaft wipers 176 and 177 to the selector H. The trunk line is protected against seizure by any other selector by a ground potential extending from ground G^{13} through side switch wiper 175, relay 174 and private wiper 173 to the private bank contact 178, and thence to the corresponding contact in the banks of all selectors F that have access to the selector H.

When the substation calling device is operated for the third digit 2 the selector repeater E operates in the same manner as for the previous digit to transmit two impulses to the vertical trunk conductor 152, followed by one impulse over the rotary conductor 153. These impulses, however, pass through the line relays of the selector H, causing it to operate in the same manner as explained for the selector F to extend the connection to a connector I over trunk conductors 179 and 180.

The impulses which are repeated to the vertical side of the line for the fourth digit 2 pass through the selectors F and H, vertical line relay 182 and upper winding of relay 183 to battery lead 112. The energization of relay 183 at this time is functionless. The energization of relay 182 serves to close a circuit from ground G^{14} through springs 184 and 185, springs 186 and 187, side switch wiper 188 and vertical magnet 189 to the battery lead 112. Since the digit called is 2 the vertical magnet operates twice to raise its wipers opposite the second level of bank contacts. The rotary impulse for this digit passes through the rotary line relay 190, lower winding of the relay 183 and springs 191 and 192 to the battery lead 112. The relay 190, upon energizing, closes an energizing circuit from ground G^{14} through the springs 184 and 193, private magnet 194 and springs 191 and 192 to the battery. The private magnet 194, upon energizing and deënergizing, permits the side switch to pass from first to second position, whereby the rotary magnet 195 is brought under the control of the vertical relay 182.

Since the last digit is 0 ten impulses are transmitted over the vertical side of the line and through the relay 182 when the substation calling device is operated for this digit. The intermittent energization of the relay 182 for this digit causes a series of impulses to pass from ground G^{14} through the springs 184 and 185, springs 186 and 187, rotary magnet 195 and side switch wiper 188 to battery. The rotary magnet operates in response to these impulses to rotate the wipers onto the contacts of the desired line. The impulse over the rotary side of the line which follows this last set of impulses over the vertical side energizes the rotary relay 190 once more, which causes the private magnet to trip the side switch to third position if the called line is idle. The movement of the side switch wipers 196 and 197 to third position completes connection with the called line through the shaft wipers 198 and 199, while the wiper 200 supplies a guarding ground potential through the shaft wiper 201 to the connector private bank contacts of the called line. The wiper 200, in third position, also completes a circuit from ground G^{15} through wipers 200 and 201 and cut-off relay 202 of the line switch C′ to battery. The relay 202, upon energizing, operates to disconnect the switch C′ from the called line and connect the rotary line 203 with the bank contact which is engaged by the wiper 199.

After the calling device has been operated for the last digit the push button 14 at the calling substation is pressed in order to cause the called substation to be signaled. The pressing of button 14 removes the short-circuit from around the resistance 15, inserting it in the circuit of the line relays of the selector E. The line relays 88 and 89 of the selector E are so adjusted that when the resistance 15 enters their circuit the relay 88 remains energized, while the relay 89 permits its armature to fall back. The relay 89, upon deënergizing, closes a circuit from ground G^{3} through springs 151 and 143 of relay 88, springs 204 and 205, springs 206 and 207, springs 208 and 209, and thence to the trunk conductor 152, and through switches F and H and the relays 182 and 183 of the connector I to battery. Since the side switch of the connector is in third position the energization of relays 182 and 183 completes a circuit through the ringer relay. This circuit extends from ground G^{14} through springs 184 and 185, springs 186 and 187, side switch wiper 188, relay 210 and springs 211 and 212 to battery lead 112. The relay 210, upon energizing, opens the

connection between the calling and called lines at a point between springs 213 and 214, and bridges the ringer generator R^2 across the called line to ring the bells 215. When the button at substation A is released the relay 210 deënergizes. When the called subscriber removes his receiver in answer to the call the springs 22 and 23 are permitted to engage and the called substation is provided with talking battery current over a circuit extending from ground G^{10} at the connector I through side switch wiper 200, lower winding of relay 216, ringer relay springs 214 and 213, wipers 197 and 199, springs 217 and 218, line 203, primary of the induction coil and transmitter at substation A^2, springs 22 and 23, line 219, wipers 198 and 196, upper winding of relay 216 and springs 212 and 220 to battery lead 112. The complete talking circuits between the two lines is shown by heavy conductors.

After the conversation is completed the release of the central office apparatus is initiated by the hanging up of the receiver at the calling substation. The hanging up of the receiver at station A breaks the energizing circuit of the relays 88 and 89 of the repeater E. The relay 88, upon deënergizing, operates to close the circuits of relays 137 and 142 in the same manner as when the relay 88 deënergizes in response to operating impulses. The relay 142, upon energizing, closes the circuits of relays 146 and 147 as previously traced. The relay 88, upon deënergizing, also breaks the circuit of relay 123, which deënergizes after a short time. The relay 123, upon deënergizing, breaks the circuit of relays 142, 147, 137 and 146. The relay 146 is quick acting and falls back immediately, while the other relays are slow acting and remain energized for an instant. At the instant relay 146 deenergizes both trunk conductors 152 and 153 are grounded. The ground for the conductor 153 is supplied from ground G^{10} through springs 155, 156, 157 and 158. The ground for conductor 152 extends from ground G^3 at the relay 88 through springs 124 and 134, springs 221 and 205, springs 206 and 207 and springs 208 and 209 to conductor 152. The simultaneous grounding of the two sides of the trunk 152—153 causes relay 183 and both line relays 182 and 190 of the connector I to be energized.

The energization of relays 183, 182 and 190 completes a circuit from ground G^{17} at selector H through side switch wiper 222, relay 223, private wiper 224, conductor 181, springs 225 and 226, release magnet 227 and springs 211 and 212 to battery lead 112. Both the relay 223 and the magnet 227 are energized over this circuit. The magnet 227, upon energizing, immediately releases the connector. The relay 223, upon energizing, completes a circuit from ground G^{13} at selector F through side switch wiper 175, relay 174, private wiper 173, springs 229 and 230 and magnet 231 to battery lead 112. The relay 174 and magnet 231 are both energized. The relay 174, upon energizing, completes the circuit of the release magnet 232. The magnets 231 and 232 thus attract their armatures and hold them in readiness to release the selectors H and F when they deënergize. As soon as the slow acting relay 147 of the selector E deënergizes the line relays of the connector I deënergize, and all circuits which were closed as a consequence of their energization are broken. The release magnets of the selectors H and F thereupon deënergize and release their respective switches. When the relay 147 of the selector E deënergizes it also closes the circuit of the release magnet 90, said circuit extending from ground G^{10} through springs 155 and 233, springs 234 and 235, springs 94 and 95 and magnet 90 to battery. The magnet 90, upon energizing, allows the mechanism to return to normal position. When the shaft reaches normal position the circuit of the release magnet is broken by the separation of springs 94 and 95.

The line switch C is restored to normal position as soon as the relay 123 of selector E deënergizes and breaks the circuit of winding 44.

The foregoing is an explanation of how connection is completed with an idle line If the line #22220 had been busy when called from substation A the wiper 201 of the connector I would have found the contact 249 grounded. This being the case, when the rotary relay 190 was energized for the last time, instead of the side switch being tripped to third position, the connector would have released. The energizing circuit for the release magnet in this case would have been the grounded private bank contact 249 through wiper 201, side switch wiper 200 (the side switch being in second position), through springs 250 and 251 of the private magnet (which is energized by the energization of relay 190), release magnet 227 and springs 211 and 212 to battery. The magnet 227, upon energizing, would have caused the connector mechanism to be restored to normal position. Now, when the calling subscriber pressed the ringing bottom, the consequent energization of the vertical relay 182 of the connector would have energized the vertical magnet 189 in a manner already explained. As soon as the shaft was raised from its normal position the arm 252 would have permitted the springs 253 and 254 to engage, thereby completing a busy signaling circuit from battery lead 112 through the secondary winding of induction coil 101, springs 253 and 254, side switch wiper 197

(in first position), springs 213 and 214, and thence over the heavy conductors to and through the substation A, back over the other side of the line and through the relays 182 and 183 of the connector I to the starting point. Upon hearing the busy signal the calling subscriber hangs up his receiver, causing the switches to be released in practically the same manner as has been described.

The foregoing is an explanation of how a subscriber on one line may obtain connection with another. If one party-line subscriber desires to call the other subscriber on his own line, however, he does not have to operate his calling device for the digits, but simply removes his receiver and presses the button 14. When the receiver is removed the line switch C operates in the same manner as has been explained to extend connection to a selector-repeater E. Now, when the button 14 is pressed the relay 89 of the switch E falls back, while the relay 88 remains energized in the same manner as when the button was pressed to signal substation A^2. Since the shaft of the switch E has not been raised from its normal position to permit springs 92 and 93 to separate, the falling back of relay 89 completes a circuit from ground G^3 at relay 88 through springs 151 and 143, springs 204 and 205, springs 206 and 207, springs 208 and 209, springs 92 and 93, conductor 120, relay 67 and lower winding of relay 73 to battery lead 112. The lower winding of relay 73 is of comparatively high resistance and prevents the relay 67 from being operatively energized over this circuit. The relay 73, however, attracts its armature and closes a circuit from ground G^{18} through interrupter 236, springs 238 and 237 and motor magnet 68 to battery lead 112. The magnet 68 then begins to rotate the wheels 71 and 72. After the wheel 71 has moved a short distance the springs 74 engage, whereby a circuit is closed from ground G^{19} through relay 76. The closure of springs 258 and 239 of the relay 76 shunts the lower winding of relay 73 by its upper winding, thereby reducing the resistance in series with relay 67 sufficiently to allow it to energize. The relay 67, upon energizing, grounds the conductor 118 at ground G^{20} and disconnects the line 107 from the switch E by separating springs 240 and 241. The simultaneous energization of relays 67 and 76 completes a circuit extending from one terminal of generator R through springs 242 and 243, springs 244 and 240, thence over the heavy conductors through the resistance 15 and talking circuit at substation A in multiple with the ringer 78 at substation A′, then back over the other side of the line, through springs 245 and 246 of relay 67 and springs 247 and 248 of relay 76 to the other terminal of the generator R. As previously explained, the current furnished by generator R is not of the proper frequency to ring bells 78. However, as the calling subscriber continues to press the button 15 the magnet 68 continues to rotate the wheels 71 and 72. After a short time the springs 74 are forced out of engagement and the wheel 72 permits the springs 75 to come into engagement, whereby the circuit of the relay 77 is closed. The relay 77 operates in conjunction with the relay 67 to connect the generator R′ with the calling line. This generator supplies current of the proper frequency to ring the bells at substation A′. As long as the calling subscriber continues to press the button the calling line will continue to be supplied with ringing current from the generators R and R′ alternately. As previously explained, there is a short period of time after either pair of springs 74 or 75 is disengaged before the other pair comes into contact. During this period of time both of the relays 76 and 77 are deënergized and the circuit of the upper winding of the relay 73 is broken. The current through the relay 67 is reduced sufficiently to allow its armature to fall back. If the button at the calling substation is released at this time or if the called subscriber has removed his receiver, the relay 89 of the selector E energizes and breaks the circuit of the lower winding of the relay 73, which deënergizes and allows the ringing interrupter mechanism to stop. If the button at the calling substation is released while either of the pair of springs 74 or 75 is in contact, the relay 89 remains deënergized, because its circuit is open at the springs 240 and 241 of the relay 67, until both pairs of springs 74 and 75 are separated and the relays 76 and 77 are both deënergized, whereupon the relay 67 deënergizes and connects the line 107 with the trunk conductor 117, causing the relay 89 at the selector E to energize and cause the ringing apparatus to come to rest, as previously explained.

When both the subscribers replace their receivers the line relays at the selector E deenergize and allow the line switch C to be released in the manner already explained.

As described, the substations A and A′ may call each other by simply pressing a button. These substations, however, are called from other lines through selector and connector switches in the regular manner.

As before mentioned, the ringers at the substations A and A′ are adapted to current furnished by the generators R and R′, respectively.

It is to be understood that the connectors which are used in calling either of the substations A or A′ are supplied with the various frequencies of ringing current whereby only one of said substations on the party

line is signaled when a call is made to said line from any other line in the system.

It will be seen from the foregoing that I provide a three-wire automatic telephone exchange system in which the party-lines are operated on the two-wire principle, whereby interference between subscribers on the same line is more easily prevented or taken care of, and in which one subscriber calls another on the same line without the necessity of first operating the calling mechanism at the substation of the calling subscriber. The ring-back arrangement described and shown is responsive to the push button at the calling substation when one party-line subscriber calls another on the same line, and the successful operation of this push button is only dependent upon first shifting the telephone instrument at the calling substation—that is to say, upon first removing the receiver from its hook. Thus a calling suscriber on a party-line may cause ringing current to be projected back over the calling line for what is known as a reverting call by simply pressing a push button at the calling substation, and without operating the calling mechanism at said station.

What I claim as my invention is:—

1. In a telephone system, a party line, a push button for each substation on said line, a telephone instrument at each substation, means for extending connection to and from said line, means responsive to said push buttons for signaling the subscribers on said line, dependent only on a preliminary non-numerical switching operation for the line, and a progressively movable non-numerical switch for performing said operation.

2. In a telephone system, a party line, means for extending connection to and from said line, a calling mechanism at each substation, and means for projecting a plurality of ringing currents of different frequencies onto the line, one at a time, whenever one subscriber calls another on the same line, a push button at each substation, whereby the subscribers on said line may control said ringing means to call each other without operating said mechanism, said ringing means being common to all of the substations on said line.

3. In a telephone system, a party line, a calling mechanism at each substation, automatic switches responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which the one subscriber calls another on the same line without operating said mechanism.

4. In a telephone system, a party line, a calling mechanism at each substation on said line, means responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which any subscriber calls another on the same line without operating said mechanism.

5. In a telephone system, a party line, a calling mechanism at each station of the party line, automatic switches responsive to said mechanism to extend connection from said line, and means for enabling the party-line subscribers to call each other without using said mechanism, the means for extending connection from said line including a combined selector and repeater, as set forth.

6. In a telephone system, a party line, a push button for each substation on said line, a telephone instrument at each substation, means for extending connection to and from said line, means responsive to said push buttons for signaling the subscribers on said line, dependent only on a preliminary non-numerical switching operation for the line, and means for performing said operation, the means for extending connection from said line including a combined selector and repeater, as set forth.

7. In a telephone system, a party line, means for extending connection to and from said line, a calling mechanism at each substation, and means for projecting a plurality of ringing currents onto the line, one at a time, whenever one subscriber calls another on the same line, including a push button at each substation, whereby the subscribers on said line call each other without operating said mechanism, the means for extending connection from said line including a combined selector and repeater, as set forth.

8. In a telephone system, a party line, a calling mechanism at each substation, means responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which the one subscriber calls another on the same line without operating said mechanism, the means for extending connection from said line including a combined selector and repeater, as set forth.

9. In a telephone system, a party line, a calling mechanism at each substation on said line, means responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which any subscriber calls another on the same line without operating said mechanism, the means for extending connection from said line including a combined selector and repeater, as set forth.

10. In a telephone system, a party line, a calling mechanism at each station of the party line, automatic switches responsive to said mechanism to extend connection from said line, and means for enabling the

party-line subscribers to call each other without using said mechanism, the said means for extending connection from the line being controlled over the two sides of the line in series, and including means for repeating impulses from the two-wire line circuit to a three-wire trunk circuit, as set forth.

11. In a telephone system, a party line, a push button for each substation on said line, a telephone instrument at each substation, means for extending connection to and from said line, means responsive to said push buttons for signaling the subscribers on said line, dependent only on a preliminary non-numerical switching operation for the line, means for performing said operation, the said means for extending connection from the line being controlled over the two sides of the line in series, and including means for repeating impulses from the two-wire line circuit to a three-wire trunk circuit, as set forth.

12. In a telephone system, a party line, means for extending connection to and from said line, a calling mechanism at each substation, and means for projecting a plurality of ringing currents onto the line, one at a time, whenever one subscriber calls another on the same line, including a push button at each substation, whereby the subscribers on said line call each other without operating said mechanism, the said means for extending connection from the line being controlled over the two sides of the line in series, and including means for repeating impulses from the two-wire line circuit to a three-wire trunk circuit, as set forth.

13. In a telephone system, a party line, a calling mechanism at each substation, means responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which the one subscriber calls another on the same line without operating said mechanism, the said means for extending connection from the line being controlled over the two sides of the line in series, and including means for repeating impulses from the two-wire line circuit to a three-wire trunk circuit, as set forth.

14. In a telephone system, a party line, a calling mechanism at each substation on said line, means responsive to said mechanism to extend connection from said line, and means including a ringing arrangement at the central station by which any subscriber calls another on the same line without operating said mechanism, the said means for extending connection from the line being controlled over the two sides of the line in series, and including means for repeating impulses from the two-wire line circuit to a three-wire trunk circuit, as set forth.

15. In a telephone system, a party line, a calling mechanism at each station on said party line, a plurality of trunk lines, a switch individual to said line for selecting an idle trunk, mechanism in said trunk for projecting different kinds of ringing current onto said line, a push button at each subscriber's station for controlling said projecting mechanism over the two sides of the line in series, and a central battery for supplying the system with current for talking purposes.

16. In a telephone system, a party line, a plurality of stations on said line, a plurality of trunk lines, a switch individual to said line for selecting an idle trunk, a relay in said trunk, a push button at the subscriber's station for controlling said relay over the two sides of the line in series, means controlled by said relay for projecting different kinds of ringing current onto said line, and a central battery for supplying the system with current for talking purposes.

17. In a telephone system, a party line, a plurality of stations on said line, a plurality of trunk lines, a switch individual to said line for selecting an idle trunk, a relay in said trunk, a push button at the subscriber's station for controlling said relay over the two sides of the line in series, means controlled by said relay for alternately projecting a plurality of different kinds of ringing currents back onto said line, and a central battery for supplying the system with current for talking purposes.

18. In a telephone system, a party line, a plurality of stations on said line, a switch individual to said line and controlled over both sides of said line in series for selecting an idle trunk extending therefrom, a second automatic switch at the opposite end of said trunk, a relay in said trunk for controlling the application of different kinds of ringing current onto said subscriber's line, a second relay in said last-mentioned automatic switch for controlling said first-mentioned relay, means for controlling said second relay from the subscriber's station, and a central battery for supplying the system with current for talking purposes.

19. In a telephone system, a party-line, a push button for each substation on said line, a telephone instrument at each substation, means for extending connection to and from said line, a source of ringing current at the central office responsive to said push buttons for signaling the subscribers on said line, dependent only on a preliminary non-numerical switching operation for the line, and a progressively movable non-numerical switch for performing said operation.

20. In a telephone system, a party-line, means for extending connection to and from said line, a calling mechanism at each substation, a plurality of ringing generators

at the central station for producing ringing current of different frequencies, and means for projecting different frequencies of ringing current from said generators onto the line, one at a time, whenever one subscriber calls another on the same line, said means including a push button at each substation, whereby the subscribers on said line call each other without operating said mechanism.

21. In a telephone system, a subscriber's station, a line terminating at a central office, a signal for said line at said station, means for controlling said signal by current from a source at the central office by closing the line and by then varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, the means for varying the resistance being manually operated and individual to the line, and a switch operated upon the closure of the line to extend the line into association with the source of signaling current.

22. In a telephone system, a subscriber's station, a line terminating at a central office, a signal for said line at said station, a trunk, means for connecting said line and trunk, means for controlling said signal by current from a source at the central office over said trunk by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, said means for varying the line resistance comprising manually operated means individual to said line.

23. In a telephone system, subscribers' stations, a line terminating at a central office, a pair of signals for said line at said stations, means having one kind of current for controlling one of said signals and another kind of current for controlling the other, equipment for controlling said means to bring said signals into action by closing the line and then varying the line resistance.

24. In a telephone system, subscriber's stations, a line terminating in a central office, a pair of signals at said stations, means at the central office having one kind of current for controlling one of said signals and another kind of current for controlling the other, the equipment for closing the line and for then controlling said means to bring said signals into action upon the first variation of the line resistance after the line closure, and for rendering the means ineffective for such purpose after said first variation.

25. In a telephone system, a subscriber's station, a line terminating in a central office, a signal for said line at said station, automatic means for controlling said signal by current from a source at the central office by closing the line and by then varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, a switch operated upon the first closure of the line to extend said line into connection with said source, said means for varying the line resistance being manually operated means individual to said line.

26. In a telephone system, a subscriber's station, a line terminating in the central office, a signal for said line at said station, means comprising a non-numerical progressively movable switch for controlling said signal by closing the line and manually operated means individual to said line for then varying the line resistance only once, whereby the signal is operated by current from the central office upon the first variation of the line resistance after the closure of the line.

27. In a telephone system, a subscriber's station, a line terminating in a central office, a signal for said line at said station, a trunk, automatic means for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated from a source of current at the central office upon the first variation of the line resistance after the closure of the line, and means for varying the line resistance comprising manually operated means individual to said line.

28. In a telephone system, a subscriber's station, a line terminating in a central office, a signal for said line at said station, a trunk, means comprising a non-numerical progressively movable switch for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated from a source of current at the central office upon the first variation of the line resistance after the closure of the line.

29. In a telephone system, a line, a plurality of signals on said line, a switch for said line, a trunk associated with said switch, means associated with said trunk for controlling said signals, means for operating said switch in response to a non-numerical impulse from the line for connecting said line and said trunk, said first means operable upon the first variation of the line resistance after the closure of the line, said trunk terminating in a trunk-selecting switch, means for controlling said switch for extending connection from the trunk and for rendering said first means inoperative.

30. In a telephone system, a subscriber's station, a line, a signal for said line at said station, a trunk, automatic means for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, means operable for extending connection from said trunk and for rendering said automatic means inoperative when

said means for extending connection is operated.

31. In a telephone system, a subscriber's station, a line, a signal for said line at said station, a trunk, automatic means for controlling said signal over said trunk, manually operated means for controlling said automatic means, by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, means operable for extending connection from said trunk and for controlling said automatic means.

32. In a telephone system, a line, a signal, a trunk, means for connecting the line and the trunk, automatic means for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, an automatic trunking switch operable for extending connection from said trunk and for rendering said automatic means inoperative when said trunking switch is operated.

33. In a telephone system, a line, a signal, a trunk, means for connecting the line and the trunk, automatic means for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, an automatic progressively movable trunking switch operable for extending connection from said trunk and for rendering said automatic means inoperative when said trunking switch is operated.

34. In a telephone system, a line, a signal, a trunk, means comprising a non-numerical progressively movable switch for controlling said signal over said trunk by varying the line resistance only once, whereby the signal is operated upon the first variation of the line resistance after the closure of the line, means operable for extending connection from said trunk and for rendering said automatic means inoperative when said means for extending connection is operated.

35. In a telephone system, a line circuit, a switch for said line, a magnet for said switch connected with said line, a second line circuit, means comprising said magnet for operating said switch to connect said first and second line circuits, automatic means for disconnecting said magnet from said first line when the switch is operated, automatic means for releasing said switch to restore said magnet to the said first line, a third circuit auxiliary to said switch for controlling said release means, a relay in said connected line circuits for controlling said release circuit, an energizing circuit for said relay extending via said connected circuits, means for opening said connected circuits and for substituting a new energizing circuit for said relay excluding said first line circuit.

36. In a telephone system, a calling line, another line, automatic switches at the exchange for connecting the two, a calling device at the calling substation for controlling said switches, a ringing switch at the calling substation, a source of ringing current at the exchange, means responsive to the operation of said ringing switch before said calling device is operated for connecting said source with the calling line, and means responsive to the operation of said ringing switch after said calling device is operated for connecting said source with the said other line.

37. In a telephone system, a substation and a line therefor, a trunk line terminating in an automatic switch, said switch provided with movable terminals for extending connection to other lines, means for moving said terminal, means for connecting said first line and said trunk line, ringing apparatus and a source of ringing current associated with said trunk line, and means at the said substation for operating said ringing apparatus to project current from said source over the said first line before said movable terminals are moved.

38. In a telephone system, a substation and a line therefor, a trunk line terminating in an automatic switch, said switch provided with movable terminals for extending connection to other lines, means for moving said terminals, means for connecting said first line and said trunk line, a ringing generator and a source of ringing current associated with said trunk line, means at the substation for operating said switch before operating said ringing apparatus, and means controlled by the initial operation of said switch for rendering said ringing apparatus inoperative.

39. In a telephone system, a calling and a called substation on the same line, a trunk line terminating in an automatic switch provided with movable terminals for connecting with other lines, means for moving said terminals, means responsive to the removal of the receiver at the calling substation for connecting said first line and said trunk line, ringing equipment and a source of ringing current associated with said trunk line, and means for controlling said ringing equipment from the calling substation to signal the called substation before operating the movable terminals of said switch.

40. In a telephone system, a substation and a line therefor, a trunk line at the exchange and means for connecting the said first line thereto, an automatic switch and a ringing equipment associated with said trunk line, the former for extending connection to other lines and the latter for projecting ringing current over said first

line, and means at the substation for operating either the switch or the ringing equipment independently at the option of the calling subscriber.

41. In a telephone system, a substation and a line therefor, a trunk line accessible to said line and terminating in an automatic switch, ringing equipment associated with said trunk line adapted to connect a source of ringing current with said line, means at said substation for producing changes in the line circuit of a particular character for operating said switch, and means at the substation for producing changes in the line circuit of a different character for operating said ringing equipment.

42. In a telephone system a trunk line at the exchange provided with an automatic switch and a ringing relay, a substation and a circuit therethrough including a line extending to the exchange, means responsive to a preliminary non-numerical operation at said substation for connecting said line and trunk line, means at the said substation for producing different changes in the said substation line circuit, means responsive to one kind of change for operating said switch to extend the line to another line, and means responsive to another kind of change for operating said ringing relay before said switch is operated.

43. In a telephone system, a trunk line terminating in an automatic switch for connecting with other lines, a ringing relay associated with said trunk line and adapted to connect the same with a source of ringing current, a calling substation and a line therefor with means for connecting said line with said trunk line, a second substation on said line with the calling substation, and means including separate devices at the calling substation whereby the calling subscriber thereat is given the option of either operating the said switch to connect with another line or operating said ringing relay to signal the said second substation.

44. In a telephone system, a substation and a line therefor, a trunk provided with an individual automatic switch and an individual ringing relay, means for connecting said line and trunk line, an operating magnet for said switch, separate circuits for said operating magnet and for said ringing relay, and means controlled by the subscriber at said substation over the said line and trunk line when connected for closing either of said circuits before closing the other.

45. In a telephone system, a line, a trunk, means for connecting said line and trunk, a ringing relay and a progressively movable switch for said trunk, means for operating said switch, means for operating said ringing relay before said switch is operated and means whereby said ringing relay is rendered inoperative after said switch has operated.

46. In a telephone system, a party line, a trunk line, means for extending connection from said party line to said trunk line, a progressively movable switch for extending connection from the trunk, means comprising a ringing relay for ringing a subscriber on said party line back over said trunk line, and means controlled by said switch for rendering said second means inoperative.

47. In a telephone system, a line, a signal on said line, a trunk line, another line, an automatic progressively movable switch for connecting said line and trunk line, an automatic progressively movable switch for connecting said trunk with said other line, a source of current associated with said trunk, means controlled over said trunk for causing said signal to be operated from said source over said line before said second switch is operated, means for operating said second switch, and means controlled by such operation for preventing said means from so controlling said signal.

48. In a telephone system, substations, a line terminating in a central office, a pair of signals at said stations, means at the central office having one kind of current for controlling one of said signals and another kind of current for controlling the other, equipment for closing the line and for then controlling said means to bring said signals into action each time the resistance of the line is varied after the line is closed.

Signed by me at Chicago, Cook county, Illinois, this 18th day of June, 1910.

FRITZ LUBBERGER.

Witnesses:
EDWARD D. FALES,
ARTHUR J. RAY.