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RING BACK ARRANGEMENT FOR COMMON BATTERY TELEPHONE PARTY LINES.

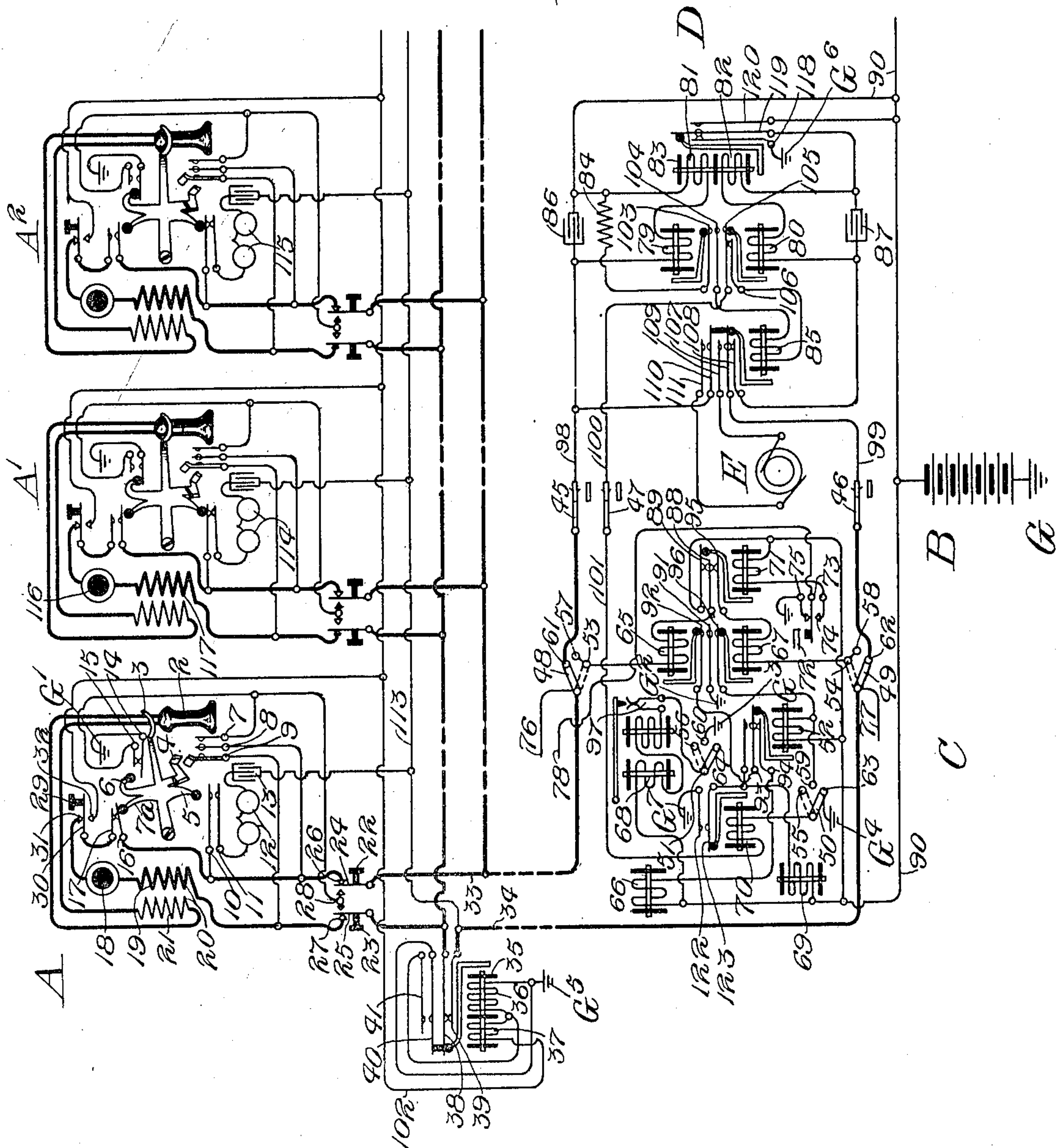
APPLICATION FILED SEPT. 19, 1907. RENEWED FEB. 23, 1918.

1,280,783.

Patented Oct. 8, 1918.

3 SHEETS—SHEET 1.

Fig. 1



Witnesses.

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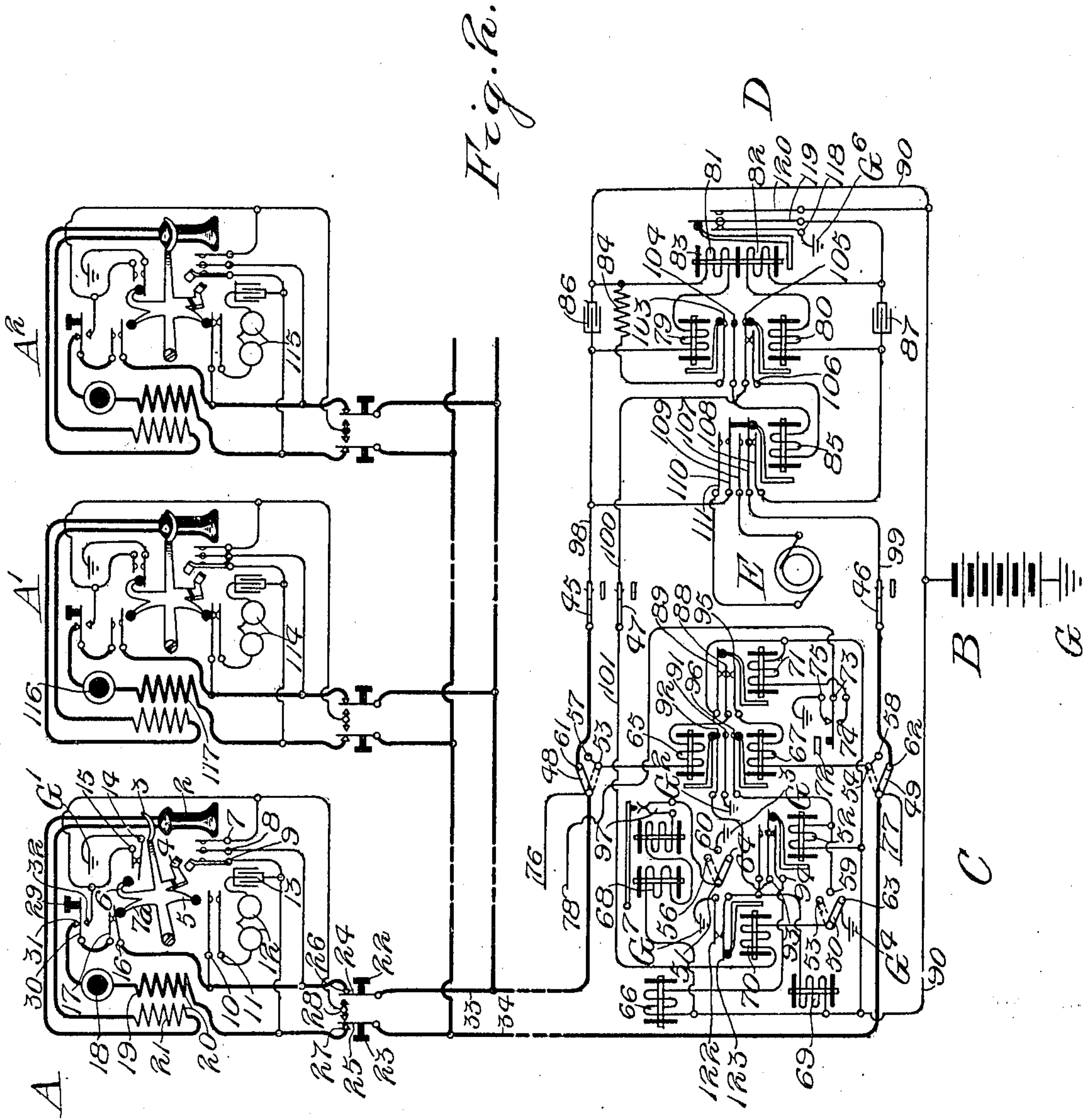
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3 SHEETS—SHEET 2.



Witnesses.

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3 SHEETS—SHEET 3.

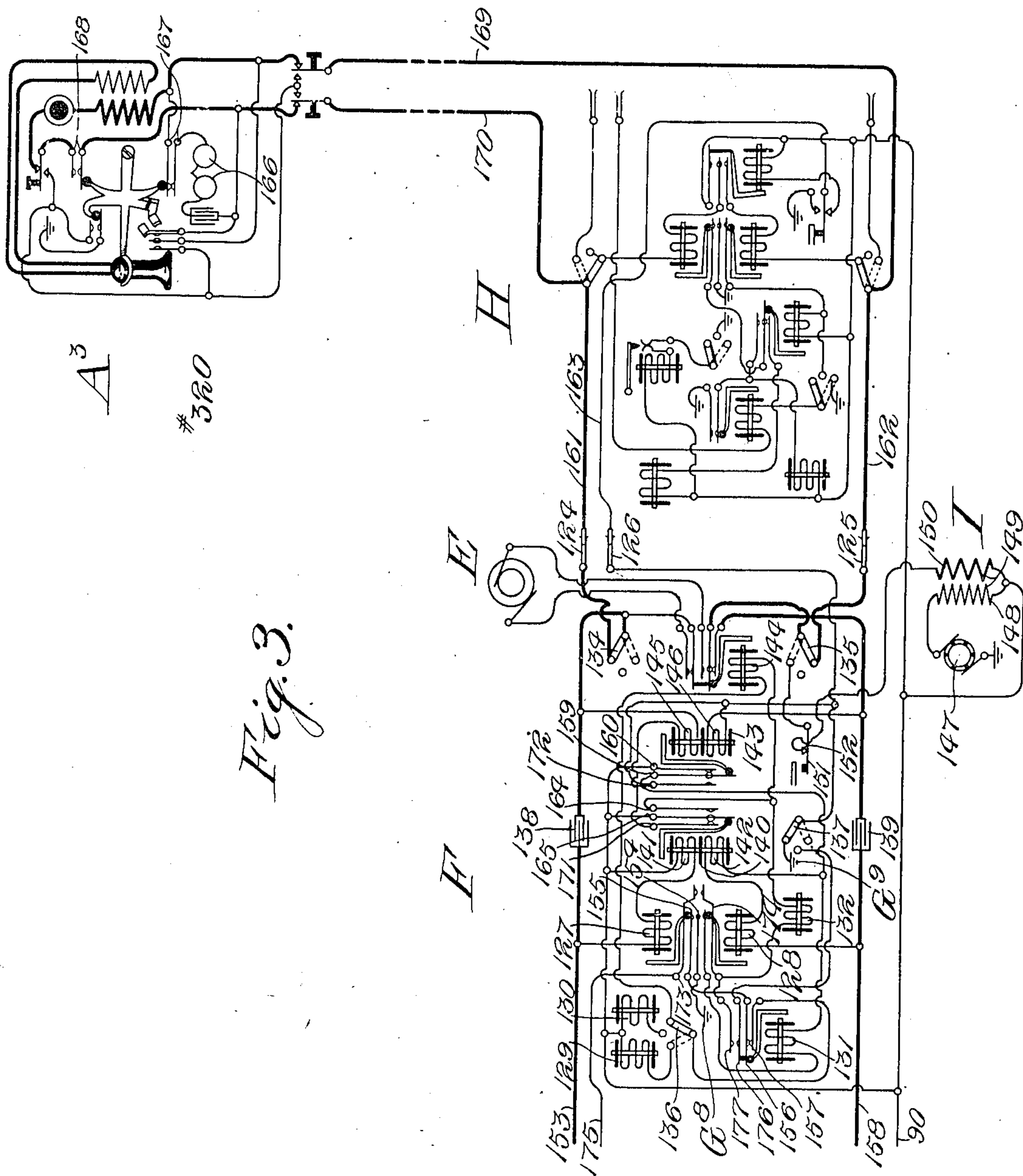


Fig. 3.

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UNITED STATES PATENT OFFICE.

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RING-BACK ARRANGEMENT FOR COMMON-BATTERY TELEPHONE PARTY-LINES.

1,280,783.

Specification of Letters Patent.

Patented Oct. 8, 1918.

Application filed September 19, 1907, Serial No. 393,654. Renewed February 23, 1918. Serial No. 218,899.

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 Ring-Back Arrangements for Common-Battery Telephone Party-Lines, of which the following is a specification.

My invention relates to automatic party-line telephone systems in general, but more particularly to the non-interfering and intercommunicating party-line system disclosed in my prior application Serial No. 393,653, filed Sept. 19, 1907, as will herein-
after more fully appear.

Objects of my invention are to provide a party-line system of this character in which the electrical current for talking purposes is supplied from the exchange or central station; in which the special ring-back arrangement for use between subscribers on the same line is adapted to control the flow of talking current to the subscriber's line, as well as to control the trunk-release circuit through the first-selector or other switch; in which the line circuit is controlled by a relay common to all of the subscribers on a party-line, which relay is energized by battery current flowing over one side of the line when any subscriber presses his ringing key, the winding or coils of said relay being included in the connection to ground which is common to the different substations, thereby preventing the release of the apparatus at the exchange which would otherwise take place should the called subscriber happen to answer before the line is grounded the last time at the calling substation; and in which certain details and features of improvement and novel combinations are employed for increasing the general efficiency and serviceability thereof.

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

In the accompanying drawings Figure 1 is a diagram showing an automatic party-line system embodying the principles of my invention, in which central energy is used for talking and signaling. It will be seen that the substations A, A¹ and A² are allotted to the party-line that terminates at the central office in the first-selector switch C, which latter may be of the general type disclosed in United States Patent No. 815,321,

granted March 13, 1906, to Keith, Erickson and Erickson, having rotary and non-rotary movements. At D is shown an arrangement by means of which any subscriber of the party-line may ring back upon his own line. A central battery for talking and operating purposes is shown at B having its positive terminal preferably grounded at G, and a central ringer generator for signaling is shown at E.

In Fig. 2 is shown a modified form of the system shown in Fig. 1.

Fig. 3 represents diagrammatically a connector switch F by means of which the subscribers may establish connection with different lines. The substation A³ is similar to substations A, A¹ and A² and, as shown, is allotted to the first-selector switch H.

It will be understood that in the central office, in addition to the first-selector switches allotted to the subscribers' lines, there may be second-selector switches of the same general type, and connectors of the general type shown in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, by means of which the subscribers may establish connection with lines other than their own. For this purpose the various bank levels of the switches may be and are provided with trunk-lines leading to second-selector switches, and likewise from the second-selector bank levels with trunk-lines leading to the connector switches, as is customary. With my new system one level, either in the first or second selector bank, is allotted to the signaling device, as shown at D—that is, the trunk-lines from the contacts in some certain level, instead of leading to a selector or connector switch, lead to a ring-back arrangement, as shown at D in Fig. 1; and a subscriber, after having properly operated the central office switch or switches and established connection with said ring-back level, may then cause ringing current to pass back over his line to signal some other subscriber occupying the same line with him. In Fig. 1 this ring-back arrangement is shown allotted to the second level of the first-selector banks. Any level, however, either of the first or second selector banks, may be equipped in the same manner.

The substations may be of any suitable or approved type. The ones in connection with which I have elected to illustrate my

invention comprise the receiver 2, a switch-hook 3, which is provided with cam-arms 4, 5, 6 and 7^a. As the switch-hook is lowered the cam-arm 4 momentarily presses the release springs 7, 8 and 9 into contact, and when the switch-hook comes to rest in its depressed condition the cam-arm 5 presses the springs 10 and 11 into contact, bridging the ringer 12 in series with the condenser 13 across the main line conductors. When the switch-hook is down the cam-arm 6 carries the spring 14 out of engagement with the spring 15, by which the substation ground G¹ is cut off. When the switch-hook is up, however, the cam-arm 7^a presses the springs 16 and 17 into contact, whereby the transmitter 18 in series with the primary winding 19 of the induction-coil 20 is bridged across the main line conductors. The secondary winding 21 is included in a series circuit with the receiver 2. The calling device, as shown, comprises two push-buttons 22 and 23 which, when pressed, are adapted to carry the springs 24 and 25 out of engagement with the contact points 26 and 27 and into engagement with the ground post 28. The signaling device by means of which the subscriber may ground the vertical line conductor to signal a called subscriber comprises a push-button 29 which, when pressed, carries the spring 30 out of engagement with the spring 31 and into engagement with the contact point 32. Allotted to the main line conductors 33 and 34, which are common to the substations A, A¹, A², etc., there is a relay 35 composed of two windings 36 and 37. The winding 36 may be of comparatively high resistance, while the winding 37 is comparatively low. This relay, upon energizing, operates to disengage the springs 38 and 39 and to carry the springs 40 and 41 into contact. When the springs 38 and 39 disengage, then the rotary line conductor 34 is disconnected from the substation. The engagement of the springs 40 and 41 provides a shunt or short-circuit for the winding 36.

The first-selector switch shown at C is constructed as follows: The switch shaft (not shown) carries the vertical and rotary wipers 45 and 46, respectively, and the private wiper 47. The side switch is well known and comprises the side switch wipers 48, 49, 50 and 51, which may be designated as the vertical, rotary and private side switch wipers, and the rotary magnet wiper, respectively. The side switch is under the control of the private magnet 52, and when the side switch is in normal or first position the wipers 48, 49, 50 and 51 occupy the contact points 53, 54, 55 and 56, respectively. In the second position the wipers rest on the contact points 57, 58, 59 and 60, respectively, and in the third position the contact points 61, 62, 63 and 64 are engaged by their

respective wipers. Through the medium of the vertical line relay 65, and while the side switch is in first position, the subscriber controls the vertical magnet 66, which latter operates to raise the switch shaft and wipers 45, 46 and 47 vertically. By means of the rotary line relay 67 the subscriber controls the private magnet 52 and, therefore, the side switch. While the side switch is in second position the rotary magnet 68, which operates to carry the switch shaft and wipers 45, 46 and 47 in a rotary direction, is energized. The vertical and rotary line relays 65 and 67, acting conjointly, provide means whereby the subscriber controls the release magnet 69 while the side switch is in the first or second position. If the side switch passes to the third position, then, since the selector is of the trunk-release type, the selector is controlled by means of the back-release relay 70 from the next switch with which a connection is at that time established, through the private wiper 47. The bridge-cut-off relay 71 is provided to open the connection between the line relays 65 and 67, and between said relays and battery B. This is desirable, because if the relays are not disconnected from each other and battery the ringing current for signaling the subscriber may operate either or both of the relays 65 and 67 and cause some interference with the switch. It is also desirable to remove the bridge formed through the said relays from across the line to give the voice-currents as clear a path as possible. In addition, the first-selector is provided with a normal arm 72 which, when the shaft is raised, permits the spring 73 to pass out of engagement with the spring 74 and into engagement with the spring 75. The normal conductors 76, 77 and 78, over which incoming calls are made, terminate in the connector banks, as is usually the case in systems of this general character.

The ring-back arrangement shown at D comprises the vertical and rotary line relays 79 and 80 connected in series with the windings 81 and 82 of the differential relay 83, and to the battery terminals. A dead resistance coil 84 is provided in the trunk-release circuit to cut down the flow of current through the release relay 70 of the selector, which relay is of one-half ohm resistance. The ringer relay 85, upon energizing, operates to bridge the terminals of the ringer generator E across the line conductors. The condensers 86 and 87 are provided for bridging the impedance in the vertical and rotary line talking circuits.

The connector switch may also be of any suitable or approved type, for instance of the general type described in said connector patent. The mechanical details of the selector and connector, as is well known, are

very much the same, although there is some material difference in the circuits. For instance, the connector switch shaft (not shown), like the selector switch shaft, carries the line wipers 124 and 125 and the private wiper 126. The connector switch is also controlled by the calling subscriber through the medium of the vertical and rotary line relays 127 and 128. The vertical line relay 127 directly controls the vertical magnet 129 and also the rotary magnet 130. The function of the vertical magnet 129 is to give the shaft and shaft wipers a vertical motion, and the rotary magnet 130 imparts to the shaft and shaft wipers a rotary or circular motion. The rotary line relay 128 controls the private magnet 131, which latter, under certain conditions, controls in turn the vertical and rotary magnets 129 and 130; the release magnet 132, and also the side switch wipers 134, 135, 136 and 137. The side switch of the connector, like the side switch of the selector, has a normal or first position, a second position and a third position. The release magnet 132 is also controlled by the vertical and rotary line relays 127 and 128 conjointly. By the use of the condensers 138 and 139 the connector divides the circuit through it into two sections. The connector is provided with a differentially-wound relay 140 which is composed of the windings 141 and 142. The function of this relay is to provide the calling subscriber with talking battery current when the back-bridge relay 143 energizes, and also, by means of the vertical line relay 127, to control the ringer relay 144 by means of which the ringer generator E is bridged across the terminals of the called line to signal the called subscriber. The back-bridge relay 143, comprising the windings 145 and 146, provides the called subscriber with talking battery current when the primary circuit of the called substation is bridged across the line. The central station is equipped with the busy-signaling apparatus I of any suitable design, as, for example, the one comprising an interrupter 147 in series with the primary winding 148 of the induction-coil 149, whereby a busy-signaling current is induced in the secondary winding 150 of the said induction-coil. The secondary winding 150 is connected with the side switch wiper 135 through the normal springs 151 and 152 when the switch shaft is raised and the side switch is in first position.

A clearer understanding of my invention may be had by considering its action when one subscriber operates the central office switches to call back on his own line. It will be assumed that subscriber A desires to signal the subscriber at substation A¹, in which event the selector switch C allotted to the line conductors 33 and 34 is operated to establish connection with the ring-back

arrangement D which is allotted to the second level of the first-selector banks. The subscriber at substation A removes the receiver 2 from the switch-hook 3, whereby the springs 14 and 15 engage, thus providing ground for the ground post 28. Since the ring-back arrangement is allotted to the second level of the first-selector, the vertical line conductor 33 is given two ground impulses and the rotary line conductor 34 is given one. The push-button 22 is, therefore, pressed twice, whereby the spring 24 is carried onto the ground post 28 twice, and as a result the vertical line relay 65 of the first-selector C is energized each time by a flow of current from the substation ground G¹ through the springs 14 and 15, ground post 28, spring 24, vertical line conductor 33, side switch wiper 48 and contact point 53, through the vertical line relay 65, bridge-cut-off relay springs 88 and 89 to the battery lead 90, thence through battery B to ground G. The vertical line relay, upon energizing, operates to place the line relay springs 91 and 92 in contact, thus in turn closing an energizing circuit through the vertical magnet 66. The vertical magnet is thereby energized, and the wipers 45, 46 and 47 of the selector C are raised to the second bank level and brought opposite the first contact. The energizing circuit for the said vertical magnet 66 extends from ground G² through the springs 91 and 92, private magnet springs 93 and 94, through the vertical magnet 66 to the battery lead 90, thence through battery B to ground G. The rotary push-button 23 is then pressed, carrying the spring 25 onto the ground post 28, thereby establishing an energizing circuit through the rotary line relay 67 extending from the substation ground G¹ to the ground post 28, spring 25, through the springs 38 and 39, rotary line conductor 34, side switch wiper 49, contact point 54, through the winding of the rotary line relay 67, bridge-cut-off relay springs 95, 88 and 89 to the battery lead 90, thence through battery B to ground G. The rotary line relay, upon energizing, presses the springs 96 and 91 into contact, thereby establishing a circuit through the private magnet 52 extending from ground G² through the springs 91 and 96, private magnet 52 to the battery lead 90, thence through battery B to ground G. The private magnet, upon energizing and deenergizing, permits the selector side switch to pass from first to second position, permitting the side switch wipers 50 and 51 to engage the contact points 59 and 60. The closure of connection between the side switch wiper 51 and the contact point 60 provides an energizing circuit for the rotary magnet 68 extending from ground G³ to the side switch 51, interrupter springs 97, through the winding of the rotary magnet 68 to the

battery lead 90, thence through battery B to ground G. The said rotary magnet 68 then operates to rotate the wipers 45, 46 and 47 into engagement with the first contact of the second level, from which contact, it is assumed, the trunk-line conductors 98, 99 and 100 lead to the ring-back arrangement D. If the first trunk-line is busy, however, and the wipers have to pass over busy contacts, then as soon as the private wiper 47 engages the first grounded private bank contact point the private magnet 52 again energizes, locking the side switch in second position. The energizing circuit for the said private magnet extends from ground G through an occupying switch (not shown) to the private wiper 47, thence over the conductor 101, through the back-release relay 70, side switch wiper 50, contact point 59, private magnet 52 to the battery lead 90, thence through battery B to ground G. The private magnet 52, when thus energized, locks the side switch in second position, and the wiper 51 in engagement with the contact point 60, whereby the rotary magnet 68 will be energized step-by-step until the wipers are carried beyond the last busy trunk-line. At the instant that the private wiper leaves the last busy contact point the energizing circuit through the private magnet 52 is destroyed, and as a result the selector side switch passes to third position. If, however, there are no busy trunk lines the rotary magnet 68 releases the side switch to third position as soon as the wipers are carried into engagement with the first trunk-line. As soon as the side switch passes to third position, as stated, the subscriber's line conductors 33 and 34 are extended to the conductors 98 and 99 which, in this case, it is assumed lead to the ring-back arrangement D. The extending of the line occurs, of course, as soon as the side switch wipers 48 and 49 engage the contact points 61 and 62, respectively. Not only is the subscriber's line thus extended, but a guarding potential is also established at the private wiper 47, when the side switch wiper 50 passes onto the ground contact point 63, for protecting the seized trunk-line against interference by other calling subscribers. This guarding potential is established from ground G⁴ through the side switch wiper 50, back-release relay 70, conductor 101 to the private wiper 47. Furthermore, when the selector shaft is given a vertical step the normal arm 72 permits the spring 73 to engage the grounded contact point 75, whereby a guarding potential is established at the connector bank for protecting the calling line against seizure by other subscribers. It will be seen, of course, that the energizing circuit for the rotary magnet 68, to which reference has already been made, is destroyed when the idle trunk-line is seized—that is, when the

side switch wiper 51 leaves the contact point 60. The calling subscriber has now extended the conductors 33 and 34 to the ring-back arrangement shown at D, and the central office switches occupy the position indicated in Fig. 1. To signal the subscriber at substation A¹ the calling subscriber at substation A presses the signaling button 29, whereby an energizing circuit is established through the vertical relay of the ring-back arrangement, extending from ground G⁵ through the windings 36 and 37 of the double-wound relay 35, conductor 102, contact point 32, push-button spring 30, through the springs 17 and 16, through the calling device springs to the vertical line conductor 33, through the side switch wiper 48, shaft wiper 45, trunk-line conductor 98, vertical line relay 79, winding 81 of the differential relay 83 to the battery lead 90, thence through battery B to ground G. This circuit provides energizing current for the relay 35, which operates to disengage the springs 38 and 39 and to close the springs 40 and 41 in contact. When the springs 40 and 41 engage, a new circuit is established, shunting or short-circuiting the high resistance winding 36. This new circuit is the same as the old circuit, except that the high resistance winding 36 is shunted or short-circuited. The winding 37 is provided in order to maintain the relay 36 energized after the winding 36 is short-circuited. When the winding 36 is included in series in the circuit, sufficient current does not flow to operatively energize the relay 79; but when this winding 36 is short-circuited, after the relay operates, sufficient current then flows to operatively energize the vertical line relay 79; and also, since the winding 81 is included in this circuit, the relay 83 operates, but this operation at this time is of no consequence. The relay 79, upon energizing, closes the springs 103 and 104 in contact, whereby an energizing circuit is established through the ringer relay 85, extending from ground G⁴ at the selector C, through the side switch wiper 50, back-release relay 70 to the private wiper 47, conductor 100, through the springs 105 and 106, through the ringer relay 85, springs 104 and 103, through the dead resistance coil 84 to the battery lead 90, thence through battery B to ground G. The ringer relay 85, upon energizing, operates to shift the spring 107 from the spring 108 to the spring 109; also, the spring 110 is carried into engagement with the spring 111. By the operation of this relay the terminals of the ringer generator E are bridged across the extended line conductors 33 and 34, whereby ringing current is permitted to flow from the rotary line conductor 34 to the conductor 113, and then through the ringers 114 and 115 in multiple with the substations A¹ and A² to the verti-

cal line conductor 33. The provision by which the substation rotary line conductors are disconnected from the main line conductor 34, when the springs 38 and 39 disengage, is made for the following reason: Without this provision, when the subscriber at substation A pressed the signaling button 29 and grounded the vertical line conductor 33, this same ground potential would be transmitted through the called subscriber's primary circuit, which includes the transmitter 116 and primary winding 117, to the rotary line conductor 34, if the calling subscriber presses his signaling button after the called subscriber has removed his receiver from the switch-hook, and then to the rotary line relay 80 of the ring-back arrangement, thus energizing both the vertical and rotary line relays simultaneously, whereby the release of the central office apparatus would be brought about. To prevent the possibility of a premature release being brought about in this manner, the relay 35 is provided for opening up the rotary line conductors, and thus preventing the ground potential at the vertical line conductor from passing through a subscriber's station to the rotary line conductors. The subscriber at substation A, in response to his signal, which may be two rings, removes his receiver from the switch-hook and bridges his primary circuit across the main line conductors 33 and 34, in multiple with the primary circuit of the substation A. Talking battery current for these two multiple primary circuits is established over a circuit extending from ground G^6 through the springs 118 and 119, through the winding 82 of the relay 83, rotary line relay 80, ringer relay springs 108 and 107, through the conductors 99 and 34, springs 39 and 38, then through the primary windings 20 and 17, transmitters 18 and 116 to the vertical line conductor 33, side switch wiper 48, shaft wiper 45, conductor 98, through the vertical line relay 79 and winding 81 of the differential relay 83 to the battery lead 90, thence through battery B to ground G. The windings 81 and 82 of the relay 83 are so arranged that when both windings carry current, as before explained, the said relay does not operatively energize; also, the relays 79 and 80, which are included in the talking circuit, are so arranged and adjusted that they do not operate when included in the talking circuit. The two substations being thus provided with talking current, conversation may be carried on in the well-known manner. After the subscribers have finished their conversation the subscriber who first restores his receiver to the switch-hook brings about the release of the central office switching apparatus, as follows: Suppose subscriber A restores his receiver first. In that event the cam-arm 4 presses the release springs 7, 8 and 9 into contact momentarily, whereby the vertical and rotary line conductors are simultaneously grounded. The grounding of the rotary line conductor 34 short-circuits the winding 82 of the differential relay 83, whereby the said relay becomes unbalanced and operates to shift the spring 119 out of contact with the spring 118 and into engagement with the spring 120. By this operation a new energizing circuit is established through the winding 82, which now assists the winding 81 in maintaining the relay 83 in an operated position. The energizing circuits through the windings 81 and 82 extends from the substation ground G^1 through the springs 14 and 15, through the release springs 7, 8 and 9 to the vertical and rotary line conductors 33 and 34, then on one side over the vertical line conductor to the side switch wiper 48, shaft wiper 45, trunk conductor 98, through the vertical relay 79 and winding 81 to the battery lead 90, thence through battery B to ground G; and on the other side the circuit over the rotary line extends from the conductor 34, through the side switch wiper 49, shaft wiper 46, conductor 99, through the ringer springs 107 and 108, through the rotary relay 80 and winding 82, through the springs 119 and 120 to the battery lead 90, thence through battery B to ground G. The vertical and rotary line relays 79 and 80 now operatively energize to place the springs 103, 104 and 105 in contact, whereby an energizing circuit is established through the back-release relay 70 of the selector switch C, said circuit extending from ground G^4 through the back-release relay 70, conductor 101, shaft wiper 47, conductor 100, springs 105, 104 and 103, resistance coil 84 to the battery lead 90, thence through battery B to ground G. The back-release relay 70, upon energizing, places the springs 122 and 123 in contact, whereby an energizing circuit is in turn provided for the release magnet 69, this circuit extending from ground G^7 through the springs 122 and 123, and through the release magnet 69 to the battery lead 90, thence through battery B to ground G. All of the relays and magnets thus energized attract their respective armatures and remain in readiness to return to normal position as soon as the ground to the main line conductors is broken, when the release springs 7, 8 and 9 disengage. If the subscriber at substation A, however, desires to establish connection with a subscriber on some other line, the selector C is operated to seize some idle trunk-line leading to a connector, or to another selector, and finally to a connector which is operated to establish connection directly with the desired line. For example: To call the number 320 (substation A^3) the subscriber at substation A removes his receiver from the switch-hook and operates the call-

ing device once for each digit in the well-known manner. When the device is operated for the first digit the first-selector switch C is operated to establish connection with an idle trunk-line leading to the connector switch F. The impulses for the last two digits are directed toward the connector switch F, which operates to place the shaft wipers in connection with the contacts corresponding to the desired line. The first digit being 3 the spring 26 is pressed onto the ground post 28 three times. As a result the vertical line relay 65 of the first-selector C is energized each time by a flow of current from the substation ground through the vertical line relay 65 to the battery lead 90, as previously explained. The vertical line relay in turn operates to energize the vertical magnet 66, whereby the shaft wipers are raised opposite the bank contacts of the third level. Following the vertical impulses the rotary line relay 67 is energized as before, and the private magnet in turn operates to carry the side switch from first to second position, whereby the rotary magnet becomes energized and the shaft wipers 45, 46 and 47 are operated to select an idle trunk-line leading to the connector switch F. The grounding of the line conductors 33 and 34 for the last two digits affects the connector by operating the vertical and rotary line relays 127 and 128. When the vertical line conductor 33 is grounded the vertical line relay 127 is energized by a flow of current from substation ground G¹ through the vertical line conductor 33, side switch wiper 48, shaft wiper 45, trunk conductor 153, vertical line relay 127, winding 141 of the relay 140 to the battery lead 90, thence through battery B to ground G. The winding 141 of the relay 140 being included in this circuit the said relay energizes, but this operation is without effect at this particular time. Each time that the vertical line relay 127 operates for the second digit the vertical magnet 129 operatively energizes to carry the shaft wipers 124, 125 and 126 in a vertical direction one step at a time until the said wipers are carried two steps and thus brought opposite a level in which are located the terminals of the line #320. The circuit through the vertical magnet 129 extends from ground G² through the springs 154 and 155, private magnet springs 156 and 157, side switch wiper 136, vertical magnet 129 to the battery lead 90, thence through battery B to ground G. When the rotary line conductor 34 is grounded, following the grounding of the vertical line conductor, the connector rotary line relay 128 becomes energized through a circuit from ground G' to the rotary line conductor 34, side switch wiper 49, shaft wiper 46, rotary trunk conductor 158, rotary line relay 128, winding 142 of the differential relay 140, through the springs 159 and 160 to the

battery lead 90, thence through battery B to ground G. The winding 142 of the differential relay 140 being included in this circuit, said relay 140 energizes, but with no effect. The rotary line relay 128, upon energizing, operates to close an energizing circuit through the private magnet 131, which latter in turn operates to release the side switch from first to second position. For the last digit the subscriber operates the calling device, as previously described, grounding the vertical line conductor 33 ten times and the rotary line conductor 34 once. The vertical and rotary line relays 127 and 128 are operated over previously traced circuits. However, when the vertical line relay operates, a circuit is closed through the rotary magnet 130 instead of through the vertical magnet 129, since the side switch wiper 136 is now in second position. Each time that the rotary magnet is energized the shaft wipers 124, 125 and 126 are rotated one step at a time until the said wipers are carried into engagement with the normal conductors 161, 162 and 163, the first two of which lead to the line terminals of the desired substation. The rotary line relay 128, upon energizing, completes an energizing circuit through the private magnet 131 as before, which latter now operates with one of two results, namely the release of the side switch from first to second position, or the so-called busy-release of the connector. It will be assumed that the former result occurs, and that the side switch passes to third position, whereby the side switch wipers 134 and 135 are placed in connection with the shaft wipers 124 and 125, respectively. Furthermore, when the side switch passes to third position a guarding potential is established for protecting the called line. This potential extends from ground G³ through the side switch wiper 137 to the shaft wiper 126 which engages the private bank contact of the seized line. In order to signal, the subscriber at substation A presses the signaling button 29, whereby the vertical line conductor 33 is grounded, and the connector vertical line relay 127 and the differential relay 140 become energized as before. It will be assumed that the side switch has passed from second to third position, and that the side switch wiper 136 is in engagement with a third-position contact point, thereby placing the vertical line relay 127 in control of the ringer relay 144 in the same manner in which the rotary magnet 130 came under the control of the vertical line relay when the side switch passed from first to second position. Therefore, when the vertical line relay presses the springs 154 and 155 into contact the ringer relay 144 is energized from ground G³ through the springs 154 and 155, private magnet springs 156 and 157, side switch wiper 136, ringer

relay 144, springs 164 and 165 (bearing in mind that the differential relay 140 is energized) to the battery lead 90, thence through battery B to ground G. The ringer relay, upon energizing, operates to bridge the terminals of the ringer generator E across the conductors of the desired line. A signaling current is therefore sent from the ringer generator H to the substation ringer 166.

In response to the signal the subscriber at substation #320 removes his receiver from the switch-hook, whereby the switch-hook rises, permitting the springs 167 to disengage and the springs 168 to engage, thereby removing the ringer 166 from across his line and bridging instead the transmitter and primary winding. When the primary winding and transmitter come across the line an energizing circuit is established through both windings of the relay 143 extending from ground G⁹ through the side switch wiper 137, through the winding 146 of the relay 143, through the ringer relay springs and side switch wiper 135 to the rotary normal conductor 162, rotary line conductor 169, through the primary winding and transmitter to the vertical line conductor 170, vertical normal conductor 161, shaft wiper 124 and side switch wiper 134, through the winding 145 of the relay 143, through the springs 171 and 165 to the battery lead 90, thence through battery B to ground G. The relay 143, upon energizing, operates to shift the spring 159 from the spring 160 (which latter is connected with the battery lead 90) to the spring 172, which in turn is connected with ground. The reversal of polarity of the spring 159 sets up a circuit which provides the calling subscriber with battery current for talking purposes. This current may be traced from ground G⁹ through the side switch wiper 137, springs 172 and 159, through the winding 142 of the relay 140, rotary line relay 128, conductors 158 and 34, through the primary winding and transmitter of substation A to the vertical line conductors 33 and 153, vertical line relay 127, winding 141 of the differential relay 140 to the battery lead 90, thence through battery B to ground G. Both windings of the relay 140 now carry current, but the windings are so arranged that the said relay does not operatively energize. The vertical and rotary line relays 127 and 128 being included in the above circuit operatively energize and place their springs in contact, and the release springs 173 and 174 are also brought into contact, but the simultaneous action of these relays at this particular time is without effect, since no energizing circuits are established thereby. The two substations A and A³ being thus provided with battery current for talking purposes, conversation may be carried on over circuits shown by the heavy line

conductors in Figs. 1 and 3. The release of the central office switching apparatus is brought about when the calling subscriber restores the receiver 2 to the switch-hook 3, thereby pressing the release springs 7, 8 and 9 into engagement for a moment. The contact of the said release springs grounds the vertical and rotary line conductors 33 and 34 simultaneously from ground G¹ to the release spring 7, thence through the springs 8 and 9 to the vertical and rotary line conductors. The grounding of the rotary line conductor 34 produces a short-circuit of the rotary line relay 128 in series with the winding 142 of the differential relay 140. The said circuit extends from ground G⁹ at the connector to the side switch wiper 137, springs 172 and 159, through the winding 142, rotary line relay 128, conductors 158 and 34, through the release springs 9, 8 and 7 to the substation ground G¹. Therefore, since the winding 141 of the differential relay 140 alone carries current, the said relay becomes energized and attracts its armature, which shifts the spring 165 out of contact with the spring 171 and into contact with the spring 164. The disengagement of the springs 171 and 165 destroys the energizing circuit through the relay 143, and the spring 159 passes out of engagement with the spring 172 and into engagement with the spring 160, which removes the said short-circuit of the rotary line relay 128 and winding 142 and establishes an energizing circuit instead from the substation ground G¹ through the release springs 7, 8 and 9 to the rotary line conductor 34, thence to the rotary line relay 127, as previously traced, winding 142 of the differential relay 140, through the springs 159 and 160 to the battery lead 90, thence through battery B to ground G. The rotary line relay 128 now operates and the springs 173 and 174 come into contact, whereby an energizing circuit is established through the release magnet 132 of the connector F and the release relay 70 of the selector C. However, the current now in passing, as above stated, through the winding 142 aids the winding 141 in maintaining the springs 164 and 165 in contact. The energizing circuit through the release magnet 132 extends from ground G⁴ at the selector C through the side switch wiper 50, back-release relay 70, shaft wiper 47, conductor 175, through the release springs 173 and 174, release magnet 132, springs 164 and 165 to the battery lead 90, thence through battery B to ground G. The connector release magnet, upon being supplied with current, energizes, and as a result the switch shaft and side switch are restored to normal condition, thus breaking the connection between the connector switch shaft wipers 124, 125 and 126 and the normal conductors 161, 162 and 163. The back-release relay 70 be-

ing in the same circuit with the release magnet 132 energizes simultaneously with the latter, and operates to close the circuit through the release magnet 52 of the selector C by pressing the back-release springs 122 and 123 together. The circuit through the release magnet 69 extends from ground G⁷ through the springs 122 and 123, and through the release magnet 69 to the battery lead 90. When the ground to the line conductors 33 and 34 is interrupted, all the magnets involved in the release are deenergized and all switches fully restored. If the called line #320 is busy at the time that the calling subscriber attempts to establish connection, the connector F is released by the last impulse to the rotary line conductor 34 as follows: The said impulse energizes the rotary line relay 128 of the connector, which relay in turn energizes the private magnet 131, pressing the private springs 176 and 177 into contact after the private wiper 126 is carried onto the private bank contacts. Of course, it is understood that whenever the line #320 is busy the connector private bank contacts connected with the private normal conductor 163 are all connected to ground. Therefore, since the connector side switch is in second position, when the private magnet springs 176 and 177 are brought into contact an energizing circuit is established through the release magnet 132 from the said grounded private bank contact to the private wiper 126, thence to the side switch wiper 137 (which is in second position), through the private magnet springs 176 and 177, through the winding of the release magnet 132, springs 164 and 165 to the battery lead 90, thence through battery B to ground G. The connector switch shaft and side switch are thus released, and connection is not established with the called line. Now, when the calling subscriber presses the signaling button the vertical line relay 127 becomes energized and operates to close the circuit through the vertical magnet 129. The vertical magnet operates to carry the vertical shaft vertically, whereby the off-normal springs 151 and 152 engage to permit a busy-signaling current to pass to the called subscriber in the usual way. Of course, when the subscriber hangs up his receiver after receiving the busy-signal, he grounds the line conductors 33 and 34, as already explained, producing the release of the switching apparatus as formerly.

From the foregoing it will be seen that I provide a common battery system in which party-line subscribers uniformly call the subscribers on the same line by a single movement of the calling dial. In other words, the special ring-back arrangement, such as shown at D, is reached by the first selector as a result of the numerical opera-

tion of the dial to find the particular level to which the ring back is allotted. After the level is found however, the selector switch, as the result of a non-numerical operation, is automatically connected with the ring back which is exclusively for calling between subscribers on the same line. The ordinary common battery connectors having ringer relays can be employed for calling and signaling between different lines. The said ring-back arrangement not only controls the flow of both ringing and talking current to the substations of the party-line, but also controls the trunk-release circuit extending back through the first-selector, in the manner explained.

In the modification shown in Fig. 2 the common relay 35 is omitted. In this system the ring-back arrangement is identical with that shown at D in Fig. 1, but the substation circuit is necessarily changed slightly. In the substations shown in Fig. 2 the ringer push button spring 32 is connected to ground through the springs 15 and 14 instead of through the relay 35, and the ringer circuits in Fig. 2 connect with the rotary line in the various substation instruments, and not at the relay 35 as is the case in Fig. 1. With the apparatus shown in Fig. 2 only two conductors are required between the different substations on a line. When the relay 35 is omitted the release of the exchange apparatus, which would otherwise be brought about upon the called subscriber removing his receiver while the line is still grounded at the signaling button of the calling subscriber, is prevented by the opening of the rotary line at the springs 108 and 107 of the ringer relay 85. If, however, the signaling button at the calling substation is again pressed after the called subscriber has removed his receiver, the exchange apparatus might be prematurely released if the relay 35 is not used.

What I claim as my invention is:—

1. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a ringing apparatus, automatic selectors having one contact level thereof adapted for automatically extending said line into connection with said ringing apparatus, and having other levels thereof adapted for service in calling subscribers on other lines, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station and means for transmitting ringing current from said ringing apparatus via said selectors to said line.

2. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, a special party-line ringing apparatus used only when one subscriber is calling another upon the

same line, automatic means for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, and means for transmitting ringing current from said ringing apparatus via said automatic means.

10 3. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means including automatic connectors for calling from one line to another, means including a special ringing apparatus independent of said connectors, adapted for enabling one party-line subscriber to call another on the same line, without using said connectors, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, said first means comprising a switch for extending connection to said ringing apparatus and means for transmitting ringing current from said ringing apparatus via said switch to the said line.

4. The combination, in a telephone system, of a subscriber's telephone line, automatic means for trunking calling lines into connection with called lines, a plurality of subscribers' stations on one or more of said lines, an automatic ringing apparatus exclusively for use between calling and called subscribers on the same line, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, said automatic means comprising a switch for extending connection to said ringing apparatus, and means for transmitting ringing current from said ringing apparatus via said switch to the said line.

5. The combination in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a rotary calling dial for each subscriber's station, adapted to come to rest after operation thereof for each digit of the called number, means including automatic switches whereby one subscriber's line can be connected with another line, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, and subscribers' transmitters connected to receive current for talking purposes from the exchange or central station.

6. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, a calling dial for each subscriber's station, means necessitating a plurality of movements of the dial when a party-line subscriber calls a subscriber of some other line, automatic means by which subscribers on the same line uniformly call each other by a

single movement of the dial, and subscribers' transmitters connected to receive current for talking purposes from the exchange or central station.

7. The combination, in a telephone system, of means for signaling between subscribers on the same line, said means comprising a pair of line relays, a ringer relay governed by one of said line relays, an automatic switch and a release circuit therefor controlled by the energizing of the line relays simultaneously, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, means for extending said line to said signaling means, and means for transmitting ringing current from said signaling means via said connecting means to said line.

8. The combination, in a telephone system, of means for signaling between subscribers on the same line, said means comprising a pair of line relays, a ringer relay governed by one of said relays, a source of ringing current adapted to be connected for ringing by the energizing of the ringer relay, an automatic switch and a release circuit therefor controlled by the simultaneous energizing of said line relays, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, means for extending said line to said signaling means, and means for transmitting ringing current from said signaling means via said connecting means to said line.

9. The combination, in a telephone system, of means for signaling between subscribers on the same line, said means comprising a pair of line relays, a battery to one pole of which the windings of said relays are connected in multiple, a ringer mechanism governed by one of said line relays, an automatic switch and a trunk-release circuit therefor controlled by the energizing of the line relays simultaneously, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, means for extending said line to said signaling means, and means for transmitting ringing current from said signaling means via said connecting means to said line.

10. The combination, in a telephone system, of means for signaling between subscribers on the same line, said means comprising a pair of line relays, a battery to one pole of which the windings of said relays are connected in multiple, a ringer mechanism governed by one of said line relays, an automatic switch and a trunk-release circuit therefor controlled by the energizing of the line relays simultaneously, means for extending connection to said signaling means, and means for transmitting ringing current from said signaling means via said connecting means to said line, and means

for bridging said battery across the line circuit to supply current for talking purposes to calling and called stations on the same line.

5 11. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a ringing apparatus, automatic selectors having one level thereof adapted for automatically extending
10 ing said line into connection with said ringing apparatus and having other levels thereof adapted for other service, ringers at said stations, each ringer connected via a condenser to one side of the line and switch hook
15 controlled means for disconnecting each ringer separately from the other side of said line, and means for transmitting ringing current from said ringing apparatus to said line via said selectors.

20 12. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus, automatic means for extending
25 said line directly to said ringing apparatus to enable one subscriber to call another on the same line, ringers at said stations, each ringer connected via a condenser to one side
30 of the line and switch hook controlled means for disconnecting each ringer separately from the other side of said line, and means for transmitting ringing current from said ringing apparatus to said line via said automatic means.

35 13. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means including automatic connectors for calling from one line to another, a special
40 ringing apparatus independent of said connectors and adapted for enabling one party-line subscriber to call another on the same line, ringers in said stations, each ringer connected via a condenser to one side of the line and switch hook controlled means for
45 disconnecting each ringer separately from the other side of said line, and means for extending said line to said ringing apparatus, whereby said apparatus may transmit ringing current to the calling line via said last
50 means.

55 14. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means necessitating a calling of the called subscriber's number in calling from one line
60 to another, means for enabling one party-line subscriber to signal another subscriber on the same line responsive to impulses differing in number from those corresponding to the number of the latter, ringers at said
65 stations, each ringer connected via a condenser to one side of the line and switch hook controlled means for disconnecting each ringer separately from the other side of the line.

15. The combination, in a telephone system, of a subscriber's telephone line, automatic means for trunking calling lines into connection with called lines, a plurality of subscribers' stations on one or more of said
70 lines, an automatic ringing apparatus exclusively for use between calling and called subscribers on the same line, means for extending connection from one of said last lines to said automatic ringing apparatus, and means
75 for transmitting signaling current from said ringing apparatus via said extending means to said last line, ringers at said stations, each ringer connected via a condenser to one side of the line and switch hook controlled means
80 for disconnecting each ringer separately from the other side of said line.

16. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a calling dial for
85 each subscriber's station, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, ringers at said stations, each ringer connected via a condenser to one side
90 of the line and switch hook controlled means for disconnecting each ringer separately from the other side of said line.

17. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, a calling dial for each subscriber's station, means necessitating a plurality of movements of the dial when a party-line subscriber calls a subscriber of some other line,
95 automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, ringers at said stations, each ringer connected via a condenser to one side of the line and switch
100 hook controlled means for disconnecting each ringer separately from the other side of said line.

18. The combination, in a telephone system, of a special ring-back arrangement,
110 comprising a pair of line relays, means for reaching the said arrangement, a ringer relay governed by one of said line relays to send ringing current back over said means for signaling between subscribers on the
115 same line, a release circuit for said means controlled by the energizing of the line relays simultaneously, ringers at said stations, each ringer connected via a condenser to one side of the line and switch hook controlled means for disconnecting each ringer
120 separately from the other side of said line.

19. The combination, in a telephone system, of a device for signaling between subscribers' stations on the same line, said device comprising a pair of line relays, means including
125 an automatic switch for reaching said device, a battery to one pole of which the winding of said relays are connected in multiple, a ringer mechanism governed by one of said
130

line relays to send ringing current back over said means for signaling between subscribers on the same line, a trunk-release circuit for said switch controlled by the energizing of the line relays simultaneously, ringers at said stations, each ringer connected via a condenser to one side of the line and switch hook controlled means for disconnecting each ringer separately from the other side of the line.

20. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch controllably from any one of said stations, trunks having terminals in said switch, one or more of said terminals appropriated exclusively for calling between subscribers on the same line, means for controlling said switch to extend a connection over said trunks for signaling back over said switch, ringers at said stations, each ringer connected via a condenser to one side of said line and switch hook controlled means for disconnecting each ringer separately from the other side of said line, a test circuit for one of said trunks, and means in the automatic switch controlled over said test circuit for causing the switch to move away from the terminals of one of said trunks.

21. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch provided with a bank of trunk terminals, one level of said bank being appropriated exclusively for calling between subscribers on the same line, means for controlling said switch to extend a connection over said trunks for signaling back over said switch, ringers at said stations, each ringer connected via a condenser to one side of said line and switch hook controlled means for disconnecting each ringer separately from the other side of said line, test circuits for said trunks, and means in the automatic switch controlled over said test circuits for causing the switch to move away from the terminals of one of said trunks.

22. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus, automatic means for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

23. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means including automatic connectors for calling from one line to another, a special ringing apparatus independent of said connectors and adapted for enabling one

party-line subscriber to call another on the same line, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

24. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means necessitating a calling of the called subscriber's number in calling from one line to another, means for enabling one party-line subscriber to signal another subscriber on the same line responsive to impulses differing in number from those corresponding to the number of the latter, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

25. The combination, in a telephone system, of a subscriber's telephone line, automatic means for trunking calling lines into connection with called lines, a plurality of subscribers' stations on one or more of said lines, an automatic ringing apparatus exclusively for use between calling and called subscribers on the same line, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

26. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a calling dial for each subscriber's station, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

27. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, a calling dial for each subscriber's station, means necessitating a plurality of movements of the dial when a party-line subscriber calls a subscriber of some other line, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

28. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same line, comprising a pair of line relays, a ringer relay governed by one of said line relays, an automatic switch and a release circuit therefor controlled by the energizing of the line relays simultaneously, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

29. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same

line, comprising a pair of line relays, a ringer relay governed by one of said relays, a source of ringing current adapted to be connected for ringing by the energizing of the ringer relay, an automatic switch and circuit therefor controlled by the simultaneous energizing of said line relays for controlling the switch, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

30. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same line, comprising a pair of line relays, a battery to one pole of which the windings of said relays are connected in multiple, a ringer mechanism governed by one of said line relays, an automatic switch and a trunk-release circuit therefor controlled by the energizing of the line relays simultaneously, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

31. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch controllable from any one of said stations, trunks having terminals in said switch, one or more of said terminals appropriated exclusively for calling between subscribers on the same line, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

32. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch provided with a bank of trunk terminals, one level of said bank being appropriated exclusively for calling between subscribers on the same line, and a relay for opening one side of the party-line when one subscriber thereon rings another on the same line.

33. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a ringing apparatus, automatic selectors having one level thereof adapted for automatically extending said line into connection with said ringing apparatus and having other levels thereof adapted for other service, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

34. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus, automatic means for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line, and a relay adapted for opening one side of the party-line and

provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

35. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means including automatic connectors for calling from one line to another, a special ringing apparatus independent of said connectors and adapted for enabling one party-line subscriber to call another on the same line, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

36. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, means necessitating a calling of the called subscriber's number in calling from one line to another, means for enabling one party-line subscriber to signal another subscriber on the same line responsive to impulses differing in number from those corresponding to the number of the latter, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

37. The combination, in a telephone system, of a subscriber's telephone line, automatic means for trunking calling lines into connection with called lines, a plurality of subscribers' stations on one or more of said lines, an automatic ringing apparatus exclusively for use between calling and called subscribers on the same line, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

38. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations on said line, a calling dial for each subscriber's station, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

39. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, other lines, a calling dial for each subscriber's station, means necessitating a plurality of movements of the dial when a party-line subscriber calls a subscriber of some other line, automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial, and a relay

adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

40. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same line, comprising a pair of line relays, a ringer relay governed by one of said line relays, an automatic switch and a release circuit therefor controlled by the energizing of the line relays simultaneously, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

41. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same line, comprising a pair of line relays, a ringer relay governed by one of said relays, a source of ringing current adapted to be connected for ringing by the energizing of the ringer relay, an automatic switch and a circuit therefor controlled by the simultaneous energizing of said line relays for controlling the switch, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

42. The combination, in a telephone system, of a special ring-back arrangement for signaling between subscribers on the same line, comprising a pair of line relays, a battery to one pole of which the windings of said relays are connected in multiple, a ringer mechanism governed by one of said line relays, and automatic switch and a trunk-release circuit therefor controlled by the energizing of the line relays simultaneously, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

43. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch controllable from any one of said stations, trunks having terminals in said switch, one or more of said terminals appropriated exclusively for calling between subscribers on the same line, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

44. The combination, in a telephone system, of a party-line, a plurality of subscribers' stations located on said line, an automatic switch provided with a bank of trunk

terminals, one level of said bank being appropriated exclusively for calling between subscribers on the same line, and a relay adapted for opening one side of the party-line and provided with means for short-circuiting a portion of its own resistance when energized by current from the central station.

45. In a party-line telephone system, a switch having the contacts thereof arranged in levels, a ring-back arrangement accessible only at a certain level for ringing back over said switch, a common battery for talking purposes, and means for controlling the operation of said switch.

46. In a telephone system, a party-line, means including an automatic switch for calling back on said line, means for releasing said switch by simultaneously grounding the two sides of said line, means for grounding one side of said line to signal a subscriber, and means for opening the opposite side of said line during signaling to prevent the release of said switch.

47. In a telephone system, a party-line, means including an automatic switch for calling back on said line, means for releasing said switch by simultaneously grounding the two sides of said line, means for grounding one side of said line to signal a subscriber, and a relay adapted to be energized during signaling to open the opposite side of said line to prevent the release of said switch.

48. In a telephone system, a line, a plurality of subscribers' stations on said line, means for grounding one side of said line to signal a subscriber, a relay adapted to be energized during signaling, and means controlled by said relay for opening the opposite side of said line during the signaling operation to enable one subscriber on said line to signal another subscriber thereon.

49. In a telephone system, a subscriber's line, means for grounding one side of said line to signal the subscriber thereon, a relay having a pair of energizing windings adapted to be energized during signaling, and means controlled by the operation of said relay for opening the opposite side of said line and for short-circuiting one of the windings of said relay.

50. The combination, in a telephone system, of a special ringing arrangement comprising a pair of line relays, means comprising a progressively movable switch for reaching the said arrangement, a ringing relay governed by one of said line relays to send ringing current back over said means for signaling between subscribers' stations on the same line, a circuit for said means controlled by the simultaneous energizing of said line relays for controlling the switch, ringers at said stations, each ringer connected via a condenser to one side of the line

and switch hook controlled means for disconnecting each ringer separately from the other side of said line.

51. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing apparatus, progressively movable central office equipment for said line for establishing connection with said ringing apparatus, said ringing apparatus comprising means for sending ringing current only to the calling line, a central battery, subscribers' transmitters one for each station, said transmitters connected to receive current for talking purposes from said central battery.

52. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing apparatus, progressively movable central office equipment for said line for establishing connection with said ringing apparatus, said ringing apparatus being ready to send ringing current only to the calling line as soon as it is seized by the said switch, and subscribers' transmitters connected to receive current for talking purposes from the central station.

53. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing device and automatic means for extending connection from said line to said ringing device to enable one subscriber to signal another subscriber on the same line by transmitting signaling current via said automatic means to said line, and subscribers' transmitters connected to receive current for talking purposes from the exchange or central station.

54. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a source of ringing current, automatic means for extending a non-inductive connection from said line to said source to enable one subscriber to signal another subscriber on the same line by transmitting signaling current from said source via said automatic means to said line, and subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, a test circuit for said line and means controlled by said automatic means for applying a potential over said test circuit to guard the line against seizure.

55. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing apparatus, progressively movable central office equipment for said line for establishing connection with said ringing apparatus, said ringing apparatus comprising means for sending ringing current to the calling line, a central battery, subscribers' transmitters, one for each station, said transmitters connected to receive current for talking purposes from said central battery, a test circuit for said

line, and means controlled by said equipment for applying a potential over said test circuit to guard the line against seizure.

56. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing apparatus, progressively movable central office equipment for said line for establishing connection with said ringing apparatus, said apparatus being ready to send ringing current to the calling line as soon as it is seized by the said switch, subscribers' transmitters connected to receive current for talking purposes from the central station, a test circuit for said line, and means controlled by said equipment for applying a potential over said test circuit to guard the line against seizure.

57. In a telephone system, a subscriber's line, an automatic switch associated with said line, said switch provided with means for signaling, means for grounding one side of said line to signal the subscriber, and means for opening the other side of said line between the substation and the central office for preventing the switch operating to render the means for signaling inoperative during said signaling.

58. The combination in a telephone system of a line, a plurality of subscribers' stations for said line, a transmitter for each station, a signal for each station connected to the line, an automatic switch associated with the line, means for controlling said switch from any one of said stations, lines having terminals accessible to said switch, means controlled over said lines for operating any one of said signals, means for connecting the transmitter of any signaled station to the line, a central battery for supplying current to any transmitter over said line for talking purposes, a test circuit for said line terminating in said switch, said switch having means controlled over said circuit for causing the switch to move away from the terminals of said line.

59. The combination, in a telephone system, of a line, a plurality of subscribers' stations for said line, a transmitter for each station, a signal for each station connected to the line, an automatic switch associated with the line, means for controlling said switch from any one of said stations, said switch provided with a bank of terminals, trunk-lines terminating in said terminals, certain of said terminals being used for calling between stations on the same line, means controlled over said trunk lines for operating any one of said signals, means for connecting the transmitter of any signaled station to the line, a central battery for supplying current to said transmitter over said line for talking purposes, a test circuit for said line terminating in said switch, said switch having means controlled over said

test circuit for causing the switch to move away from the terminals of said line.

60. In a telephone system, the combination of a plurality of lines, a plurality of stations on each line, an auxiliary line, terminals for said auxiliary line, ringing apparatus controlled over said auxiliary line, progressively movable switching equipment for said lines having access to said terminals for establishing connections with said apparatus whereby said apparatus may be controlled over said lines, said apparatus comprising means for sending ringing current to any one of said lines only over said terminals, and a central battery for supplying current to said lines for talking purposes.

61. In a telephone system, a two conductor line and a signal connected thereto, a two conductor trunk line, a switch controllable over said first line for connecting the two lines, a pair of line relays, a double wound relay and a grounded battery all in series with the two conductors of said trunk line, said relays normally inoperative, a source of signaling current, means under the control of one of said line relays for connecting said source to said trunk line to operate said signal, means for releasing said switch and a circuit for said means controlled jointly by said line relays, means

controlled by said double wound relay for shifting one of its windings from the grounded to the ungrounded pole of said battery, and means for grounding one or both conductors of said line whereby the associated signal may be operated or the said switch released, substantially as described.

62. In a telephone system, the combination of a line, a plurality of subscribers' stations on said line, a ringing device including a source of ringing current, automatic means for extending connection from said line to said source of current to enable one subscriber to signal another subscriber on the same line after said automatic means is operated by transmitting signaling current from said source via said automatic means to said line, subscribers' transmitters connected to receive current for talking purposes from the exchange or central station, and means for connecting said source of current across the line.

Signed by me at Chicago, Cook county, Illinois, this 14th day of September, 1907.

FRITZ LUBBERGER.

Witnesses:

EDWARD D. FALES,
ARTHUR B. SPERRY.