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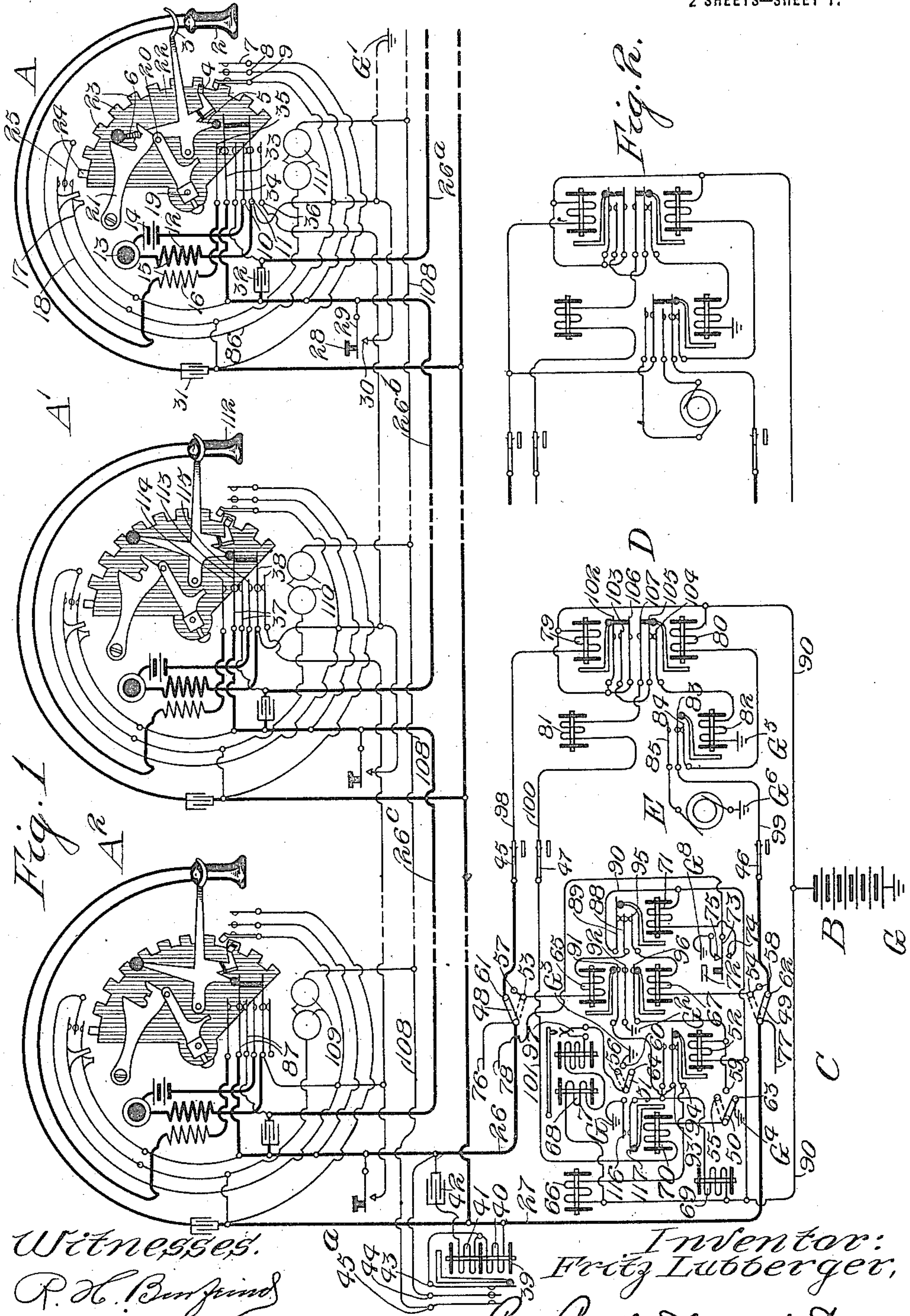
RING BACK ARRANGEMENT FOR TELEPHONE PARTY LINES.

APPLICATION FILED SEPT. 19, 1907. RENEWED JULY 13, 1917.

1,280,256.

Patented Oct. 1, 1918.

2 SHEETS—SHEET 1.



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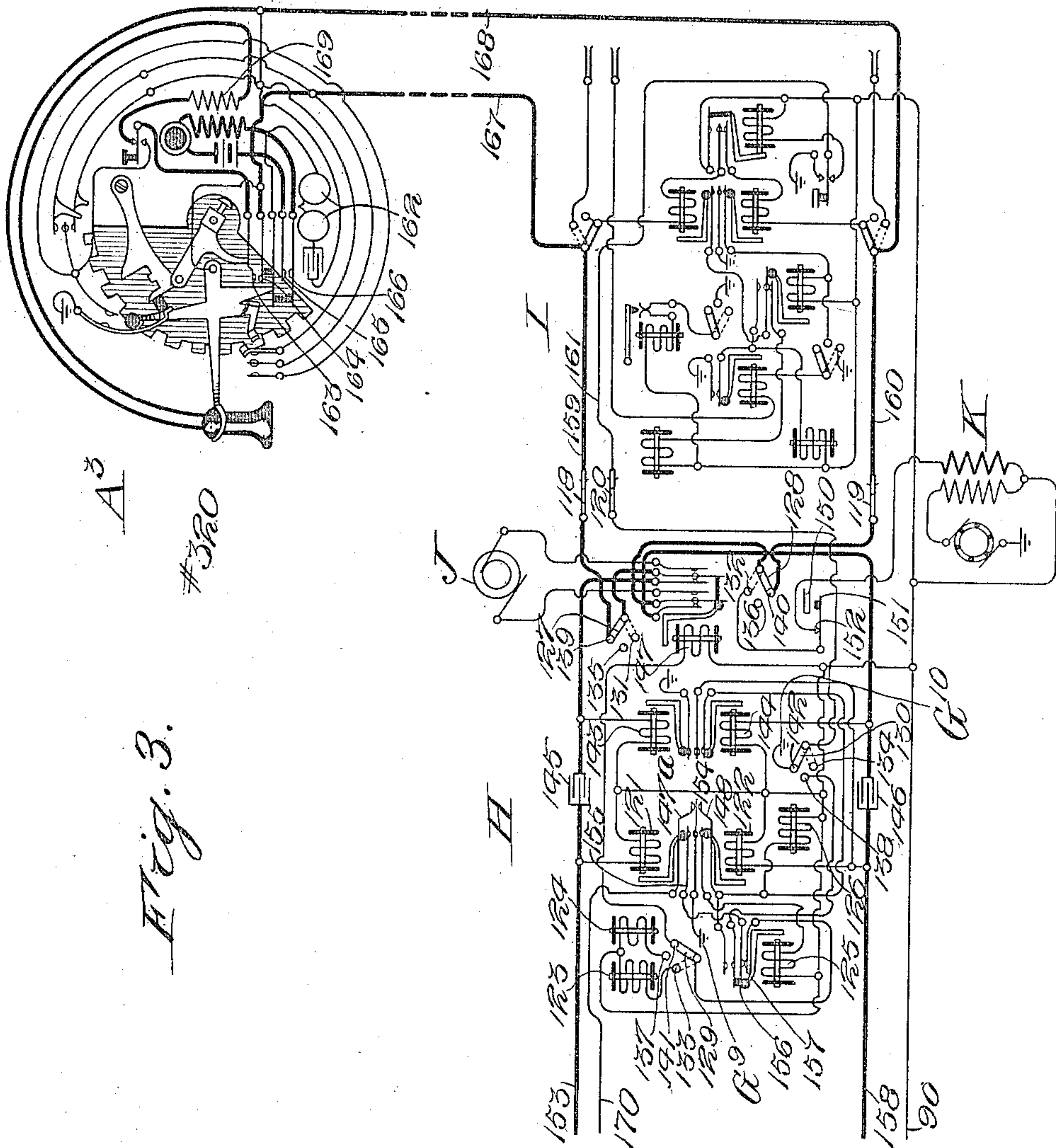
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UNITED STATES PATENT OFFICE.

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RING-BACK ARRANGEMENT FOR TELEPHONE PARTY-LINES.

1,280,256.

Specification of Letters Patent.

Patented Oct. 1, 1918.

Application filed September 19, 1907, Serial No. 393,653. Renewed July 13, 1917. Serial No. 180,481.

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 Telephone Party-Lines, of which the following is a specification.

My invention relates to automatic or semi-automatic telephone exchange systems of that character in which a plurality of subscribers' stations are located on one and the same line.

Generally stated the object of my invention is the provision of improved and highly efficient means for enabling a party-line subscriber to automatically call and signal any other subscriber on the same line.

Special objects are the provision of means whereby the connectors or other automatic switches which are necessary for calling from one line to another are unnecessary when a party-line subscriber desires to call another subscriber on the same line; the provision, in an automatic or semi-automatic party-line system of this character, of means for enabling a calling party-line subscriber to open the operating circuits of all other subscribers' stations located on the same line between his station and the exchange, and for opening the line back of the calling subscriber, thus completely preventing interference by any other subscriber on the same line; the provision of means whereby the ringing circuits of the party-line substations are normally open, and adapted to be closed by the energizing of a relay, which relay is energized by the ringing current; and the provision of certain details and features of improvement and combinations tending to increase the general efficiency of a telephone system of this particular character.

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, and in which the ringing circuit is normally open to prevent the tapping of the ringer bells while call-impulses are being transmitted, and also showing means including a line relay for automatically closing the ringing circuit when the ringing current is

put on the line. At this juncture it will be seen that the substations A, A' and A² are allotted to the common 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 vertical and 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 is shown at B having its positive terminal preferably grounded at G.

In Fig. 2 is shown a modification of the apparatus shown at D. As shown at D the ringer generator is grounded and during signaling ringing current passes out over one side of the line to ground, while in Fig. 2 the ringer generator is not grounded, the ringing circuit being full metallic. I do not, however, limit myself to the use of centralized ringing current. It will be seen that my invention is adapted to systems in which the current for ringing party-line subscribers may be generated at the telephones.

Fig. 3 represents diagrammatically a connector switch H of the general type disclosed in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson. The substation A³ is similar to substations A, A' and A² (Fig. 1) and, as shown, is allotted to the first-selector switch I.

It will be understood that in the central office allotted to the subscribers' lines besides the first-selector switch there may be second-selector switches of the general type shown in said selector patent, and connectors of the general type shown in said connector patent, by means of which the subscribers may establish connection with lines other than their own. For the latter 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 extend trunk-lines leading to the connector switches, as is customary. With my system, however, one level, either in the first or second selector bank, is allotted to the signaling devices, 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 in Fig. 1; and a subscriber, after having operated the central office switches and established connection with the so-called ring-back level, may then cause ringing current to pass back over this line to signal some subscriber occupying the line with him. In Fig. 1 this ring-back level 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 a receiver 2, a switch-hook 3 for controlling the substation circuits, which controlling operations are accomplished through the medium of any suitable means, such as the cam-arms 4, 5 and 6.

As the switch-hook is lowered the cam-arm 4 momentarily presses the release springs 7, 8 and 9 into engagement, whereby the substation line conductors may be grounded simultaneously. When the switch-hook is down the cam-arm 5 disengages the springs 10 and 11, thus breaking the local circuit which includes the primary winding 12, transmitter 13 and local battery 14 in series. The said substation comprises the usual induction-coil 15 having the primary winding 12 and secondary winding 16. Being an automatic substation it is provided with the usual vertical and rotary impulse springs 17 and 18. Said substation is, of course, provided with a dial (not shown) which is secured to the shaft 19, together with the locking dog 20. Furthermore, there is a locking cam 21 that locks the dog while the receiver is on the switch-hook to prevent a rotation of the dial.

For operating the impulse springs 17 and 18 the substation is provided with an impulse wheel 22 that is secured to the shaft 19, which impulse wheel carries on its periphery the so-called vertical impulse teeth 23 and one rotary impulse tooth 24. The said impulse teeth are so arranged that when the dial is drawn down the impulse springs 17 and 18 are not carried into contact with the ground post 25; but as the dial returns, first the vertical teeth engage the vertical impulse spring 17, and after they have completed their work the rotary impulse tooth 24 operates the rotary impulse spring 18. In this operation the subscriber's line conductor 26 is first given a number of ground impulses, and then the rotary line conductor 27 is given one ground impulse. Means whereby the subscriber may signal the called subscriber comprises the push-button 28 and spring 29. When the button 28 is pressed the spring 29 engages the contact point 30, whereby the vertical line conductor 26 may be grounded. Furthermore, the substation is provided with the condenser 31 in the receiver circuit, and the condenser 32 in the vertical line, which latter condenser is normally short-circuited by the springs 33 and 34 when the receiver is on the switch-hook. When the receiver is removed the spring 33 engages the spring 35, whereby the receiver is in series with the secondary winding 16 is bridged across the line conductors. When the receiver is on the switch-hook the spring 11 engages the spring 36, whereby the common ground potential G' is extended to the substations A' and A^2 ; but when the receiver is off the hook and the springs are disengaged, ground is cut off from all the substations on the line between substation A and the exchange. When the springs 33 and 34 are disengaged the short-circuit around the condenser 32 is removed, and the vertical line conductor is opened to all of the substations on the line back of the substation A. This will be clearly understood upon referring to substation A' , where it will be seen that when the springs 37 disengage, the vertical line conductor then extends to the substation A through the condenser; but when the said springs are in contact, a full metallic circuit is provided. Also, when the springs 38 disengage, the common ground G' is then disconnected from the substation A^2 . Thus it will be seen that when the receiver is removed the vertical line conductor is opened to all of the substations on the right, and the ground potential is cut off from all of the substations on the left. As there are no substations on the left of substation A^2 from which this substation should cut off the ground it is, of course, not necessary to have any connection to the lower spring of the hook switch group at the said substation A^2 . To the main line conductors common to the substations A, A' and A^2 there is allotted the ringer circuit controlling relay 39 having the two windings 40 and 41 which are bridged in series with the condenser 42 across the main line conductors 26 and 27. This relay is adapted to be energized by the ringing current, whereby the springs 43, 44 and 45^a are placed in contact. The engagement of the springs 44 and 45^a connects the vertical line conductor 26 with the common ringer conductor, and the engagement of the springs 43 and 44 short-circuits the winding 41 through the condenser 43, leaving the winding 40 across the main line conductors. The reason for short-circuiting the winding 41 is to make the relay slow-acting.

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 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 release magnet is controlled through the next switch with which a connection is then established, and through the private wiper 47, and by means of the back-release relay 70. 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 contact 74 and into engagement with the contact 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, as shown at D, comprises the vertical and rotary line relays 79 and 80 connected with the battery lead. Also, a dead resistance coil 81 is provided in the trunk-release circuit to cut down the flow of current through the release relay 70, which is of one-half ohm resistance. The ringer relay, upon energizing, operates to shift the spring 83 out of engagement with the spring 84 and into engagement with the spring 85, whereby the grounded ringer generator E becomes connected with the line.

The modification shown in Fig. 2 is in all respects similar to the apparatus shown at D in Fig. 1, with the addition of two normally open springs to the relay 82. One of these springs is connected to the vertical side of the line, and the other is connected to the terminal of the generator which was connected to ground in Fig. 1. In this modification, when the ringer relay 82 is energized, the generator E is bridged directly across the line.

The mechanical details of the first-selector and connector, as is well known, are very much the same, although there is some material difference in the circuits. The connector switch shaft (not shown), like the first-selector switch shaft, carries the line wipers 118 and 119 and the private wiper 120. The connector switch is also controlled by the calling subscriber through the medium of the vertical and rotary line relays 121 and 122. The vertical line relay directly controls the vertical magnet 123, and also the rotary magnet 124 and ringer relay 147. The function of the vertical magnet 123 is to give the shaft and shaft wipers their vertical motion, and the rotary magnet 124 imparts to the shaft and shaft wipers a rotary or circular motion. The rotary line relay 122 controls the private magnet 125, which latter, under certain conditions, controls in turn the vertical and rotary magnets 123 and 124, the release magnet 126, and also the side switch wipers 127, 128, 129 and 130. The side switch of the connector, like the side switch of the first-selector, has normal or first-position contact points 131, 132, 133 and 134, second-position contact points 135, 136, 137 and 138, and third-position contact points 139, 140, 141 and 142. The release magnet 126 is also controlled by the line relays 121 and 122 conjointly. By the condensers 145 and 146 the circuit through the connector is divided into two sections. The back-bridge relays 143 and 144 give to the called subscriber means whereby he may release the connector switch which has been connected with his line. The central office is equipped with a busy-signaling apparatus K of any suitable design, as, for example, the one comprising an interrupter in series with the primary winding of the induction-coil, whereby a busy-signaling current is induced in the secondary winding of the said coil. The connector switch shaft also carries a normal post arm 150 which, when the connector shaft is off normal, allows the spring 151 to engage the contact point 152, whereby the busy-signal may be transmitted to the rotary line conductor.

A clearer understanding of the operation of the party-line arrangement thus constructed may be had by following the general operation of the apparatus when one

subscriber calls another. Assume, for example, that the subscriber at substation A desires to signal a subscriber at substation A'. As previously explained, the ring-back arrangement is allotted to the second level of the first-selector bank. Hence, for the subscriber at substation A to signal the subscriber at substation A' he must operate the first-selector C to the second level, and place the line conductors 26 and 27 in connection with the ring-back arrangement D. When the subscriber at substation A removes the receiver from the switch-hook the spring 33 disengages from the spring 34, thereby disconnecting the vertical line conductor 26^b from the vertical line conductor 26^a, and thus leaving the vertical line open to other subscribers on the right of substation A. Also, when the switch-hook rises, the springs 36 and 11 disengage, whereby the common ground G' is disconnected from all the substations at the left of substation A. By this arrangement it will be seen that the substations at the right of substation A cannot interfere with an established connection, since the vertical line conductor is open. The substations on the left may still have their vertical line closed; their ground connection, however, is cut off at substation A, and these substations are also unable to destroy an established connection, as the subscriber at substation A alone controls the main line conductors at this particular time. To call the digit 2 the subscriber at substation A operates the calling device in the well-known manner, and when the dial rotates backward the first-selector C is operated. The number called being 2, the spring 17 is pressed onto the ground post 25 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 common ground G' through the conductor 86 to the ground post 25, thence through the vertical impulse spring 17, vertical conductor 26^b, substation springs 37, vertical conductor 26^c, substation springs 87 to the main line vertical conductor 26, side switch wiper 48, contact point 53, vertical line relay 65, bridge-cut-off springs 88 and 89 to the battery lead 90, thence through battery B to ground G. Each time that the vertical line relay 65 energizes the line relay spring 91 is pressed onto the ground spring 92. The vertical magnet 66 is thereby energized, and the shaft 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 extends from ground G² through the springs 92 and 91, 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 impulse spring 18 is pressed onto the ground post 25, grounding the rotary line conductor 27 and energizing, therefore, the rotary line relay 67 of the selector C. The energizing current passes from ground G' through the conductor 86 to the ground post 25, thence through the impulse spring 18 to the rotary line conductor 27, through the side switch wiper 49, contact point 54, rotary line relay 67, bridge-cut-off 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 line relay spring 96 onto the ground spring 92, thereby establishing a circuit through the private magnet 52 from ground G², through the springs 92 and 96, through the 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, respectively. The closure of connection between the side switch wiper 51 and the contact point 60 sets up an energizing circuit for the rotary magnet 68 extending from ground G² through the interrupter springs 97, winding of the rotary magnet 68 to the battery lead 90, thence through battery B to ground G. The said rotary magnet then operates to rotate the wipers 45, 46 and 47 of the selector into engagement with the first contact of the second level of the selector bank, from which contact it is assumed that 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 private bank contact 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 through the conductor 101, through the winding of 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 contact. 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 main line conductors 26 and 27 are extended to the trunk line conductors 98 and 99 which, in this case, it is assumed lead to the ring-back arrangement D. The extending of the line occurs 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 grounded contact point 63, for protecting the seized trunk line against interference by other calling subscribers. This guarding potential is established from ground G^4 through the contact point 63, side switch wiper 50, back-release relay 70, conductor 101 to the private wiper 47. Furthermore, when the shaft is given a vertical step the normal arm 72 permits the spring 73 to pass out of engagement with the spring 74 and into engagement with the spring 75, whereby a guarding potential is established at the connector bank from ground G^8 through the springs 75 and 73, private normal conductor 78 to the connector bank contacts. This guarding potential protects the calling line against seizure by any subscriber desiring to establish connection with this line. 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. To signal the subscriber at substation A' the subscriber at substation A presses the button 28, whereby an energizing circuit is closed through the vertical relay 79 of the ring-back arrangement D. This circuit extends from ground G' through the contact point 30, spring 29, vertical conductor 26^b , through the substation springs 37, conductor 26^c , springs 87 to the main line vertical conductor 26, side switch wiper 48, shaft wiper 45, trunk conductor 98, through the vertical relay 79 to the battery lead 90, thence through battery B to ground G. When the vertical line relay 79 energizes, the springs 102 and 103 are then pressed into contact, thereby in turn closing an energizing circuit through the ringer relay 82. This circuit extends from ground G^5 through the relay 82, springs 104 and 105, springs 103 and 102 to the battery lead 90, thence through battery B to ground G. When the relay 79 energizes, then the springs 106 and 107 do not engage. The engagement of these springs occurs only when both the vertical and rotary line relays 79 and 80 are energized simultaneously, as in releasing. The ringer relay, upon energizing, operates to place the springs 83 and 85 in contact, whereby the ringer generator E becomes connected with the rotary line conductor 99. Generator cur-

rent now passes from ground G^6 through the generator E, springs 85 and 83, through the conductors 99 and 27, windings 40 and 41 of the double-wound coil 39, condenser 42 to the vertical line conductor 26, thence through the substation springs 87, vertical conductors 26^c and 26^b , through the push-button spring 29, contact point 30 to ground G' . The relay 39 energizes and places the springs 43, 44 and 45^a in contact. By the engagement of the springs 44 and 45^a all the ringers of the substations A, A' , A^2 , etc., become connected with the vertical line conductor 26, thus establishing a second path for the ringer current. This path extends from the generator E through the conductors 99 and 27, thence through the ringers 109, 110 and 111 in multiple to the ringer conductor 108, through the springs 45^a and 44 to the vertical line conductor 26, through the substation springs 87, conductors 26^c and 26^b , through the push-button springs 29 and 30 to ground G' . The subscriber at substation A' , upon recognizing his signal, which may be two rings, removes the receiver 112 from the switch-hook, whereby his secondary circuit, upon the engagement of the springs 113 and 114, becomes bridged across the line conductors in multiple with the receiver circuit of substation A. The primary circuit is closed when the spring 38 engages the spring 115. It will also be noted that when the relay 39 energizes, then the spring 43 engages the spring 44, thereby short-circuiting the winding 41 and the condenser 42, as aforesaid, leaving the winding 40 across the line conductors 26 and 27. This arrangement is provided in order to prevent the relay 39 from chattering when ringing current passes over the line, as explained. As already pointed out, the shunting of the winding 41 prevents the relay 39 from responding too quickly to the ringing current. The two subscribers being thus connected conversation may be carried on in the usual manner. The release of the central office switching apparatus is brought about by the subscriber who last restores his receiver to the switch-hook, who, it will be assumed, is subscriber A. When the switch-hook is lowered the cam-arm 4 momentarily presses the release springs 7, 8 and 9 into contact, whereby an energizing circuit is momentarily established through the vertical and rotary relays 79 and 80. This circuit extends from ground G' through the release springs 9, 8 and 7 to the vertical and rotary line conductors 26 and 27, through the relays 79 and 80 to the battery lead 90, thence through battery B to ground G. The said relays, upon energizing simultaneously, press the springs 102 and 103, and 106 and 107, into contact, whereby an energizing circuit is completed through the back-release relay 70 at the selector switch C. This cir-

cuit extends from ground G^4 through the side switch wiper 50, back-release relay 70, conductor 101 to the shaft wiper 47, conductor 100, thence through the dead resistance coil 81, springs 107 and 106 to the battery lead 90, thence through battery B to ground G. The back-release relay 70, upon energizing, places the springs 116 and 117 in contact, which in turn closes an energizing circuit through the release magnet 69 extending from ground G^7 through the winding of the release magnet 69 to the battery lead 90, thence through battery B to ground G. All the relays and magnets thus energized retain their armatures attracted until the release springs 7, 8, and 9 are separated, whereupon by the deenergization of the release magnet 69 the selector C is restored to normal in the usual and well understood manner.

In the foregoing it has been shown how a subscriber may signal another subscriber on his own line. If he desires to call some other subscriber not on the same line, the central office switches, including the selectors and connector, are operated in the usual manner to establish connection with the desired line.

To call the number 320 (substation A^3) the subscriber at substation A removes the receiver from the switch-hook and operates the calling device once in the well-known manner for each digit. For the first digit the first-selector switch C is operated to seize an idle trunk-line leading to a connector switch H. The impulses for the last two digits are directed toward the connector switch H, which operates to place the shaft wipers in connection with the contacts corresponding to the desired line. The first digit being 3 the vertical line conductor 26 is grounded three times, and as a result the vertical line relay of the selector C is energized, and in turn the vertical magnet which operates to raise the shaft wipers three steps. When the rotary line conductor 27 is grounded the rotary line relay is energized, and the private magnet is in turn operated to release the side switch from first to second position. The rotary magnet now operates to carry the shaft wipers into engagement with an idle trunk-line which leads to the connector switch H. The grounding of the line conductors 26 and 27 for the last two digits affects the connector by operating the vertical and rotary line relays 121 and 122. When the vertical line conductor 26 is grounded the vertical line relay 121 is energized by a flow of current from the substation ground G' over the conductor 26, side switch wiper 48 and line wiper 45 to the trunk conductor 153, vertical line relay 121 to the battery lead 90, thence through battery B to ground G. The vertical line relay, upon energizing, operates to place the

springs 154 and 155 in contact, whereby an energizing circuit is established through the vertical magnet 123 extending from ground G^9 through the springs 154 and 155, private magnet springs 156 and 157, through the side switch wiper 129, contact point 133, vertical magnet 123 to the battery lead 90, thence through battery B to ground G. Each time that the vertical line relay 121 operates for the second digit the vertical magnet 123 operatively energizes to carry the shaft wipers 118, 119 and 120 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 substation #320. When the rotary line conductor 27 is grounded, following the grounding of the vertical line conductor, the connector rotary line relay 122 becomes energized over a circuit extending from the substation ground G' through the conductor 27, side switch wiper 49, line wiper 46, rotary trunk conductor 158, rotary line relay 122 to the battery lead 90, thence through battery B to ground G. The rotary line relay, upon energizing, operates to close an energizing circuit through the private magnet 125, 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 26 ten times and the rotary line conductor 27 once. The connector vertical and rotary line relays 121 and 122 are operated over previously traced circuits. However, when the vertical line relay operates a circuit is closed through the rotary magnet 124 instead of through the vertical magnet 123, since the side switch wiper 129 is now in second position. Each time that the rotary magnet is energized the shaft wipers 118, 119 and 120 are rotated one step at a time until the said wipers are carried into engagement with the normal conductors 159, 160 and 161, the first two of which lead to the line terminals of the desired substation. The rotary line relay 122, upon energizing, completes an energizing circuit through the private magnet 125 as before, which latter now operates with one of two results, namely the release of the side switch from second to third 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 127 and 128 are placed in connection with the shaft wipers 118 and 119, respectively. Furthermore, when the side switch passes to third position a guarding potential is established for protecting the called line. This guarding potential extends from ground G^{10} through the side switch wiper 130 to the shaft wiper 120

which engages the private bank contact of the called line.

A continuation of the above circuit may be traced by way of conductor 161, the normally closed off-normal springs, and through the bridge cut-off relay to the battery lead 90, thence through battery B to ground G. The energization of the bridge cut-off relay removes the line relay bridge from the called line. In order to signal, the subscriber at substation A presses the signaling button, whereby the vertical line relay 121 becomes energized as before. It will be assumed that the side switch has passed from second to third position and that the side switch wiper 129 is in engagement with the contact point 141, thereby placing the vertical line relay 121 in control of the ringer relay 147 in the same manner in which the rotary magnet 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 147 is energized by a flow of current from ground G⁹ through the springs 154 and 155, private magnet springs 156 and 157, side switch wiper 129, contact point 141, through the ringer relay 147 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 J across the normal conductors 159 and 160. A signaling current is, therefore, sent through the substation ringer 162. As soon as the calling subscriber ceases to press the signaling button the ringer relay becomes deenergized, and the springs assume their normal position. In response to the signal the subscriber at substation #320 removes the receiver from the switch-hook, thereby permitting the springs 163 and 164, and 165 and 166 to engage. The engagement of the springs 165 and 166 closes a local transmitter circuit, and the engagement of the springs 163 and 164 bridges the receiver in series with the secondary winding 169 across the line conductors 167 and 168. The two substations A and A³ are now connected and conversation may be carried on over the circuits shown by the heavy line conductors in Figs. 1 and 3. The release of the switching apparatus is brought about when the calling subscriber restores the receiver 2 to the switch-hook 3 and presses the springs 7, 8 and 9 into contact, whereby an energizing circuit is momentarily established through the vertical and rotary line relays 121 and 122 of the connector H. The said relays, upon energizing, simultaneously press the springs 147^a and 148 into contact, thereby closing an energizing circuit through the back-release relay 70 of the selector C and release magnet 126 of the connector H. This circuit extends from ground G⁴ through

the side switch wiper 50, back-release relay 70, shaft wiper 47, conductor 170, trunk-release springs 147^a and 148, release magnet 126 to the battery lead 90, thence through battery B to ground G. The release magnet 126, upon energizing, operates to restore the switch shaft wipers 118, 119 and 120 and the side switch wipers to normal position. The back-release relay 70 being included in this circuit also energizes and places the springs 116 and 117 in contact, which in turn closes an energizing circuit through the release magnet 69 extending from ground G⁷ through the winding of the release magnet 69 to the battery lead 90, thence through battery B to ground G. By the energization and subsequent deenergization of the release magnet 69 the selector C is restored to normal as previously explained.

From the foregoing it will be seen that I provide an arrangement which enables one subscriber on a party-line to call another subscriber on the same line without using the connectors which are necessary when a call is made from one line to another. A single movement of the calling subscriber's dial is sufficient to bring about an automatic connection with a special ring-back arrangement, and the calling subscriber is thus given control of the ringing current without the necessity of calling back on his line through the medium of a connector. If the trunk leading to the ring-back arrangement is arranged to terminate in a certain level of the first-selectors, then it is not even necessary for a calling party-line subscriber to use second-selectors in calling another subscriber on the same line. After one subscriber has called another on the same line, or after one subscriber on the party-line has called some subscriber on another line, all of the subscribers on the same party-line are precluded from interfering, as provision is made for either cutting off their ground connections, or opening up the line back of the calling subscriber. The ringing circuits of the different substations are all normally open, as explained, and closure of these circuits is contingent upon the actual presence of ringing current in the line circuits. The second or parallel circuit through the relay 39 prevents the latter from chattering, as the induced current in this circuit will obviously be out of phase with the current flowing in the circuit which includes the winding 40, and thus a practically continuous and steady energizing of this relay is obtained whenever ringing current is projected onto the line.

The trunks leading to the ring-back arrangements are multiplied through the corresponding bank contacts of a group of selector switches in the same well-known manner as that employed when these trunks lead to selector switches or connectors. By this

method of connection a number of ring-back arrangements are common to a group of selectors, and any selector of the group may establish connection with the first idle ring-back arrangement.

What I claim as my invention is:—

1. In a telephone system, a party line, a plurality of subscribers' stations on said line, a signal for each station, a ringing apparatus, a line for said ringing apparatus, an automatic selector switch having one level thereof adapted for automatically extending said party line into connection with said ringing apparatus over said second line and having other levels thereof adapted for service in extending trunk connections to subscribers on other lines, a source of signaling current, and a relay normally connected with said second line for controlling said ringing apparatus to operate one of said signals by transmitting current from said source over the conductor of the second line to which said relay is connected and through said selector switch.

2. In a telephone system, a party line, a plurality of subscribers' stations located on said line, signals for said stations, a ringing apparatus, a line for said apparatus, an automatic selecting switch including means having a plurality of relays for connecting said party line directly with said ringing apparatus over said second line to enable one subscriber to call another on the same party line, a source of signaling current, and a relay normally connected with said second line for controlling said apparatus to operate said signals by transmitting current from said source over a conductor of said second line to which said relay is connected and over conductors of said selector switch.

3. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, other lines, a source of signaling current, means including automatic connector switches for calling from one line to another, means for finding idle connectors, and means comprising a signaling apparatus independent of connector switches for enabling one party-line subscriber to call another on the same line by applying signaling current from said source to said line.

4. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, other lines, a calling impulse device, means necessitating the operation of said device in accordance with the digits of the called subscriber's number in calling from one line to another, and means for enabling one party-line subscriber to signal another subscriber on the same line by current from the central station, without calling the number of the latter, said means having a plurality of relays.

5. In a telephone system, 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, and an automatic ringing apparatus exclusively for use between calling and called subscribers on the same line.

6. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, a ringing circuit for each station, a relay common to said stations normally connected to said line and controlling the ringing circuits thereof, and means by which the said relay is energized by a ringing current from the central station to close the ringing circuits of all said stations.

7. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, normally open ringing circuits for said substations, a relay common to the said stations and controlling the ringing circuits thereof, means for energizing said relay by the ringing current to close said circuits, and a special ringing apparatus exclusively for use between calling and called subscribers on the same line.

8. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, a normally open ringing circuit for each station, a relay common to the said stations for controlling the ringing circuits thereof, means for energizing said relay by a ringing current over a circuit including a condenser, and means operated by the energizing of the relay for short-circuiting a portion of the winding thereof and said condenser.

9. In a telephone system, a relay, a source of alternating current for energizing said relay over a circuit including a condenser, and contacts controlled by the armature of said relay for closing a short-circuit around a portion of the winding thereof and said condenser.

10. In a telephone system, a relay, a source of alternating current for energizing the same over a circuit of given capacity and self induction, and means directly controlled by the armature of said relay and operated by the energizing of said relay for closing another energizing circuit therefor having a different capacity.

11. In a telephone system, a relay, a source of alternating current for energizing said relay over one circuit, and means operated by the energizing of said relay for closing another energizing circuit therefor, together with provisions for putting the current in one circuit out of step with the current in the other circuit, for the purpose set forth.

12. In a telephone system, a subscriber's line, a relay and a condenser bridged in series across said line, means by which a sub-

scriber calling said line energizes said relay, and signaling means at the called subscriber's station controlled by said relay.

13. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, means by which an intermediate subscriber disconnects all subscribers' stations in front of him from the ground, means by which the same calling subscriber opens the line back of him, and means including a common source of ringing current by which one subscriber signals another.

14. A telephone system comprising a party-line, a plurality of subscribers' stations located on said line, a condenser in the line for each station, a hook-switch for each station normally short-circuiting the condenser thereof, each short-circuit adapted to be opened by the removal or taking down of the associated receiver.

15. In a telephone system, a party-line, a plurality of subscribers' stations on said line, a rotary calling dial for each subscriber's station, means for variably limiting the rotation of said dial, and automatic means having vertical and rotary motion by which subscribers on the same line uniformly call each other by a single movement of the dial.

16. In a telephone system, 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, and automatic means by which subscribers on the same line uniformly call each other by a single movement of the dial.

17. In a telephone system, an automatic switch for use in extending a connection from a calling to a called subscriber's line, 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, a release circuit for said automatic switch controlled by the energizing of the line relays simultaneously, and means for signaling subscribers on other lines.

18. In a telephone system, 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, a circuit controlled by the simultaneous energizing of said line relays, and switching means controlled by said circuit.

19. In a telephone system, an automatic switch for use in extending a connection from a calling to a called subscriber's line, a special ring-back arrangement for signaling between subscribers on the same line, com-

prising 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, a release circuit for said automatic switch controlled by the energizing of the line relays simultaneously, and means for signaling subscribers on other lines.

20. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, an automatic switch controllable from any one of said stations, other automatic switches for extending a connection to a called line, trunks having terminals in said first-mentioned switch, one or more of said terminals appropriated exclusively for calling between subscribers on the same line, and other trunks thereof leading to said other switches.

21. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, and an automatic vertical and rotary motion 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 the other levels being adapted for use in calling subscribers on other lines.

22. In a telephone system, the combination of a party-line, a plurality of subscribers' stations on said line, a ring-back apparatus, automatic selectors having one level of contacts thereof adapted for automatically extending said line into connection with said ringing apparatus, and having other levels thereof adapted for service in extending trunk connection to subscribers on other lines, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

23. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus, automatic vertical and rotary motion means for connecting said line directly with said ringing apparatus, to enable one subscriber to call another on the same line, a local battery for each subscriber's station, a central battery for operating said automatic means, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

24. In a telephone system, the combination 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, without using said connectors, a local

battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

25. In a telephone system, the combination 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 without calling the number of the latter, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers removed their receivers.

26. In a telephone system, the combination 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, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

27. In a telephone system, the combination of a party line, a plurality of subscribers' stations located on said line, a ringing circuit for each station, a relay common to said stations and controlling the ringing circuits thereof, means by which the said relay is energized by a ringing current to close the ringing circuits of all said stations, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

28. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, normally open ringing circuits for said substations, a relay common to the said stations and controlling the ringing circuits thereof, means for energizing said relay by the ringing current to close said circuits, a special ringing apparatus exclusively for use between calling and called subscribers on the same line, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

29. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a normally open ringing circuit for each station, a relay common to the said stations for controlling the ringing circuits thereof, means for energizing said relay by a ringing current over a circuit including a condenser, means operated by the energizing of the relay for short-

circuiting a portion of the winding thereof and said condenser, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

30. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, means by which an intermediate subscriber disconnects all subscribers' stations in front of him from the ground, means by which the same calling subscriber opens the line back of him, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

31. In a telephone system, the combination of a party-line, a plurality of subscribers' substations located on said line, a condenser in the line for each station, a hook-switch for each station normally short-circuiting the condenser thereof, each short-circuit adapted to be opened by the removal or taking down of the associated receiver, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

32. In a telephone system, the combination 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, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

33. In a telephone system, the combination 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, a local battery for each subscriber's station, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

34. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, an automatic switch having vertical and rotary motion 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, means for mov-

ing said switch so as to select any of said terminals, a local battery for each subscriber's station, a central battery for operating said switch, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

35. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a calling mechanism at each station adapted to come to rest after each digit of any called number, an automatic switch provided with a bank of trunk terminals comprising a plurality of levels, one level of said bank being appropriated exclusively for calling between subscribers on the same line, a local battery for each subscriber's station, a central battery for operating said switch, a normally open circuit for each local battery, and means for closing the said local circuits when the subscribers remove their receivers.

36. In a telephone system, the combination of a party-line, a plurality of subscribers' stations on said line, a ringing apparatus, automatic selectors comprising a plurality of contacts arranged in levels and having one level thereof adapted for automatically extending said line into connection with said ringing apparatus, and having other levels thereof adapted for service in trunking to other lines, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

37. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus, automatic means having vertical and rotary motion for connecting said line directly with said ringing apparatus, to enable one subscriber to call another on the same line, a ringing key for each subscriber's station on the party-line, a common ground normally disconnected from all of said ringing keys, and a relay for controlling said ground.

38. In a telephone system, the combination 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 subscribed to call another on the same line, a ringing key for each subscriber's station on the party-line, a common ground normally disconnected from all of said ringing keys, and a relay for controlling said ground.

39. In a telephone system, the combination 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, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

40. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a ringing circuit for each station, a relay common to said stations and controlling the ringing circuits thereof, means by which the said relay is energized by a ringing current to close the ringing circuits of all said stations, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

41. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, normally open ringing circuits for said substations, a relay common to the said stations and controlling the ringing circuits thereof, means for energizing said relay by the ringing current to close said circuits, a special ringing apparatus exclusively for use between calling and called subscribers on the same line, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

42. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a normally open ringing circuit for each station, a relay common to the said stations for controlling the ringing circuits thereof, means for energizing said relay by a ringing current over a circuit including a condenser, means operated by the energizing of the relay for short-circuiting a portion of the winding thereof and said condenser, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

43. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, means by which an intermediate subscriber disconnects all subscribers' stations in front of him from the ground, means by which the same calling subscriber opens the line back of him, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

44. In a telephone system, the combination of a party-line, a plurality of subscribers' substations located on said line, a condenser in the line for each station, a hook-switch for each station normally short-circuiting the condenser thereof, each short-circuit adapted to be opened by the removal or taking down of the associated receiver, a ring-

ing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

45. In a telephone system, the combination 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, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

46. In a telephone system, the combination 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, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys.

47. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a calling mechanism at each station adapted to come to rest after each digit of any called number, 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, a ringing key for each subscriber's station on the line, a common ground normally disconnected from all of said ringing keys whereby any station calls another, and a relay for controlling said ground.

48. In a telephone system, the combination of a party-line, a plurality of subscribers' stations located on said line, a calling mechanism at each station adapted to come to rest after each digit of any called number, an automatic switch provided with a bank of trunk terminals comprising a plurality of levels, one level of said bank being appropriated exclusively for calling between subscribers on the same line, a ringing key for each subscriber's station on the party-line, and a common ground normally disconnected from all of said ringing keys, whereby any station calls another.

49. In a telephone system, a plurality of subscribers' lines including one or more party-lines, means on said party lines for transmitting a plurality of series of impulses for extending a connection from said lines to a second line, and means for transmitting a single series of impulses for establishing a connection with another subscriber on the same line.

50. In a telephone system, a plurality of

party lines, a plurality of subscribers' stations on each line, signals for said stations, ringing apparatus less in number than said lines, a line for said apparatus, automatic selecting switches for connecting said party lines to said ringing apparatus to enable one subscriber to call another on the same party line, and a relay normally connected with said second line for controlling said apparatus to operate said signals by transmitting signaling current over the conductor of said second line to which said relay is connected and through said selector switch.

51. In a telephone system, a party-line, a plurality of subscribers' stations located on said line, a ringing apparatus comprising a ringing generator and a plurality of relays for controlling the ringing circuit, said ringing apparatus being normally disconnected from said line, and automatic means for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line.

52. In a telephone system, a party line, a plurality of subscribers' stations on said line, a ring back 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 service in extending trunk connection to subscribers on other lines, and means for transmitting ringing current from said ring back apparatus via said selectors to said line.

53. In a telephone system, a party line, a plurality of subscribers' stations located on said line, a special party line ringing apparatus, an automatic selecting switch including means having a plurality of relays for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line, and means for transmitting ringing current from said ringing apparatus via said switch.

54. In a telephone system, 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 for finding idle connectors, a special ringing apparatus located at the central station independent of said connectors and adapted for enabling one party line subscriber to call another on the same line, 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 said line.

55. In a telephone system, a vertical and rotary motion switch, a party line ring back arrangement accessible only at a particular bank level of said switch, and means for transmitting ringing current from said ring back arrangement via said switch.

56. In a telephone system, a plurality of

party lines, a plurality of subscribers' stations on each line, ringing apparatus less in number than said lines, automatic selecting switches for connecting said lines with said ringing apparatus to enable one subscriber to call another on the same line, and means for transmitting ringing current from said ringing apparatus via said switches to said lines.

57. In a telephone system, a party line, a plurality of subscribers' stations located on said line, a ringing apparatus comprising a ringing generator and a plurality of relays for controlling the ringing circuit, said ringing apparatus being normally disconnected from said line, automatic means for connecting said line directly with said ringing apparatus to enable one subscriber to call another on the same line, and means for transmitting ringing current from said ringing apparatus via said automatic means.

58. In a telephone system, a party line, a switch having bank contacts divided into groups, a party line ring back apparatus accessible from said party line only through a particular group of said bank contacts, and means for transmitting ringing current from said ring back apparatus via said switch to said line.

59. In a telephone system, a line, a plurality of subscribers' stations on said line, signals for said stations, a signaling apparatus, a source of signaling current, an automatic selecting switch for said line for connecting said line with said signaling apparatus, and means in said apparatus for transmitting signaling current from said source back over said connection via said switch to said line to operate said signals.

60. In a telephone system, a party line, a plurality of subscribers' stations located on said line, signals for said stations, a ringing apparatus normally disconnected from said line and comprising a ringing generator and a plurality of relays, a line associated with said ringing apparatus, and automatic means for connecting said party line directly with said ringing apparatus over said second line to enable one subscriber to call another on the said line, one of said relays normally connected with said second line for controlling said ringing apparatus to operate said signals by transmitting current from said generator over the conductor of said second line to which said relay is connected and through said selector switch.

61. In a telephone system, a line, a second line, conductors for said second line, a signal for said first line, means for extending a connection to said second line, signaling equipment for said second line, a source of signaling current, a relay normally connected with the conductor of said second line for controlling said equipment to operate said signal by transmitting current from said source back

over the conductor of said second line to which said relay is connected and back over said extended connection.

62. In a telephone system, a line, a signal therefor, a second line, a switch, means for controlling the said switch over said first line to connect the two lines, a source of current for signaling purposes and a relay energized over said second line to control the connection of said source to said second line through said switch, whereby said signal may be operated.

63. In a telephone system, a line, a signal connected thereto, a second line, a switch, means for controlling said switch over said first line to connect the two lines, a source of signaling current, a pair of relays controllable over said second line, a third relay for controlling said source from said second line to operate said signal, and a circuit for said third relay including contacts of each relay of said pair.

64. In a telephone system, a party line, a plurality of subscribers' stations located on said line, other lines, a source of signaling current, means including automatic connector switches for calling from one line to another, means for finding idle connectors, means comprising a signaling apparatus for enabling one party line subscriber to call another on the same line by applying signaling current from said source to said line without operating any one of said connectors.

65. In a telephone system, a party line, a plurality of subscribers' stations located on said line, other lines, a source of signaling current, means including automatic connector switches for calling from one line to another, means for finding idle connectors, means comprising a signaling apparatus for enabling one party line subscriber to call another on the same line by applying signaling current from said source to said line without making use of any one of said connectors.

66. In a telephone system, a first line, a plurality of stations on said line, another line, an automatic progressively movable switch having a terminal of said first line whereby said other line calls the first line, and means whereby any station on the first line signals any other station on said first line without calling the number of said first line.

67. In a telephone system, a first line, a plurality of stations on said line, another line, progressively movable automatic switches having a terminal of said first line whereby said other line calls the first line via said terminal in accordance with the number of said first line, and means whereby any station on the first line signals any other station on said first line without calling the number of said line.

68. In a telephone system, party lines, a series of automatic switches at the exchange

controllable from any substation on a calling line to extend a connection to a called line, a set of normally closed contacts at each substation on the calling line, and
 5 means at the calling substation for closing a control circuit for said switches including the said contact sets at all the other substations on the same line in series.

69. In a telephone system, party lines, a
 10 series of automatic switches at the exchange controllable from any substation on a calling line to extend a connection to a called line, two series of normally closed contact sets at the substations on the calling line,
 15 and means at the calling substation for closing a control circuit for said switches including contact sets in both of said series.

70. In a telephone system, a party line, two conductors extending through all the
 20 substations on said line in series, automatic switches at the exchange, and means at a calling substation for closing a control circuit for said switches including a portion of one of said conductors and a portion of
 25 the other conductor corresponding to the unused portion of the first conductor.

71. In a telephone system, a party line, two conductors extending through all the
 30 substations on said line in series, automatic switches at the exchange, and means at a calling substation for closing a control circuit for said switches including a portion of each conductor and for disconnecting the unused portion of each conductor from the
 35 said control circuit.

72. In a telephone system, a party line, two conductors extending through all the
 40 substations on said line in series, automatic switches at the exchange, means at a calling substation for disconnecting a portion of one conductor extending to a second substation and for disconnecting a portion of
 45 the other conductor extending to a third subscriber, and means at the said calling substation for connecting the remaining portions of said conductors together to control said switches.

73. In a telephone system, a series of substations connected by a line with the central
 50 exchange, two conductors of said line extending in opposite directions through said series of substations and terminating at opposite ends of the series, automatic switches at the exchange, and means at any
 55 substation intermediate in the series for opening both conductors and for connecting the exchange ends thereof together to complete a control circuit for said switches.

74. In a telephone system, a series of substations connected by a line with the cen-

tral exchange, two conductors of said line extending in opposite directions through said series of substations and terminating at opposite ends of the series, a series of
 65 automatic switches at the exchange successively operable to extend a connection from said line, and means at any substation intermediate in the series for opening both conductors and for connecting the live or
 70 exchange ends thereof together to complete a control circuit for said switches.

75. In a telephone system, a series of substations connected by a line with the central exchange, two conductors of said line extending in opposite directions through
 75 said series of substations and terminating at opposite ends of the series, automatic switches at the exchange, means at any substation intermediate in the series for opening both conductors and for connecting the
 80 exchange ends thereof together to complete a control circuit for said switches, and a third conductor of said line connected in multiple to all of said stations and adapted to be included with one of said other con-
 85 ductors in a talking circuit.

76. In a telephone system, a series of substations connected by a line with the central exchange, two conductors of said line extending in opposite directions through
 90 said series of substations and terminating at opposite ends of the series, a series of automatic switches at the exchange successively operable to extend a connection from said line, means at any substation interme-
 95 diate in the series for opening both conductors and for connecting the live or exchange ends thereof together to complete a control circuit for said switches, and a third conductor of said line connected in mul-
 100 tiple to all of said stations and adapted to be included with one of said other conductors in a talking circuit.

77. In a telephone system, line conductors, a plurality of subscribers' stations consec-
 105 utively arranged, switch contacts at each of said stations and within the control of the subscriber at said station, each station being connectible to one of said line conductors through switch contacts controlled at
 110 the preceding station, and connectible to the other of said line conductors through switch contacts controlled at the succeeding station.

Signed by me at Chicago, Cook county, Illinois, this 4th day of September, 1907.

FRITZ LUBBERGER.

Witnesses:

ALVINA B. NURNBERG,

EDWARD D. FALES.