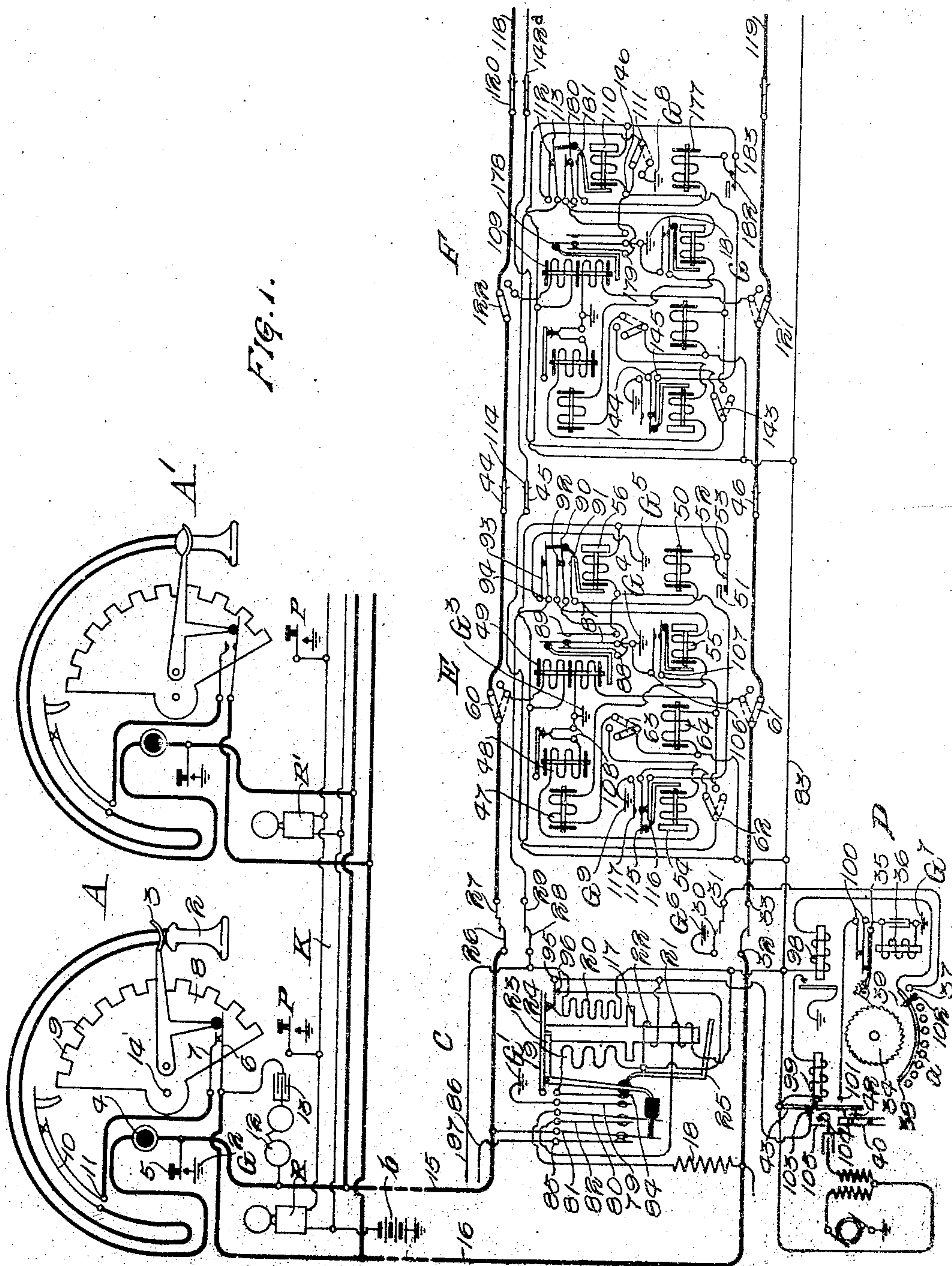


T. G. MARTIN.
TELEPHONE EXCHANGE SYSTEM.
APPLICATION FILED MAY 6, 1910.

1,155,672.

Patented Oct. 5, 1915.

2 SHEETS—SHEET 1.



WITNESSES

A. J. Ray
A. Anderson

INVENTOR:

Talbot G. Martin
By Bulfinch, Perdue & Dwyer
ATTORNEYS.

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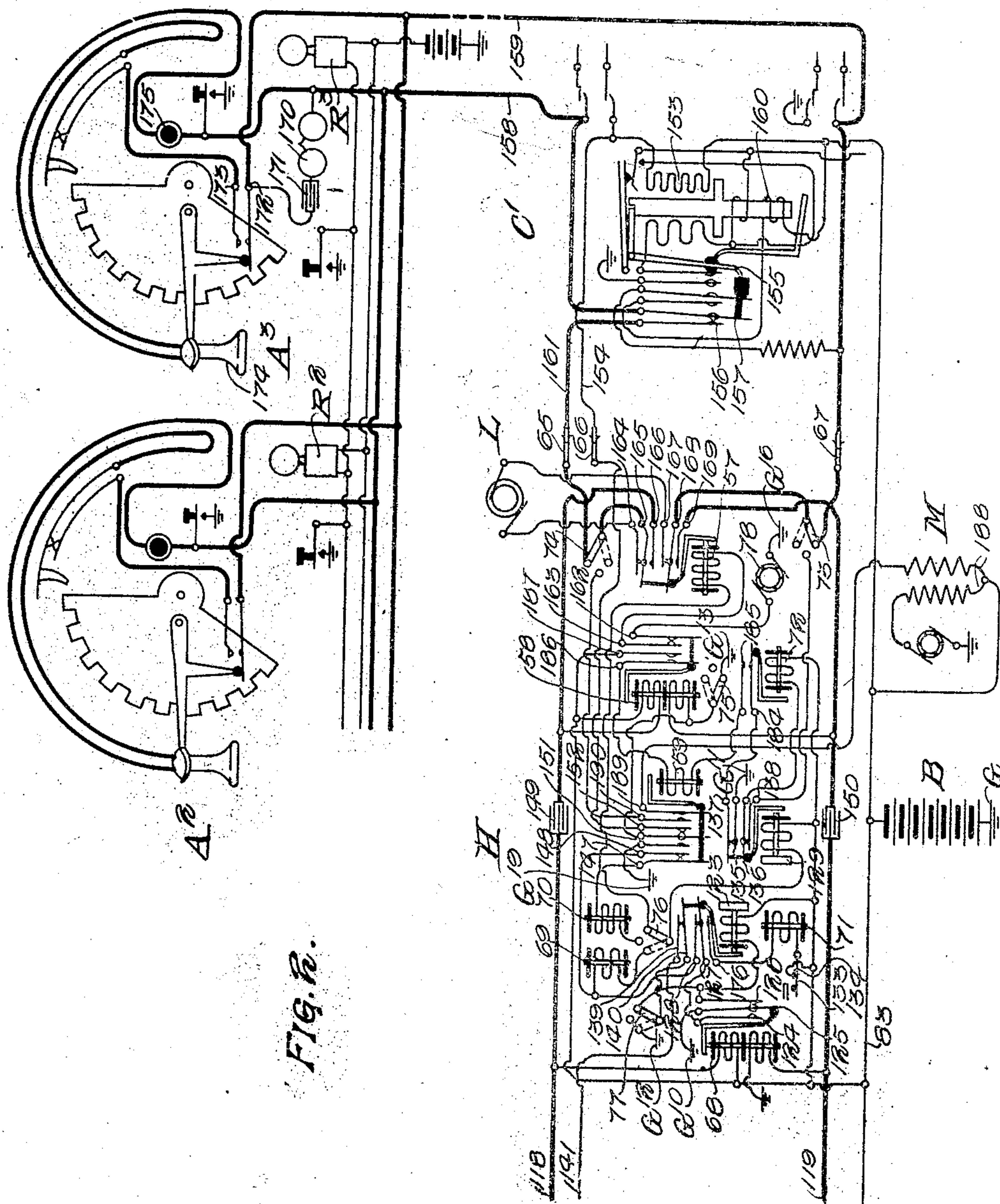


FIG. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

TALBOT G. MARTIN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE-EXCHANGE SYSTEM.

1,155,672.

Specification of Letters Patent.

Patented Oct. 5, 1915.

Application filed May 6, 1910. Serial No. 559,815.

To all whom it may concern:

Be it known that I, TALBOT G. MARTIN, a citizen of the United States of America, and resident of Chicago, Cook county, Illinois, have invented a certain new and useful Improvement in Telephone-Exchange Systems, of which the following is a specification.

My invention relates to telephone exchange systems of that kind in which automatic switches are employed at the exchange or central station for establishing connection between calling lines and called lines. A system of this kind may be either entirely automatic or it may be semi-automatic, depending upon circumstances, but in each case there are a suitable number of automatic switches for selecting trunks, or completing connections, or doing other parts of the work necessary to the establishment of a connection between calling and called lines.

My invention relates more particularly to a system of this kind in which the subscribers' lines are provided with automatic switches, and in which one or more of said lines are provided with extensions, or with a plurality of substations, whereby several telephones are allotted to and common to one and the same line.

My invention contemplates an extension or party-line system of this general character in which the said extensions or party-lines are provided with automatic trunking switches, ordinarily known as line switches, and in which two persons or subscribers on the same line may converse with each other without disturbing the normal condition of the automatic switch for such line, notwithstanding that the current for talking purposes is derived from a common battery or other source at the exchange or central station, and regardless of the fact that talking current flows in the line immediately upon the taking down of any receiver thereon, no operating grounds being necessary at the substations, in so far as the calling of a subscriber's number is concerned, the system being of the two-wire type for that purpose at least.

This invention is in the nature of an improvement on the following copending applications: Serial #522,065, filed October 11, 1909; Serial #422,462, filed March 21, 1908; Serial #507,210, filed July 12, 1909; Serial

#546,581, filed March 1, 1910; Serial #536,131, filed January 3, 1910; Serial #530,401, filed November 29, 1909; Serial #596,710, filed December 10, 1910; and Serial #546,582, filed March 1, 1910.

As will hereinafter more fully appear, it will be seen, however, that my invention further contemplates a system of this kind in which a special ground is provided at each telephone on the extension or party-line, which ground is used merely for operating the non-numerical trunking switch of the said line, all other switches then being controlled, while the call is progressing, by using the two sides of the line in series.

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

In the accompanying drawings Figures 1 and 2 taken together represent diagrammatically a call from one party-line to another in a telephone exchange system embodying the principles of my invention.

In Fig. 1 there is shown at A and A' two automatic substations allotted to the same line, which line terminates in the line switch C. At D there is shown a master switch which is used to keep the plungers of the line switches C opposite an idle trunk line. At E and F selector switches are shown.

At H (Fig. 2) there is shown a connector switch. At L a ringing current generator is shown and at M a busy signaling machine is represented. At C' there is shown a line switch similar to the line switch C. The substations shown at A² and A³ are similar to those shown at A and A'. These substations, like the substations A and A', are allotted to the same line which terminates in the line switch C'. At B is represented a battery with its positive terminal preferably grounded at G. Of course, there may or may not be more than one battery B used with this system, depending upon the conditions to be met. Also, as herein shown, only one set of ringers is shown bridged across each line. There may, however, be one or more sets used. In order to prevent tinkling of the ringer 12 by the impulses which operate the central office switches, ordinary biased ringers may be used, biased in such direction as not to be affected by these operating impulses.

To provide means whereby the different substations on the same line may call each other an independent buzzer circuit is employed, as represented at K (Fig. 1). This circuit consists essentially of the ringers or buzzers R and R', one for each substation. Current is supplied to these buzzers by the battery 7. As herein shown, the substation A consists of the receiver 2, switch hook 3, transmitter 4, push button 5, hook springs 6 and 7, impulse wheel 8 on which are the impulse teeth 9, impulse springs 10 and 11, ringer 12 and condenser 13. The impulse wheel 8 is secured to the shaft 14, to which there is also secured a dial (not shown) containing finger holes.

The removal of the receiver 2 from its hook allows the hook to rise, which permits the engagement of the springs 6 and 7. The engagement of these springs closes a bridge across the conductors 15 and 16 through the transmitter 4, receiver 2 and impulse springs 10 and 11. The conductors 15 and 16 terminate in the line switch C at the central office or exchange. The line switch C is of the general type disclosed in British Patent No. 26,301 of 1906, and in the *American Telephone Journal* of New York, N. Y., of June 6, 1908. This switch is provided with the usual plunger arm 24 which is adapted to be attracted by the magnet 17. This magnet comprises four windings, namely, the pull-in winding 19, cut-off winding 20, line winding 21 and auxiliary winding 22. The magnetic circuit of the windings 21 and 22 is separate from that of the windings 19 and 20, so that the armature 23 and plunger arm 24 are affected only by the windings 19 and 20, and the windings 21 and 22 affect only the armature 25. The winding 19, when energized, operatively attracts both the plunger arm 24 and armature 23, while the winding 20, when energized, will only pull up the armature 23, but will hold the plunger arm 24 in an operated position after it has been pulled up by the winding 19. The attraction of the plunger arm thrusts a plunger (not shown) into a group of springs to force the springs 26, 28, 30 and 32 into engagement with the springs 27, 29, 31 and 33, respectively, whereby the line conductors are extended to a first selector, such as the first selector E. Although only one group of springs (26-33) is shown, there may be, however, a plurality of such groups to which the plunger of the line switch C has access, each of which groups is the terminal of a trunk line leading to a first selector similar to the selector E. The line conductor 16 is normally connected to ground at the switch C through the resistance 18.

The plungers of the group of line switches of which the switch C is a member are controlled by a common mechanism D usually

called a master switch. This master switch controls the plungers in such a manner that they are normally held in a position opposite an idle trunk. The master switch D comprises the ratchet wheel 34 which is actuated by the armature 35 of the motor magnet 36 and a bank of contacts *a* which consists of a number of individual segments 37 and a common segment 38. The master switch also has the circuit-controlling relays 98 and 99. The bank *a* is provided with a wiper 39 for keeping one of the individual segments 37 in electrical connection with the common segment 38. By means of a suitable mechanical connection the rotary motion of the ratchet wheel 34 is transmitted to the plunger shaft to give said shaft an oscillatory motion to move the plungers which are normally in register therewith back and forth in front of the terminals of the trunks leading to the first selectors. To the plunger shaft there is also secured a locking plate 40 having in its surface a number of openings, one of which is normally engaged by the pin 42 on the armature 43. The openings in the locking plate 40 are so positioned that the pin 42 can only engage an opening when the plungers that are in engagement with the plunger shaft are directly opposite the terminals of a trunk leading to a first selector.

The selector switch shown at E is of the general type disclosed in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson & Erickson, but, as here shown, is modified to operate in conjunction with a two-wire system—that is, a system in which the central office mechanism is controlled over the two sides of the telephone line in series. Among other details, the selector E comprises the wipers 44, 45 and 46 mounted upon a shaft (not shown) which has a vertical motion controlled by the vertical magnet 47 and a rotary motion controlled by the rotary magnet 48. The calling subscriber controls the operation of the switch through the medium of the double-wound line relay 49. The release of the selector is brought about by means of the release magnet 50. Battery current is supplied to the release magnet as soon as the shaft is raised one or more steps, thus lifting the arm 51 and permitting the springs 52 and 53 to engage. The selector is released upon the energization of the release magnet, rather than upon its deenergization, as shown in said selector patent. The relays 54, 55 and 56 are slow-acting relays—that is, their armatures are slow to fall back after having once been attracted. This slow action is usually accomplished by means of a copper ring placed around the end of the core. The selector also has a private magnet 64 which controls the side switch comprising the wipers 60, 61, 62 and 63.

The selector F is similar to the selector E.

The connector H is of the type disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson & Erickson, and, like the selector, is modified to operate with a two-wire system. Like the selector, the connector comprises a shaft upon which are the wipers 65, 66 and 67, double-wound relay 68, vertical magnet 69, rotary magnet 70, release magnet 71, and private magnet 72 which controls the side switch with its wipers 73, 74, 75, 76 and 77. The connector also has, in addition, the back-bridge relay 58 through which talking current is supplied to the called subscriber, and ringer relay 57 which serves to disconnect the calling line from and connect the ringing current generator L to the called line. Ground is only supplied intermittently to the ringer relay through the interrupter 78. The connector is also supplied with a busy locking relay 59, the function of which will be explained later.

As before stated, the line switch C¹ and substations A² and A³ are similar to line switch C and substation A, respectively, of Fig. 1.

Having thus described the general character of the apparatus which is used in the system embodying the principles of my invention, I will now describe the process by which a calling subscriber A, whose number we will assume to be 2221, establishes connection with the subscriber A³, whose number we will assume to be 2220. I will also describe how subscriber A may converse with any other station on his own line, substation A', for instance.

When the subscriber A removes his receiver preparatory to making the call, a circuit is closed through line winding 21 of the line switch C. This circuit extends from ground G' through springs 79 and 80, resistance 18, line conductor 16, springs 6 and 7, which engage as soon as the switch hook rises, impulse springs 11 and 10, receiver 2, transmitter 4, line conductor 15, springs 81 and 82 and line winding 21 to battery lead 83, thence through battery B to ground G. Since this circuit includes resistance 18, sufficient current does not flow to cause winding 21 to attract the armature 25. Therefore, in order for subscriber A to operate the line switch C, it is necessary for him to press the button 5, which action completes a new circuit through the line winding 21. This circuit extends from ground G² through conductor 15, springs 81 and 82, line winding 21 to battery lead 83. Sufficient current now flows through the winding 21 to attract the armature 25, which causes the engagement of springs 79 and 84. A circuit is now completed through the pull-in winding 19 in series with winding 22. This circuit extends from ground G' through

springs 79 and 84, winding 19, winding 22, contact 103 and armature 43 to battery lead 83, thence through battery B to ground G. The armature 23 and plunger arm 24 are attracted upon the closure of this circuit. The attracting of the armature 23 breaks the circuit of the winding 21 and also connects the line 15 to the normal conductor 86 by the engagement of springs 81 and 85. Before the armature 25 falls back upon the breaking of the circuit of the line winding 21, a circuit is closed through the cut-off winding 20 in the following manner: The plunger arm 24, upon being attracted, closes a circuit extending from ground G³ through the lower winding of the double-wound line relay 49 of the selector E, side switch wiper 61, springs 33 and 32, line 16, substation circuit, as before described, line 15, springs 26 and 27, side switch wiper 60 and upper winding of the relay 49 to battery, thence through battery B to ground G. The relay 49 energizes over this circuit to shift the spring 87 out of engagement with the spring 88 and into engagement with the spring 89, which closes a circuit extending from ground G⁴ through the springs 87 and 89 and relay 56 to battery lead 83, thence through battery B to ground G. The relay 56 upon energizing, shifts the spring 90 out of engagement with the spring 91 and into engagement with the spring 92 and closes contact between springs 93 and 94. The shifting of the spring 90, as described, prepares the circuit of the vertical magnet to receive impulses. The engagement of springs 93 and 94 closes a circuit extending from ground G⁵ through the springs 93 and 94, springs 29 and 28 and winding 20 to battery B, thence through battery to ground. The plunger being thus in an operated position is held by the winding 20. In its operated position the plunger short-circuits the auxiliary winding 22 by closing the springs 95 and 96. This short-circuiting of the winding 22 helps to retain the armature 25 in an operated position for a moment, thus causing the relay to deenergize slowly. A circuit is closed to the connector private bank contact of the calling line. This is to prevent another party from calling the substation A while it is calling. This guarding circuit extends from ground G⁵ through springs 93 and 94, springs 29 and 28 to the private normal conductor 97, thence to the banks of all of the connectors that have access to the line of substation A. When the springs 30 and 31 are closed by the plunger, a circuit is completed through the relay 98 of the master switch D. This circuit extends from ground G⁶ through springs 30 and 31, contact 37, wiper 39, common segment 38 and relay 98, to battery lead 83, thence through battery B to ground G. The relay 98, upon energizing, closes a circuit through the relay 99, which in turn

energizes to attract its armature 43. The pulling up of this armature closes a circuit through the motor magnet 36, and also lifts the pin 42 on the armature 43 from the opening in the locking plate 40. The circuit through the motor magnet extends from ground G⁷ through magnet 36, interrupter springs 100, contact 101 and armature 43 to battery, thence through battery B to ground G. The motor magnet energizes to break its own circuit and also to rotate the ratchet wheel 34 one step. As soon as the ratchet wheel is rotated one step, the pin 42 no longer registers with the opening in the locking plate, but is resting on top of the plate, thus holding the spring 101 in engagement with the armature 43 to maintain the circuit of the motor magnet 36. Thus it will be seen that the magnet operates with a buzzer-like action, rotating the plunger shaft until the pin 42 again engages an opening in the locking plate, during which time the wiper 39 has moved to the next contact and the plungers are opposite the next trunk. Had the next adjacent trunk been busy, the wiper 39 would have found the contact 102 grounded and the circuit of the motor magnet would have been maintained to cause the plungers to pass to the next idle trunk. It will also be seen that as long as the master switch is operating, battery is disconnected from all of the line switches of the group of which the switch C is a member, thereby preventing any party in the group from calling as long as the master switch is operating. This battery is disconnected at the contact point 103. The contact point 104 engages the spring 105 when the armature 43 is pulled up, thereby giving the busy signal to any party who attempts to call while the master switch is operating.

The foregoing operations occur upon the depression of the button 5 at the substation A, and before the impulses are sent in for the first digit of the desired number. When the dial is operated in the usual manner for the first digit 2, the teeth 9 cause the springs 10 and 11 to twice momentarily break contact during the backward rotation of the wheel 8. The opening of the springs 10 and 11 breaks the energizing circuit of the line relay 49 of the selector E twice. The relay 56, being slow-acting, does not deenergize, as its circuit is momentarily broken by the deenergization of relay 49; therefore the engagement of springs 87 and 88 completes a circuit through the vertical magnet extending from ground G⁴ through springs 87 and 88, springs 90 and 92, slow relay 55, vertical magnet 47 and side switch wiper 63 to battery lead 83, thence through battery B to ground G. The vertical magnet 47 energizes twice over this circuit to lift the shaft and shaft wipers two steps opposite

the second level of bank contacts. The relay 55 energizes on the first impulse, but, being slow-acting, does not deenergize until the last impulse is sent in. In its energized position the relay 55 completes a circuit through the private magnet 64 over a circuit extending from ground G⁴ through springs 106 and 107 and private magnet 64 to battery, thence through battery B to ground G. As soon as the slow relay 55 deenergizes, the circuit of the private magnet is broken, which in turn deenergizes and permits the side switch to pass to the second position. The passing of side switch wiper 63 to second position shifts the battery connection from the vertical to the rotary magnet. The wiper 62 in second position, connects the private wiper 45 with the private magnet. As soon as the battery is shifted to the rotary magnet 48 a circuit is closed extending from ground G² through interrupter springs 108, magnet 48, relay 54 and side switch wiper 63 to battery lead 83, thence through battery B to ground G. The rotary magnet energizes over this circuit to rotate the shaft and shaft wipers one step, to break its own circuit at the interrupter springs, and presses down the private magnet armature. The breaking of its own circuit at the springs 108 causes it to deenergize. If the first contact is idle, the private magnet armature will return to normal position, thereby permitting the side switch to pass to third position. If, however, the first contact is busy, the first private bank contact will have a guarding ground upon it, as will be explained later. The private wiper, 45, upon engaging the grounded contact, completes a circuit extending from the said bank contact through the private wiper 45, side switch wiper 62 (in second position) and private magnet 64 to the battery lead 83, thence through battery B to ground G. Thus it is evident that the side switch remains in second position, and, consequently, the rotary magnet continues to energize to rotate the shaft and shaft wipers to an idle contact.

The passing of the wipers 60 and 61 to third position extends the calling line to the second selector F. The extending of the lines to the second selector closes the circuit of the relay 109 in the same manner as it did the relay 49 of the first selector. The energizing of the relay 109 closes a circuit through the slow relay 110, which energizes to provide a holding ground for the relay 56 over a circuit extending from ground G³ through the side switch wiper 111, springs 112 and 113, private bank contact 114, and the corresponding bank contacts of all the selectors that have access to the selector F, private wiper 45, side switch wiper 62, springs 115 and 116, through the relay 56 to battery, thence to ground G. A

short period of time elapses between the time that the side switch wiper 62 leaves the second position and the time that the guarding ground is supplied to the private bank contact by the second selector. The relay 54 is put in for the purpose of supplying a guarding ground to the private bank contact during this time. It will be remembered that the relay 54 was energized in series with the rotary magnet and, being a slow relay, it remains held up a short time after the side switch has passed to third position, thereby putting a ground on the private wiper from ground G^9 through the springs 117 and 115 and wiper 62 to the private wiper 45. It is evident that the relay 56 must be slower than the relay 54 in order to prevent the switch from releasing. The second selector operates for the second digit 2 in the same manner as described for the first selector to extend the lines to the connector H over the conductors 118 and 119. The relay 68 of the connector H energizes upon the passing of the wipers 121 and 122 of the selector F to third position, and closes the circuit of the relay 123, as in the selectors. The apparatus is now in readiness for the third digit 2. The subscriber operates the dial for the third digit 2 as for the two previous digits. The relay 68 deenergizes twice to close a circuit through the vertical magnet 69 extending from ground G^{10} through springs 125 and 124, springs 127 and 128, magnet 69, side switch wiper 76 and relay 129 to battery lead 83, thence through battery B to ground G. The vertical magnet energizes over this circuit to raise the shaft and shaft wipers 65, 66 and 67 two steps and opposite the second level of bank contacts. As soon as the shaft is lifted the springs 133 and 134 engage, putting battery on the release magnet 71. The relay 129 also energizes in the circuit with the vertical magnet to cause springs 135 and 136 to engage and to cause springs 136 and 137 to break contact with springs 138 and 135, respectively. The engagement of springs 135 and 136 closes a circuit through the private magnet 72. This circuit extends from ground G^{11} through springs 135 and 136 and private magnet 72 to battery lead 83, thence through battery B to ground G. The relay 129 energizes upon the first impulse and, being slow-acting, does not deenergize during the momentary interruption of the circuit, but remains held up until the last impulse has been delivered. As soon as it does deenergize, however, it breaks the circuit of the private magnet, which in turn deenergizes to allow the side switch to pass to the second position. It should be stated that as soon as the relay 123 energizes, the engagement of springs 139 and 140 puts a guarding ground on the private banks of all the second se-

lectors that have access to the connector H. This circuit extends from ground G^{12} through the side switch wiper 77 (in first position), springs 140 and 139 and conductor 141 to the private bank contact 142 of the second selector. A circuit continues from this grounded contact 142 through the private wiper 142^a, wiper 143, springs 144 and 145 to the point 146, and from the point 146 one branch goes through the relay 110 to battery, and another branch goes through the side switch wiper 111 over a circuit that has once been traced through the relay 56 of the first selector. These relays 56 and 110 are thus held in an energized position.

Returning again to that point where the side switch of the connector is allowed to pass to the second position, the passing of the side switch wiper 76 to the second position disconnects the vertical magnet from and places the rotary magnet in the circuit with the slow relay 129. The apparatus is now in position to receive the impulses for the fourth or last digit O. As the dial is operated for this digit the circuit of the relay 68 is broken ten times, as before. The relay 68 deenergizes ten times, each time closing a circuit extending from ground G^{10} through the springs 125 and 124, springs 127 and 128, springs 148 and 147, rotary magnet 70, side switch wiper 76 and relay 129 to the battery lead 83, thence through battery B to ground G. The rotary magnet 70 energizes ten times to rotate the shaft and shaft wipers onto the bank contacts of the called line #2220. The relay 129 energizes on the first impulse, as before, and deenergizes a moment after the last impulse has been sent in, thereby permitting the side switch to pass to the third position. The passing of the wipers 73 and 74 to the third position connects the calling line to the called substation through the condensers 149 and 150. The passing of the wiper 77 to the third position shifts the holding ground for the release relays 110 and 56 of the selectors from ground G^{12} to ground G^{10} through the springs 125 and 126. In its third position the wiper 75 serves to place ground on the relay 58, and also completes the circuit of the winding 153 of the line switch C'. This last circuit extends from ground G^{13} through the side switch wiper 75, springs 151 and 152 to the private wiper 66, conductor 154 and winding 153 of the line switch to the battery lead 83, thence through battery B to ground G. The armature 155 is attracted, thereby disconnecting the line winding 160 from the called line, and also extends the conductor 161 to the line 158 by closing the springs 156 and 157. The side switch wiper 76 of the connector, in the third position, serves to close the circuit of the ringer relay 57. This circuit extends from ground G^{16} through the interrupter 78,

springs 162 and 163, ringer relay 57, side switch wiper 76 and relay 129 to the battery lead 83, thence through battery to ground. The ringer relay is energized intermittently to disconnect the calling line and connect the called line with the ringing current generator L. A ringing current then extends from generator L through springs 164 and 165, side switch wiper 74, shaft wiper 65, springs 156 and 157, line conductor 158, bell 170, condenser 171 (assuming that there is but one set of bells on the line), line 159, wiper 67, side switch wiper 73 and springs 168 and 167 to the other side of the generator L. The subscriber at substation A³ removes the receiver in response to the signal, and thereby closes an energizing circuit as soon as relay 57 again deenergizes, should it be pulled up at the time, through the back-bridge relay 58 of the connector. This circuit extends from ground G¹³ through side switch wiper 75, lower winding of relay 58, springs 169 and 168, side switch wiper 73, shaft wiper 67, line 159, springs 172 and 173, impulse springs, receiver 174, transmitter 175, line 158, springs 157 and 156, wipers 65 and 74, springs 165 and 166, and upper winding of relay 58, to battery lead 83, thence through battery B to ground. Thus the called subscriber is supplied with talking battery current. The relay 58 energizes over the circuit just traced to break the circuit of the ringer relay 57 at springs 162 and 163.

After the conversation is completed, the release of the central office apparatus used in the foregoing call is initiated by the calling subscriber hanging up his receiver. The release is as follows: The breaking of the engagement of springs 6 and 7 at the calling substation breaks the circuit through the relay 68 of the connector, which in turn deenergizes, thereby breaking the holding ground for release relays 123, 110 and 56 of the connector H and selectors F and E, respectively. These relays each deenergize and close the circuits of the release magnets of their respective switches. The circuit of the connector release magnet 71 extends from ground G¹⁰ through springs 125 and 124, springs 127 and 176, magnet 71 and springs 133 and 134 to battery.

The energization of the release magnet permits the switch to return to normal position, thereby separating the springs 133 and 134. The circuit of magnet 177 of selector F extends from ground G¹⁸, through springs 178 and 179, springs 180 and 181, magnet 177, springs 182 and 183 to battery lead 83, thence through battery B to ground G. The selector E releases over a circuit similar to that of selector F. The contact between springs 52 and 53, 182 and 183 of the selectors E and F, respectively, is broken as the shafts return to their normal positions. The

deenergizing of relay 56 also breaks the holding circuit of the winding 20 of the line switch C. Thus all of the switches are restored to normal position and are in readiness for another call.

Returning now to that point in the operation of the connector while the side switch is yet in the second position, had the called line been busy, the side switch would not have passed to the third position, but would have been locked in the second position by the private magnet remaining energized. The circuit through the private magnet would have been from the bank contact upon which the wiper 66 is resting, which contact would have been grounded, through the wiper 66, springs 152 and 151, lower winding of the relay 58, ringer springs 169 and 168, wiper 73 (in second position), springs 138 and 136 and private magnet 72 to battery B, thence to ground. The simultaneous energizing of the relay 58 and the private magnet 72 closes a circuit through the busy relay 59. This circuit extends from ground G¹¹, springs 135 and 137, 184 and 185, relay 59, springs 186 and 187 to battery B, thence to ground. The relay 59 energizes over this circuit to disconnect the rotary magnet 70 from the spring 124 at the springs 147 and 148, and to shift the holding ground for the relays 58 and 72 to ground G¹⁹, and also give the calling subscriber the busy signal over a circuit extending from the battery lead 83 through the secondary of induction coil 188 of the busy signaling machine M, springs 189 and 190, side switch wiper 74 (in second position), springs 165 and 166, condenser 149, thence over the heavy conductors to and through the substation A, back over the heavy conductors through the lower winding of the relay 68 to ground, thence to the starting point.

The object in having the ground shifted from the private wiper 66 to ground G¹⁹ is to prevent the side switch from deenergizing should the guarding potential be removed before the switch H has been released. The release of the switches in case the called line is busy is the same as if the connection had been obtained.

It having been explained how a connection is extended from one line to another, it will now be explained how the subscribers at two substations on the same line, substations A and A', for instance, may converse without manipulating the central office apparatus. If a party at substation A desires to converse with a party at substation A', all that is necessary for him to do is to remove his receiver after having signaled the other party by means of the buzzer circuit K. Sufficient talking battery current is supplied to the parties for them to converse, but enough current does not flow to

pull up the armature 25, due to the resistance 18. The two substations are provided with talking battery current from the central office over a circuit as follows:

8 From ground G', springs 79 and 80, resistance 18, line 16, through both substations in parallel, as before described, back over the line 15, springs 81 and 82, line winding 21 to the battery lead 83, thence through battery B to ground G. Although sufficient
10 current flows over this circuit to energize the transmitters at the substations, the resistance 18 prevents the current from being strong enough to cause the armature 25 to
15 be attracted by the winding 21, as previously explained. Thus it is evident that no switches at the central office are made busy during the time that any of the parties on the same line are conversing.

20 Should the subscriber at substation A desire to converse with the subscriber at substation A², he calls the station A³. The party at substation A³ then signals the subscriber A², assuming that there is but the
25 one set of bells 170 bridged across the line.

Thus it will be seen that I provide an extension or party-line system in which provision is made for preventing actuation of the line switch when the line is used for intercommunicating purposes, and in which
30 the said switch is controlled over the two sides of the line in series, current for talking purposes being derived from a common battery or other central source. So far as
35 I am now aware, therefore, it is new to enable two common battery subscribers on the same line to be supplied with talking current from a central source without operating any switches of the system.

40 What I claim as my invention is:—

1. In a telephone system, a telephone line, a plurality of telephones for said line each provided with means for intercommunicating over said line, automatic trunking apparatus in which the line terminates, means
45 operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes, and means for preventing the normal condition of said trunking apparatus being disturbed under such conditions.

2. In a telephone system, a subscriber's line, a plurality of telephones for said line
55 each provided with means for intercommunicating over said line, an automatic trunking switch for said line, means operative to supply current over the line from the central station to two of said telephones
60 when the said line is used for intercommunicating purposes, and means for preventing the normal condition of said trunking apparatus being disturbed under such conditions.

3. In a telephone system, a subscriber's
65 line, trunk line, means for automatically se-

lecting idle trunks ahead of the calls, switching apparatus for connecting the subscriber's line with a preselected trunk line, a plurality of telephones for said subscriber's line, means for supplying talking current over
70 the subscriber's line to said telephones, and means preventing actuation of said switching apparatus when a person at one telephone uses said current for conversation with a person at another telephone on the same
75 line.

4. In a telephone system, a subscriber's line, a plurality of telephones for said subscriber's line, an automatic switch for said line, means for supplying talking current
80 through said switch to the line, a resistance for preventing actuation of said switch when a person at one telephone converses with a person at another telephone on the same line, and means at each telephone for short-circuiting
85 said resistance to cause the actuation of said switch when connection with another line is desired.

5. In a telephone system, a telephone line, a plurality of telephones for said line, automatic switching apparatus in which the line
90 terminates, means operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes, means for preventing the normal condition of said trunking apparatus being disturbed under such conditions, and means whereby
95 a person at one of said telephones may signal a person at another telephone on the same line.

6. In a telephone system, a subscriber's line, a plurality of telephones for said line, an automatic trunking switch for said line, means operative to supply current over the
105 line from the central station to two of said telephones when the said line is used for intercommunicating purposes, means for preventing the normal condition of said trunking apparatus being disturbed under
110 such conditions, and means whereby a person at one of said telephones may signal a person at another telephone on the same line.

7. In a telephone system, a subscriber's line, trunk lines, means for automatically
115 selecting idle trunks ahead of the calls, switching apparatus for connecting the subscriber's line with a preselected trunk line, a plurality of telephones for said subscriber's line, means for supplying talking
120 current over the subscriber's line to said telephones, means preventing actuation of said switching apparatus when a person at one telephone converses with a person at another telephone on the same line, and
125 means whereby a person at one of said telephones may signal a person at another telephone on the same line.

8. In a telephone system, a subscriber's line, a plurality of telephones for said sub-
130

subscriber's line, an automatic switch for said line, means for supplying talking current through said switch to the line, a resistance for preventing actuation of said switch when a person at one telephone converses with a person at another telephone on the same line, means at each telephone for short-circuiting said resistance to cause the actuation of said switch when connection with another line is desired, and means whereby a person at one of said telephones may signal a person at another telephone on the same line.

9. In a telephone system, a telephone line, a plurality of telephones for said line each provided with means for intercommunicating over said line, switching apparatus in which the line terminates, means operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes; means for preventing the normal condition of said trunking apparatus being disturbed under such conditions, means at each telephone for transmitting calling impulses over the line in accordance with the digits of the number of a subscriber on some other line, and means responsive to said impulses to find the line of the called subscriber.

10. In a telephone system, a subscriber's line, a plurality of telephones for said line each provided with means for intercommunicating over said line, an automatic trunking switch for said line, means operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes, means for preventing the normal condition of said trunking apparatus being disturbed under such conditions means at each telephone for transmitting calling impulses over the line in accordance with the digits of the number of a subscriber on some other line, and means responsive to said impulses to find the line of the called subscriber.

11. In a telephone system, a subscriber's line, trunk lines, means for automatically selecting idle trunks ahead of the calls, switching apparatus for connecting the subscriber's line with a preselected trunk line, a plurality of telephones for said subscriber's line, means for supplying talking current over the subscriber's line to said telephones, means preventing actuation of said switching apparatus when a person at one telephone uses said current for conversing with a person at another telephone on the same line, means at each telephone for transmitting calling impulses over the line in accordance with the digits of the number of a subscriber on some other line, and means responsive to said impulses to find the line of the called subscriber.

12. In a telephone system, a subscriber's

line, a plurality of telephones for said subscriber's line, an automatic switch for said line, means for supplying talking current through said switch to the line, a resistance for preventing actuation of said switch when a person at one telephone uses said current for conversing with a person at another telephone on the same line, means at each telephone for short-circuiting said resistance to cause the actuation of said switch when connection with another line is desired, means at each telephone for transmitting calling impulses over the line in accordance with the digits of the number of a subscriber on some other line, and means responsive to said impulses to find the line of the called subscriber.

13. In a telephone system, a telephone line, a plurality of telephones for said line each provided with means for intercommunicating over said line, switching apparatus in which the line terminates, means operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes, means for preventing the normal condition of said trunking apparatus being disturbed under such conditions, a calling mechanism at each telephone, each calling mechanism being adapted to control the two sides of the line in series when the call is to another line, and means having first one motion to select a group and then another motion to find the called line in the predetermined group, responsive to the operation of the calling mechanism.

14. In a telephone system, a subscriber's line, a plurality of telephones for said line each provided with means for intercommunicating over said line, an automatic trunking switch for said line, means operative to supply current over the line from the central station to two of said telephones when the said line is used for intercommunicating purposes, means for preventing the normal condition of said trunking apparatus being disturbed under such conditions, a calling mechanism at each telephone, each calling mechanism being adapted to control the two sides of the line in series when the call is to another line, and means having first one motion to select a group and then another motion to find the called line in the predetermined group, responsive to the operation of the calling mechanism.

15. In a telephone system, a subscriber's line, trunk lines, means for automatically selecting idle trunks ahead of the calls, switching apparatus for connecting the subscriber's line with a preselected trunk line, a plurality of telephones for said subscriber's line, means for supplying talking current over the subscriber's line to said telephones, means preventing actuation of said switching apparatus when a person at one tele-

phone uses said current for conversing with a person at another telephone on the same line, a calling mechanism at each telephone, each calling mechanism being adapted to control the two sides of the line in series when the call is to another line, and means having first one motion to select a group and then another motion to find the called line in the predetermined group, responsive to the operation of the calling mechanism.

16. In a telephone system, a subscriber's line, a plurality of telephones for said subscriber's line, an automatic switch for said line, means for supplying talking current through said switch to the line, a resistance for preventing actuation of said switch when a person at one telephone converses with a person at another telephone on the same line, means at each telephone for short-circuiting said resistance to cause the actuation of said switch when connection with another line is desired, a calling mechanism at each telephone, each calling mechanism being adapted to control the two sides of the line in series when the call is to another line, and means having first one motion to select a group and then another motion to find the called line in the predetermined group, responsive to the operation of the calling mechanism.

17. In a telephone system, a subscriber's line, a plurality of automatic switches adapted to be successively operated, means for first grounding the line to control one of said switches, and means for then controlling the two sides of the line in series to operate another of said switches.

18. In a telephone system, a subscriber's line, a non-numerical trunking switch, a numerical trunking switch, means for grounding the line to operate the non-numerical switch, and means for controlling the two sides of the line in series to operate the numerical switch.

19. In a telephone system, a subscriber's line, a plurality of numerical switches, a non-numerical switch, means for grounding the line to operate the non-numerical switch, and means for controlling the two sides of the line in series to successively operate the said numerical switches.

20. In a telephone central office, a plurality of trunk lines, a non-numerical switch for selecting an idle trunk, an operating magnet for said switch, a circuit terminating in said office for said magnet including a line circuit and a resistance, means for short-circuiting said resistance to operate said switch and for eliminating said resistance from the line circuit when the switch is operated.

21. In a telephone central office, a plurality of trunk lines, a non-numerical switch for selecting an idle trunk, an operating magnet for said switch, a circuit for said

magnet including a line circuit terminating in said office; a resistance in said circuit to prevent the operation of said switch when said line circuit is closed, and means for short-circuiting said resistance to operate said switch and for eliminating said resistance from the line circuit when the switch is operated.

22. In a telephone central office, a plurality of trunk lines, a non-numerical switch for selecting an idle trunk, an operating magnet for said switch, a circuit for said magnet including a line circuit terminating in said office, means for closing said line circuit upon the removal of the receiver from the hook, a resistance normally in said line circuit to prevent the operation of said switch when said line circuit is closed, and means for short-circuiting said resistance to operate said switch and for eliminating said resistance from the line circuit when the switch is operated.

23. In a telephone system, a plurality of trunk lines, a non-numerical switch for selecting an idle trunk, an operating magnet for said switch, a circuit for said magnet including a line circuit, means for closing said line circuit upon the removal of the receiver from the hook, a resistance normally in said line circuit to prevent the operation of said switch when said line circuit is closed, and means for grounding one side of said line at the substation to thereby short-circuit said resistance and cause said switch to operate.

24. In a telephone system, a line, a telephone, having a circuit controller, in which said line terminates at one end, an automatic progressively movable switch in which the other end of said line terminates, a second switch, means for operating said first switch to establish connection with the second switch, another line, means for operating the second switch to establish connection with said other line, means for preventing the operation of said first switch over two sides of the first line in series, means for operating the second switch over the two sides of the line in series from said circuit controller, and a battery for furnishing the necessary current for operating purposes.

25. In a telephone system, a line, an automatic progressively movable switch for said line, another progressively movable switch, means for operating the first switch to extend a connection from the line to the second switch, and means for operating the second switch over the two sides of the line in series, means for preventing the operation of the said first switch over the two sides of the line in series, a circuit controller associated with said line for operating said switches, and a battery for furnishing the necessary current for operating purposes.

26. In a telephone system, a line, a plu-

ality of telephone talking sets associated with said line, an automatically progressively movable switch for said line, another line, means for operating the said switch to
5 extend a connection from the first to the second line, a battery for supplying current to the circuits of said system for operating purposes, means for supplying current to the line through said switch for energizing

the said talking sets, and for preventing the 10 operation of said switch as a result.

Signed by me at Chicago, Cook county, Illinois, this 27 day of April, 1910.

TALBOT G. MARTIN.

Witnesses:

EDWARD D. FALES,
ARTHUR J. RAY.