

1,263,010.

Patented Apr. 16, 1918.
3 SHEETS—SHEET 1.

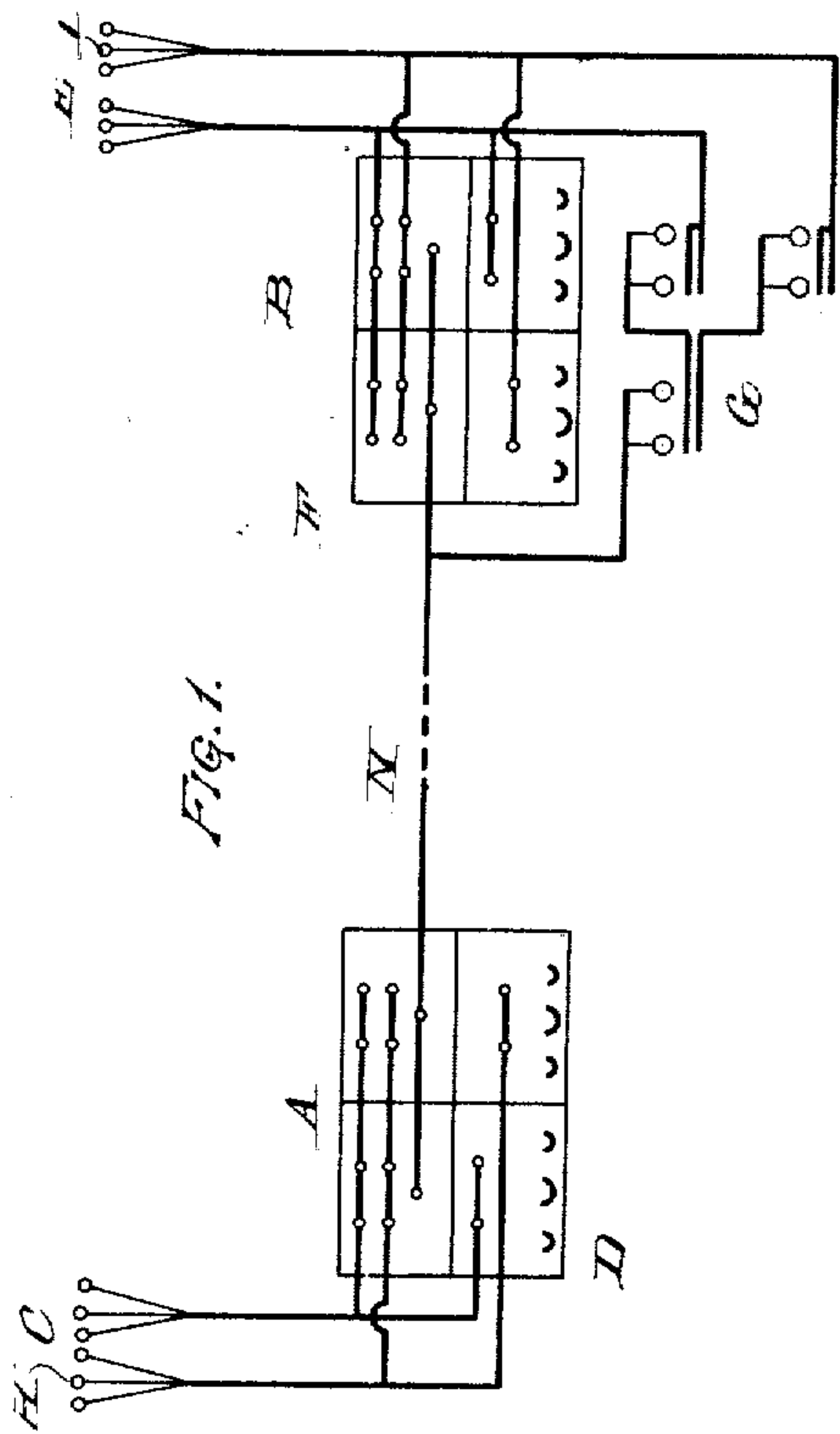


FIG. 1.

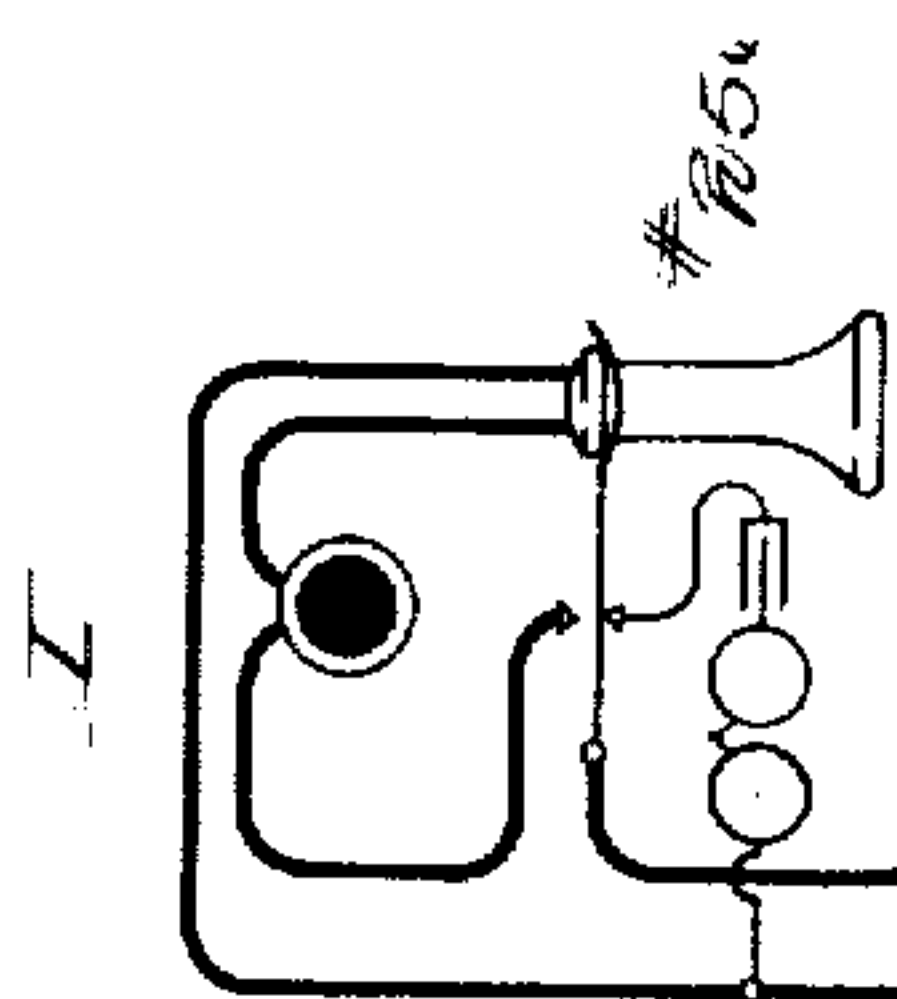


FIG. 2.

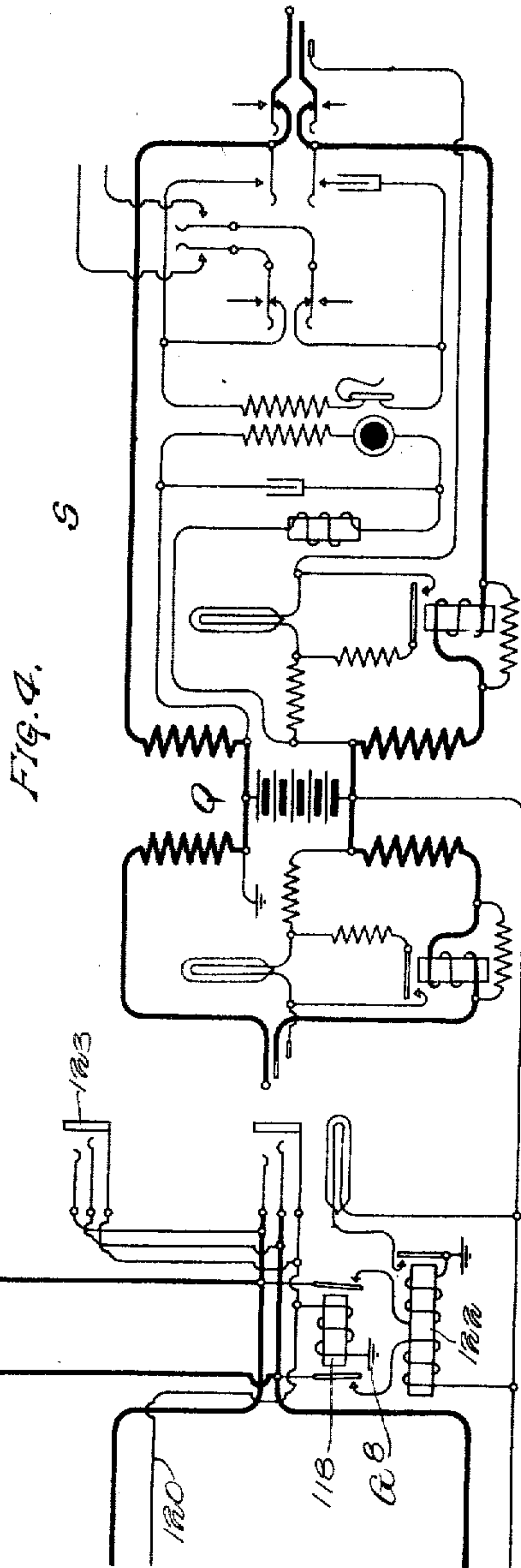


FIG. 3.

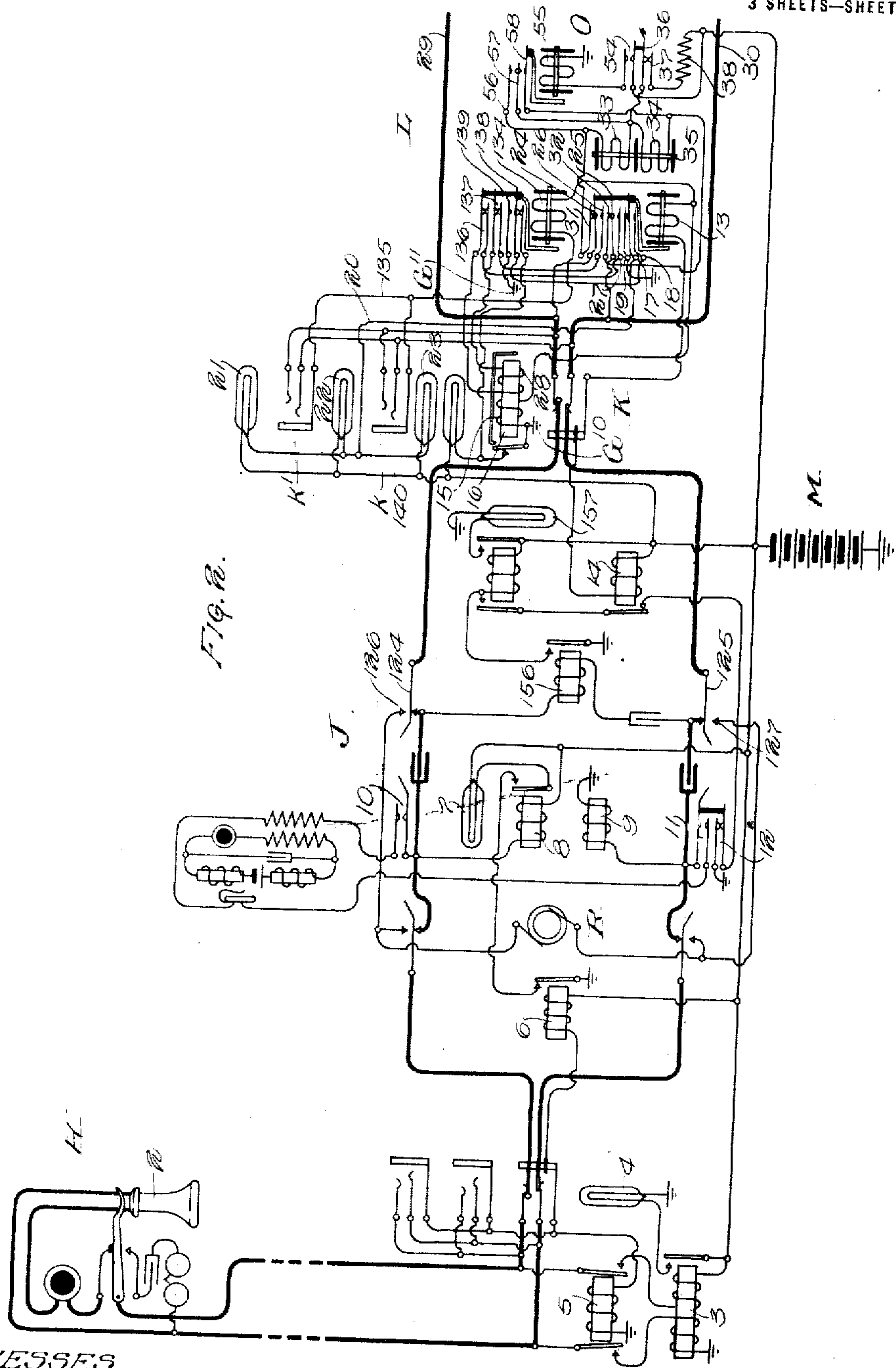
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ATTORNEYS

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B. D. WILLIS.
SEMI-AUTOMATIC TELEPHONE SYSTEM.
APPLICATION FILED OCT. 14, 1913.

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3 SHEETS—SHEET 2.



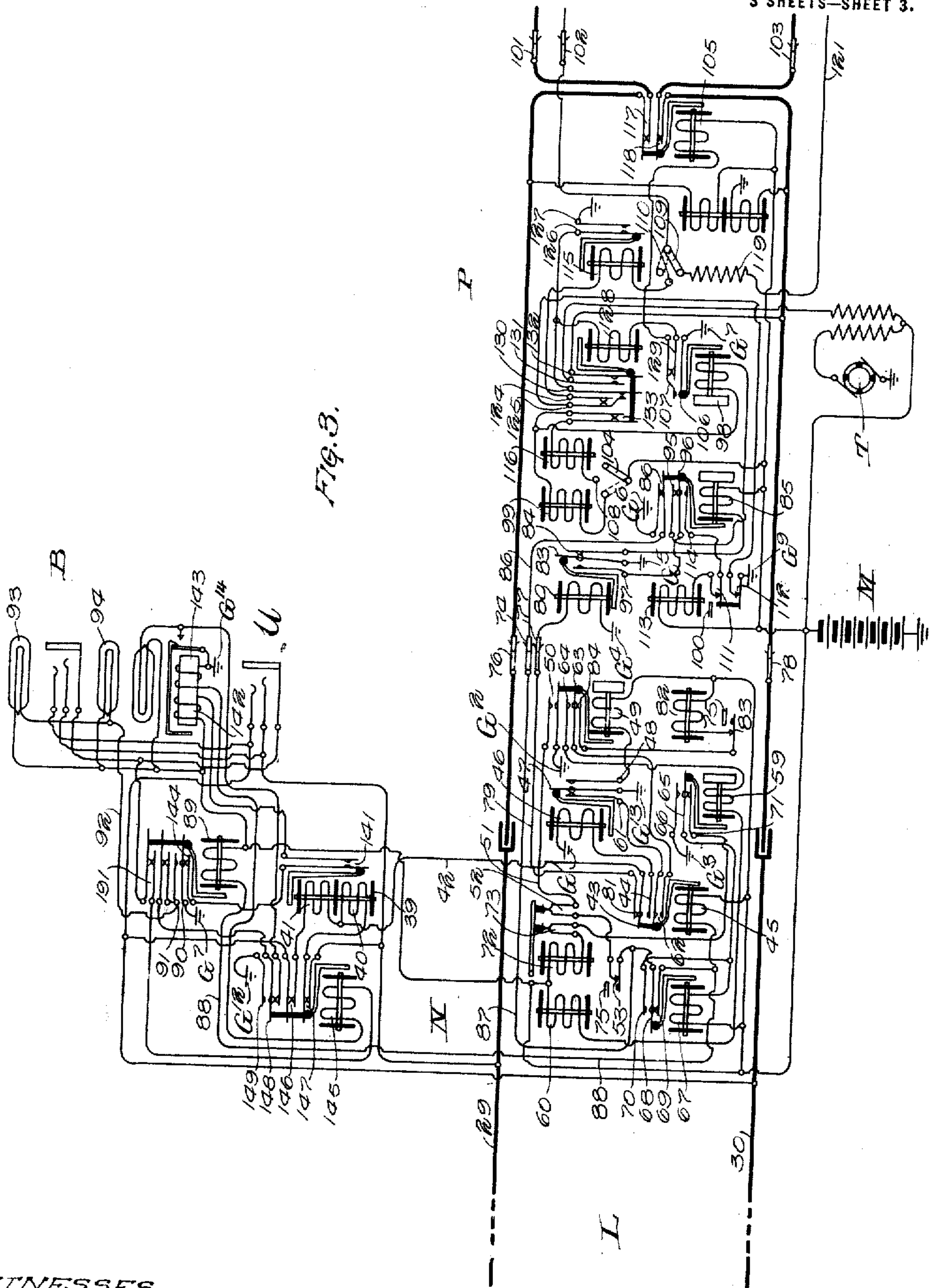
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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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SEMI-AUTOMATIC TELEPHONE SYSTEM.

1,263,010.

Specification of Letters Patent.

Patented Apr. 16, 1918.

Application filed October 14, 1913. Serial No. 795,146.

To all whom it may concern:

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

My invention relates to improvements in semi-automatic telephone systems, and it relates particularly to an improved trunking arrangement in such a system and also to certain improvements in the automatic switches therein employed.

Among the novel features of my invention is the provision of a trunk line over which a call may be extended manually in either direction, which trunk line is also adapted for the extension of automatic calls in one direction. This trunk line terminates at one end in a manual board and at the opposite end is provided with two branches, one terminating in an automatic exchange and the other terminating in a manual board. The automatic switches at the automatic exchange are controlled over this trunk line without interfering in any way with the manual apparatus by means of the provision of phantom operated circuits—that is, circuits which include the two sides of the trunk in parallel. By this means, when this trunk is being employed to extend an automatic connection, the switches are operated without in any way affecting the manual signals, and likewise when the trunk is being employed for the extension of a manual connection the automatic apparatus is not affected.

I likewise provide means for providing a guarding potential on one branch of this trunk while another branch of this trunk is in use.

A further feature of my invention is the provision of an improved side switch-less selector the trunk conductors of which are permanently connected with the switch wipers, together with the feature of having condensers in these talking conductors. The selector is likewise provided with an extra wiper, which is independent of the talking wipers, over which the line relay of the connector is controlled.

These and other objects and features of my invention will be readily understood by

reference to the accompanying drawings, in which I have illustrated my invention in connection with certain manual and automatic apparatus of a particular type.

Figure 1 is a diagrammatic illustration of the layout of a system in connection with which my invention is illustrated.

Figs. 2, 3 and 4, taken together, are a more detailed representation of the system. Fig. 2 shows the apparatus indicated at the left of Fig. 1—that is, at section A. Figs. 3 and 4 show the apparatus contained within that part of the system shown at the right of Fig. 1—that is, at section B.

The section A of Fig. 1 represents a number of subscribers C whose lines terminate in a manual board D, from which board connections may be made to the section B of the system. This last section shows a number of lines E which are accessible to a manual board F and to automatic apparatus indicated at G. When a subscriber at C wishes to establish connection with a subscriber at E, he removes his receiver and signals the operator, who thereupon extends the connection to the B section of the system, where the connection is finally completed. The circuits are so arranged and suitable apparatus provided that the operator may either complete the connection automatically by bringing into use the automatic apparatus indicated at G (Fig. 1), or she may have the connection completed manually by an operator at the board F.

We will assume first that a subscriber H of the group C (Fig. 1) wishes to establish connection with a subscriber I of the group E, and that the connection is completed by the operator through the automatic apparatus G rather than through the board F. The subscriber, upon removing his receiver, energizes the line relay 3 (Fig. 2), which relay in turn causes the light 4 to signal the operator. The operator thereupon inserts the plug of the cord J into the line or answering jack of the subscriber H, thereby connecting the line circuit with the cord circuit, as shown. At the same time a circuit is established through the cut-off relay 5 and the supervisory relay 6 in series, which causes the cut-off relay 5 to energize in the usual manner, disconnecting the line relay 3 from the line, as shown, and thus breaking the circuit of the lamp 4. The relay 6, upon

energizing, would close a circuit for the signal lamp 7 but for the fact that the relay 8 is energized in series with the subscriber's line and with a coil 9 at the cord circuit, and in this manner the lamp 7 is prevented from being displayed at this time. The operator then throws her listening key, which closes the springs 10 and 11 and separates the springs 12. The closure of the springs 10 and 11 bridges the operator's talking set across the line, whereupon the operator ascertains the number of the called subscriber I. We will assume this number to be 256. The operator then inserts the calling plug of the cord J into the jack K, thereby establishing connection with the trunk L, which terminates in the board B. A circuit is thus established through the relay 13 in series with the relay 14 and with the winding 15 of the trunk signal relay 16. The relay 13, upon energizing, shifts the spring 17 from the spring 18 and into engagement with the spring 19, thereby grounding the conductor 20 and causing the multiple lamps 21, 22 and 23 to light. These lamps indicate to the other operators which have access to this trunk by means of the jacks *k* and *k'* that the trunk is busy. The relay 13, furthermore, by separating the springs 24 and 25 from the springs 26 and 27, respectively, disconnects the winding 28 of the relay 16 from across the conductors 29 and 30 of the trunk L. Furthermore, the relay 13 by carrying the springs 24 and 25 into engagement with the springs 31 and 32, respectively, bridges the windings 33 and 34 of the phantom relay 35 across the conductors 29 and 30 of the trunk L. It will be observed that there is a connection from a point between the windings 33 and 34 through the springs 36 and 37 and through a resistance coil 38 to the battery M. The relay 13, therefore, upon energizing, has the effect of connecting the non-grounded pole of the battery M with both the trunk conductors 29 and 30 of the trunk L. It will also be observed that at the board B (Fig. 3) there is another relay 39 similar to the relay 35 which has its windings 40 and 41 normally across the conductors 29 and 30 of the trunk L, and from a point between these two windings 40 and 41 there is a connection by way of the conductor 42, which runs to the first selector N, through a pair of springs 43 and 44 under the control of the relay 45 and through the relay 46 to ground *G'*. Therefore, as soon as the battery M is bridged across the trunk L through the windings of the relay 35, a simplex circuit is established through the relay 46 (Fig. 3) to ground *G'* and back to the battery M, with the result that the relay 46 becomes energized. This relay, upon energizing, carries the spring 47 into engagement with the spring 48, thereby energizing the relay 49, which latter, upon energizing,

carries the springs 50 into engagement. When this circuit is closed at the point 50, connection is extended from ground *G'* by way of the conductor 51 and springs 52 to the off-normal springs 53, which are normally open. It will be observed, therefore, that the result of the operator inserting the calling plug of the cord J into the jack K is to put the line relay 46 of the selector N in readiness for receiving impulses from a calling device O under the control of the operator (Fig. 2), which calling device comprises the springs 36 and 37. This calling device is of the same general character as the calling device described in British patent to S. G. S. Dicker No. 29,654 of 1910. The circuits are now in readiness to respond to the action of the calling device O when it is operated in accordance with the first digit 2 of the desired number. The calling device, when so operated, carries the springs 54 into contact, thereby causing the energization of the relay 55 and at the same time the said calling device causes the separation of the springs 36 and 37, thereby disconnecting the battery M from the trunk L. The calling device is so constructed that the springs 54 are brought into contact as soon as the dial is removed from normal, and remains so closed until after the springs 36 and 37 have produced impulses corresponding to the digit being called, which in this particular case is 2. The object in having the relay 55 energized as soon as the dial leaves normal is to have it press into contact the springs 56, 57 and 58 for the purpose of short-circuiting the windings of the relay 35, so that the springs 36 and 37 may be capable of transmitting much stronger impulses to the line relay 46 of the selector N than would otherwise be the case. The line relay 46 at the selector N will respond to the operation of the calling device—that is, each time the springs 36 and 37 separate, the relay 46 de-energizes, permitting the spring 47 to fall back. Each time that the spring 47 falls back it sends an impulse through the slow acting auxiliary relay 59 and through the vertical magnet 60 in series from ground *G'* through the springs 47 and 61, springs 62 (under the control of the relay 45) and the springs 63 and 64 (under the control of the relay 49), and through the relay 59 and vertical magnet 60 to battery. These impulses energize the vertical magnet 60 twice, which operates to raise the switch shaft two steps. The relay 59 energizes while these impulses are being transmitted, carrying the springs 65 and 66 into contact, and as a result setting up a circuit through the quick auxiliary relay 67 from ground *G'* through said springs 65 and 66 and through said relay 67 to battery M. The relay 67, upon energizing, shifts the spring 68 away from the spring 69 and into engagement with the

spring 70, in which condition the said springs 68 and 70 are maintained until the switch N finds an idle trunk. This is accomplished as follows: Upon the first vertical step of the switch shaft as a result of the action of the vertical magnet 60, the off-normal springs 53 close in contact, thereby completing another energizing circuit for the relay 67 by way of its own springs 68 and 70, the off-normal springs 53, the rotary magnet interrupter springs 52 and the springs 50 to ground G^2 . After the line relay 46 sends in the last impulse for the first digit 2, the usual pause follows, during which time the spring 47 remains disengaged from the spring 61, and as a result causing the auxiliary slow acting relay 59 to deenergize. The relay 59, upon deenergizing, breaks the original energizing circuit for the quick acting auxiliary relay 67, which was closed by way of ground G^{13} . However, the relay 67 does not deenergize, because it is maintained energized over the circuit already traced, which is established through ground G^2 . The relay 59, upon deenergizing, not only disconnects the original energizing circuit for the relay 67, but by permitting the spring 65 to engage the spring 71 closes an energizing circuit for the rotary magnet 72, which causes the switch N to start on its rotary movement in search of an idle trunk. This energizing circuit extends from ground G^2 (under the control of the release relay 49) through the springs 50, rotary magnet interrupter springs 52, off-normal springs 53, springs 68 and 70, springs 65 and 71, through a second set of interrupter springs 73 (under the control of the rotary magnet) and through the rotary magnet 72 to battery M. The rotary magnet, upon energizing, rotates the shaft wipers in the usual manner, carrying them into engagement with the first set of contacts in the second level. We will assume that when the wipers are rotated, the first trunk which they find is busy, and we will explain how the switch automatically rotates onto the second trunk terminating in the connector switch F, which, it will be assumed, is idle. It will be observed that the quick acting auxiliary relay 67 is now supplied with a new energizing circuit as long as the private wiper 74 meets the private contact of a busy trunk, which is, under such condition, connected to ground, this circuit extending over the conductor 87 to the private wiper 74. The rotary magnet 72, upon drawing up its armature as a result of the closure of the circuit through ground G^2 , interrupts not only its own energizing circuit, but by separating the interrupter springs 73 and 52, also interrupts the energizing circuit for the magnet 67 which was described as passing through the springs 52 to ground G^2 . However, the relay 67 does not deenergize, because the third energizing circuit which has

been described as extending through the private wiper 74 prevents it from so doing. When the armature of the rotary magnet returns to normal position, the original circuits for both the rotary magnet and the relay 67 are restored through ground G^2 and the rotary magnet 72 again energizes, again breaking its own circuit, as well as the circuit of the relay 67 at the interrupter springs 73 and 52. The shaft 75 and the wipers 76, 74, 77 and 78 are rotated one more step onto the next trunk, which it has been assumed is idle. The result is that the third and last energizing circuit for the relay 67 is broken, whereupon the relay 67 deenergizes, thereby preventing the reestablishment of its own circuit and the circuit of the rotary magnet 72 through ground G^2 when the armature of the rotary magnet returns to normal position. The result is that the switch stops on the idle trunk terminating in the switch P. The relay 67, however, by deenergizing and permitting the springs 68 and 69 to thereby close, closes a circuit for the switching relay 45 as soon as the interrupter springs 52 of the rotary magnet close contact. This energizing circuit extends from ground G^2 through the springs 50, conductor 51, springs 52, off-normal spring 53, springs 68 and 69 and through said switching relay 45 to battery. The relay 45, upon thus energizing, opens the circuit of the line relay 46 at the spring 44 and also opens the circuit through the slow acting auxiliary relay 59 at the springs 62. It furthermore cuts through the connection from the line 42 to the conductor 79 and by way of the wiper 77 to the line relay 80 of the connector switch P, thereby substituting the line relay 80 for the line relay 46 in the circuit controlled by the calling device O (Fig. 2), which circuit extends from ground G^4 through said relay 80, wiper 77 and the springs 81 and 43 to the conductor 42, and from thence on to the apparatus in Fig. 2, as already explained. When the circuit of the line relay 46 is broken, this relay deenergizes, in turn causing the deenergization of the release relay 49. Under certain conditions this relay 49, upon deenergizing while the relay 46 is deenergized, would close the energizing circuit for the release magnet 82, since as soon as the shaft is raised, the release magnet 82 is connected by the off-normal springs 83 with the spring 84 under the control of the said release relay. This circuit of the release magnet likewise includes the contacts 62 under the control of the switching relay 45. Since the switching relay 45 is energized, the circuit that would be established through said release magnet from ground G^{13} is interrupted at the springs 62. I will now explain how the relay 45 is maintained energized even after the release relay 49 deenergizes. As

soon as the line relay 80 of the switch P energizes over circuits already pointed out, it shifts the spring 83 into engagement with the spring 84, thereby completing a circuit 5 for the release relay 85 from ground G⁵. The relay 85, upon energizing, closes contact at the springs 86, thereby connecting ground G⁶ with the conductor 86. From this point on a circuit continues through the 0 private wiper 74 and the conductor 87, through the springs 68 and 69 (under the control of the quick acting auxiliary relay 67), to and through the switching relay 45 to battery. It will be observed that this 15 same circuit from ground G⁶, after passing through the springs 68 and 69 of the quick acting auxiliary relay 67, extends by way of the conductor 88 to the relay 89 in the manual board B and thence to battery. The 20 relay 89, upon energizing, carries the spring 90 into engagement with the spring 91, thereby connecting ground G⁷ with the conductor 92 and lighting the lamps 93 and 94 as a signal to the operators at the B board 25 that the trunk L is busy. The operator is now ready to operate the calling device O for the second digit 5 of the desired subscriber. When she does so the line relay 80 responds five times in the same manner 30 as the line relay 46 responded twice for the first digit 2. Since the relay 85 is energized, and the springs 95 and 96 in contact, each time the relay 80 deenergizes and carries the spring 83 into engagement with the spring 35 97, an impulse is sent through the private magnet relay 98 and the vertical magnet 99 in series. The vertical magnet is then energized five times, raising the switch shaft 100 and the shaft wipers 101, 102 and 103 40 five steps to the fifth level. It will be understood that while these impulses are being transmitted, the side switch wiper 104 is in first position, which position is indicated by the dotted lines, and during the same 45 period the slow acting private magnet relay 98 remains energized. Upon energizing, this relay 98 closes a circuit for the private magnet 105 from ground G⁷ through the springs 106 and 107 and through the private 50 magnet 105 to battery. The private magnet remains energized as long as the relay 98 remains energized, but during the pause that follows the second digit 5 after the five impulses have been transmitted, the line 55 relay 80 remains energized and as a result the private magnet relay 98 falls back, breaking the circuit for the private magnet 105, which operates to trip the side switch from first to second position, thereby carrying the side switch wiper 104 into engagement 60 with the contact 108 and the side switch wiper 109 into engagement with the contact 110. It will be observed that when the switch shaft 100 is raised the first step, 65 a circuit is closed at the contacts 111 and

another at the contact 112. The closure of the contacts 111 extends the circuit of the release magnet 113 to the spring 114, under the control of the release relay 85, and the closure of the contact 112 prepares the circuit of the relay 115, which is completed 70 after the side switch wiper 109 passes from first to second position and engages the contact 110, provided the called line is busy, as will be explained. The apparatus is now 75 in condition to receive the impulses corresponding to the third digit 6. The line relay 80 responds as before and causes the operation of the rotary magnet 116. The impulses through this magnet pass from 80 ground G⁵ through the relay 98, thence through the rotary magnet 116 and through the side switch wiper 104, which is now in second position, to battery M. The rotary magnet 116 operates to rotate the switch 85 shaft and wipers along the fifth level, during which interval the private magnet relay 98 is energized, and therefore the private magnet 105 is also energized, due to the closure of contacts of the springs 106, and 90 107, under the control of said relay 98. The relay 105, being energized, breaks the talking conductors which are shown in heavy black lines by separating the contacts 117 and also by separating the contacts 118. 95 The object in thus opening the talking circuit is to prevent the switch P from interfering with any lines that may be busy as it passes over the bank contacts. When the six impulses corresponding to the last digit 100 have been transmitted, the wipers of the connector switch are found on the contacts of the desired line I (No. 256) shown in Fig. 4. After the impulses have ceased operating the relay 80, the private magnet 105 relay 98 deenergizes, as in the previous instance, permitting the private magnet 105 to deenergize and causing the side switch wipers 104 and 109 to pass to third position, as indicated in full lines. As soon as this 110 occurs, the cut-off relay 118 of the called line is energized over a circuit extending as follows: From ground G⁸ through the conductors 120, private wiper 102, side switch wiper 109, resistance coil 119, conductor 121 and to battery Q (Fig. 4). The 115 relay 118, upon energizing, cuts off the signal relay 122 to prevent the same from energizing when the called subscriber answers. The connection of battery Q through the 120 conductor 121 with the conductor 120 and the sleeves 123 of the jacks of the called line is the medium for providing guarding potential at said sleeves when the connector P establishes connection with the line I. 125 When connection is thus established between the cord J and the telephone I, the subscriber at the telephone I may be signaled by the operator throwing the ringing key and thereby shifting the springs 124 130

and 125 into engagement with the contacts 126 and 127, which latter are connected with the ringing generator R.

After the subscribers are through talking, they hang up their receivers and signal the operator at J, who takes down the connection. This signal is given when the lamp 7 is displayed as a result of the deenergization of the relay 8 when the subscriber H breaks the circuit at the switch hook. The operator, upon receiving the signal, takes down the cord, which restores the circuits of the called line and causes the line relay 80 of the connector P to be deenergized, whereupon the circuit of the release relay 85 is broken. This relay, as a result, brings the springs 96 and 114 into contact, and since the line relay springs 97 and 83 are now in engagement, the release magnet 113 is energized. The release magnet restores the switch P in the usual manner, and when the wipers leave the contacts of the called line, the apparatus of the called line is restored to normal. When the release relay 85 at the connector was deenergized, it not only caused the release of the connector P, but by breaking the circuit at the contacts 86 caused the deenergization of the switching relay 45 in the selector N, causing this automatic switch to release also. It will be seen that when the relay 45 deenergizes it permits the springs 62 to come into contact, thereby closing the energizing circuit for the release magnet 82, which circuit, as has been previously pointed out, would have been closed when the line relay 46 and the release relay 49 deenergized at the time the connection was extended from the switch N to the connector P but for the fact that the switching relay 45 at the same time opened the circuit at the point 62. The energizing circuit for the release magnet may be traced from ground G¹³ through the line relay springs 47 and 61, springs 62, springs 63 and 84, through the off-normal springs 83 and thence through the release magnet 82 to battery. The release magnet, upon energizing, of course removes the holding pawls from the switch shaft, causing the said shaft to return to normal position. It may be well to state that the mechanical details and operation of the switches N and P are of the same general character as those of the selectors and connectors disclosed in United States Letters Patent Nos. 815,321 and 815,176, granted March 13, 1906, to Keith, Erickson and Erickson. It will be seen that the deenergization of the relay 85 likewise breaks the energizing circuit of the relay 89 at the board B and that the relay 89 breaks the circuits of the lamps 93 and 94, in this manner removing the busy signals for the trunk L.

Assuming that the subscriber's line is busy when the wipers of the connector P

engage the contacts of the called line, then the private wiper 102 finds a guarding potential from the non-grounded terminal of the battery Q on the private bank contact of this line, said potential reaching such private contacts by way of the conductor 120 in the manner previously described. As a result, the side switch of the connector being at the time in second position, the relay 115 is energized by a flow of current from battery Q to the conductor 120, thence by way of the private wiper 102 to the side switch wiper 109 and contact 110, through the relay 115, through the springs 124 and 125 and the off-normal springs 112 to ground G⁹. When the relay 115 becomes thus energized while the side switch of the connector is in second position, it presses the springs 126 and 127 into contact, and as soon as the private magnet relay 98 deenergizes after the impulses for the last digit have been transmitted, the busy locking relay 128 energizes in series with the private magnet 105 by way of the contacts 107 and 129 under the control of the relay 98. This prevents the private magnet 105 from deenergizing and therefore prevents the calling line from being cut through to the called line. When the busy locking relay 128 energizes it does not break the energizing circuit of the relay 115, because the spring 130 engages the spring 125 before the latter leaves the spring 124, and the switch is maintained in this locking condition until the subscriber or the operator, or both, receive the busy signal, which is automatically sent to the operator and the calling subscriber when the locking relay 128 presses the springs 131 and 132 into contact. The busy signaling current, of course, originates in the busy signaling apparatus T. In order to prevent the operator from operating the rotary magnet any farther, the locking relay 128 is provided with a couple of springs 133 which, when the relay 128 energizes, breaks the energizing circuit of the rotary magnet 99. When the operator receives the busy signal, or when she receives the disconnect signal as a result of the busy signal, she releases the connection as before.

Having explained how a connection is established by the use of automatic apparatus when the subscriber H wishes to call the subscriber I, it will now be explained how the connection might be completed without the automatic apparatus and through the manual exchange B. The operator (Fig. 2), upon receiving the signal from the subscriber A, extends the connection to the B exchange, not by plugging into the jack K, but by plugging into one of the jacks K'. When the operator does this she causes the relay 134 to energize instead of the relay 13, as before. This energizing circuit extends from battery M

through the sleeve of the jack k' and by way of the conductor 135 through the relay 134 and through the winding 15 of the relay 16 to ground G^{10} . The relay 134, upon energizing, disconnects the winding 28 of the coil 16 from across the trunk L by breaking the contacts 136 and 137 and at the same time, by shifting the spring 138 into contact with the spring 139, connects the conductor 20 to ground G^{11} to thereby light the lamps 21, 22 and 23, to indicate that the trunk L is busy. The operator is now ready to signal the operator at the board B, which is done by shifting the springs 124 and 125 onto the contacts 126 and 127. Ringing current is thus transmitted from one side of the generator R through the contacts 126 and 124, one side of the cord circuit to the tip of the plug, trunk conductor 29, contact springs 147 of the relay 145, windings 40 and 41 of the phantom coil 39 in series, contacts 146, trunk conductor 30 and the opposite side of the cord circuit through the contacts 125 and 127 to the opposite side of the generator R. This ringing current operates to energize the relay 39 which, upon energizing, closes the contact 141, thereby closing an energizing circuit through the winding 142 of the signal relay 143, this circuit extending from ground G^7 , under the control of the relay 89, through the springs 90 and 144, thence through the springs 141 and through the winding 142 to battery M. The operator B, upon receiving the signal, plugs into the jack U with the plug of a cord circuit similar to that shown at S (Fig. 4), restoring the drop 143 and energizing the relay 145. This circuit extends from the non-grounded pole of the battery Q, sleeve contact of the plug and jack, contacts 191, controlled by the relay 89, relay 145 and restoring winding of the signal relay 143 to ground G^{14} . The relay 145, upon energizing, disconnects the coil 39 from across the trunk L by separating the contacts 146 and 147 and at the same time, by shifting the spring 148 into engagement with the spring 149, closes a circuit through the lamps 93 and 94 from ground G^{12} . The operator at the board B completes the connection in the usual manner. After the conversation between the subscribers is terminated, the subscribers H and I signal their respective operators to take down the connections and restore the apparatus.

If the subscriber I wishes to establish connection with the subscriber H, the subscriber I will signal the operator at the B board in the usual manner, who, through the medium of a cord circuit such as the cord circuit S, extends connection by way of the trunk L with the board A. The operator, for example, inserts the plug of the cord S into the jack U, thereby energizing the relay 145, which operates the

same as in the previous instance to disconnect the coil 39 from across the trunk and at the same time operates to light the lamps 93 and 94 to indicate that the trunk L is busy. The operator then sends ringing current over the trunk line L through the winding 28 of the signal relay 16 (Fig. 2), thereby signaling the operator at the board A. The operator at the board A then completes the connection with the subscriber H in the usual manner. When the subscribers are through talking, each signals his operator and these operators take down the connection. If for any reason the operator at the board A neglects to take down her connection, the operator at the board B can signal the operator at the board A by transmitting ringing current over the trunk to thereby energize the relay 156, which, upon energizing, causes the lamp 147 to light, thereby signaling the A operator.

It will thus be seen that I have devised a very efficient system in which an operator at one exchange, when it is desired to establish a connection with a subscriber's line which terminates in a second exchange, can extend this connection over a trunk line to a second exchange and then extend the connection to the desired line either automatically or manually by means of an operator at the second exchange. Likewise, the operator at the second exchange can employ the same trunk for extending a connection manually from the second exchange to the first exchange. Furthermore, when this trunk is in use for any one of these connections, suitable guarding potentials are provided to prevent either one of the operators employing the trunk for any other connection. Likewise, it will be seen that the line relay of the connector is operated over a circuit which is independent of the talking circuit, both the selectors and connectors being controlled over a simplex circuit which includes the two sides of the trunk in parallel with a ground return.

While I have illustrated and described certain specific embodiments of my invention, it will be understood that in its broader aspect the two-way trunk line could be employed with other forms of automatic switches, and likewise that the feature of my invention having automatic switches controlled in this manner over two sides of a trunk in series is capable of use with other forms of trunk circuits and other automatic or semi-automatic systems. Various other changes and modifications will readily suggest themselves to those skilled in the art, which modifications come within the contemplated scope of my invention.

In various places in the specification and in the claims in this application I have referred to a simplex circuit. By simplex

circuit is meant that section of a phantom circuit which is left when one of the physical branches of said phantom circuit is reduced to a single conductor.

5 What I claim as my invention is:—

1. In a telephone system, a two-way trunk line, means including operator's equipment and call signals for manually extending connections over said trunk in either one of
10 two directions, an automatic switch at one end of said trunk, and means for operating said switch over said trunk to extend a connection thereover semi-automatically.

2. In a telephone system, a manual board,
15 a trunk line terminating in said board, a pair of branches for the opposite end of said trunk, one branch terminating in an automatic switch and the second branch terminating in a second manual board,
20 means for controlling said automatic switch over said trunk line, a signal associated with said second manual board, and means for operating said signal over said trunk line.

25 3. In a telephone system, a trunk line, means for seizing one end of said trunk, a pair of branches for the opposite end of said trunk, an automatic switch connected with one of said branches, a manual jack
30 associated with the other of said branches, a signal associated with said jack responsive to calls over said trunk line, and means for operating said switch over said trunk without operating said signal.

35 4. In a telephone system, a trunk line, means for seizing one end of said trunk, a pair of branches for the opposite end of said trunk, an automatic switch connected with one of said branches, a manual jack
40 associated with the other of said branches, a signal associated with said jack, means for operating said switch over said trunk without operating said signal, and means for operating said signal over said trunk with-
45 out operating said automatic switch.

5. In a telephone system, a trunk line, means for seizing one end of said trunk, a pair of branches for the opposite end of said trunk, an automatic switch connected with
50 one of said branches, a manual jack associated with the other of said branches, a signal associated with said jack and operable over said trunk line, means for operating said switch over said trunk without operating
55 said signal, and means for preventing said trunk line being employed for establishing one connection when it is employed in establishing a second connection.

6. In a telephone system, a trunk line,
60 means for seizing one end of said trunk, a pair of branches for the opposite end of said trunk, an automatic switch connected with one of said branches, a manual jack associated with the other of said branches, a sig-
65 nal associated with said jack, means for op-

erating said switch over said trunk without operating said signal, means for operating said signal over said trunk without operating said automatic switch, and means for
70 preventing said trunk line being employed for establishing one connection when it is employed in establishing a second connection.

7. In a telephone system, a manual operator's cord circuit, a trunk line having a ter-
75 minal adapted to be connected with said cord, a pair of branches for the opposite end of said trunk, an automatic switch associated with one of said branches, a manual terminal associated with the other of said branches, a
80 signal associated with said manual terminal to indicate incoming calls, and means by which the operator at said cord circuit can control the operation of said automatic switch over said line without operating said
85 signal.

8. In a telephone system, a manual operator's cord circuit, a trunk line having a ter-
90 minal adapted to be connected with said cord, a pair of branches for the opposite end of said trunk, an automatic switch associated with one of said branches, a manual terminal associated with the other of said
95 branches, a signal associated with said manual terminal, means by which the operator at said cord circuit can control the operation of said automatic switch over said line without operating said signal, and means by
100 which said operator can operate said signal without operating said automatic switch.

9. In a telephone system, an automatic switch, a plurality of trunk lines divided
105 into groups, said switch having one motion to select groups and a second motion to find a line in the selected group, and non-differential means energized over the two sides of
110 a line circuit in parallel, for controlling the operation of said switch.

10. In a telephone system, a subscriber's line, an automatic switch, means including a
110 trunk line for extending a connection from said line to said switch, a plurality of trunk lines divided into groups extending from said switch, said switch having one motion
115 to select groups and a second motion to find a line in a selected group, and non-differential means energized over the two sides of said first-mentioned trunk in parallel, for controlling said switch.

11. In a telephone system, a trunk line, an
120 automatic switch in which said trunk terminates, a group of trunk lines extending from said switch, and non-differential means energized over the two sides of said first-mentioned trunk in parallel for controlling said
125 switch to connect with an idle one of said group of trunks.

12. In a telephone system, a trunk line,
130 an automatic switch in which said trunk terminates, a bridge, electromagnetic means

controlling the connection of said bridge across the opposite end of said trunk, a source of current connected to the mid point of said bridge, and means for controlling the operation of said switch by controlling the connection of said source of current to said bridge.

13. In a telephone system, a trunk line, an automatic switch in which said trunk terminates, a bridge, electromagnetic means controlling the connection of said bridge across the opposite end of said trunk, a source of current connected to the mid point of said bridge, means for controlling the operation of said switch by controlling the connection of said source of current to said bridge, and a plurality of groups of trunk lines extending from said switch, said switch having one motion to select groups and a second motion to find a line in a selected group.

14. In a telephone system, a trunk line, an automatic switch in which said trunk terminates, a bridge across the opposite end of said trunk, a resistance in said bridge, a connection from the mid point of said bridge to a source of current, means for controlling said switch by controlling the connection of said source of current to said bridge, and means for short-circuiting said resistance while said switch is being operated.

15. In a telephone system, a trunk line, an automatic switch in which said trunk terminates, a bridge across the opposite end of said trunk, a resistance in said bridge, a connection from the mid point of said bridge to a source of current, means for controlling said switch by controlling the connection of said source of current to said bridge, means for short-circuiting said resistance while said switch is being operated, and a plurality of groups of trunk lines extending from said switch, said switch having one motion to select groups and a second motion to find a line in a selected group.

16. In a telephone system, a trunk line, an automatic switch in which said trunk terminates, a bridge across the opposite end of said trunk, a source of current normally connected to a mid point of said bridge, and means for controlling said switch by intermittently breaking the connection of said source of current with said bridge.

17. In a telephone system, a trunk line, an automatic switch in which said trunk terminates, a bridge including a resistance across the opposite end of said trunk, a source of current normally connected to the mid point of said bridge, means for controlling said switch by intermittently breaking the connection of said source of current with said bridge, and means for short-circuiting said resistance while said switch is being operated.

18. In a telephone system, a manual exchange, a second exchange, subscribers' lines

terminating in said second exchange, a trunk line terminating in said first exchange and extending to said second exchange, means for manually extending a connection from said trunk line to a subscriber's line terminating in said second exchange, and automatic means controlled over two sides of said trunk line in parallel for extending a connection from said trunk line to a subscriber's line terminating in said second exchange.

19. In a telephone system, a manual board, a trunk line terminating in said board, a pair of branches for the opposite end of said trunk, one branch terminating in an automatic switch and the second branch terminating in a second manual board, means for controlling said automatic switch over two sides of said trunk line in parallel, a signal associated with said second manual board, and means for operating said signal over a circuit including two sides of said trunk line in series.

20. In a telephone system, a trunk line, a bridge across one end of said trunk, a second bridge across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to the mid point of one of said bridges, a source of current adapted to be connected to the mid point of the other of said bridges, and means for controlling the connection of said source of current to said second bridge to thereby control the operation of said automatic switch.

21. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, and means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch.

22. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, and means for short-circuiting said last-mentioned resistances while said switch is being operated.

23. In a telephone system, a trunk line, a bridge across one end of said trunk, a second bridge across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to the mid point of one of said bridges, a source of current adapted to be connected to the mid point of the other of said bridges, means for controlling the connection of said source of current to said second bridge to thereby control the operation of said automatic switch, and a plurality of trunk lines divided into groups, said switch having one motion to select groups and a second motion to connect with a line in a selected group.

24. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, and a plurality of trunk lines divided into groups, said switch having one motion to select groups and a second motion to connect with a line in a selected group.

25. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, means for short-circuiting said last-mentioned resistances while said switch is being operated, and a plurality of trunk lines divided into groups, said switch having one motion to select groups and a second motion to connect with a line in a selected group.

26. In a telephone system, a trunk line, a bridge across one end of said trunk, a second bridge across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to the mid point of one of said bridges, a source of current adapted to be connected to the mid point of the other of said bridges, means for controlling the connection of said source of current to said second bridge to thereby control the operation of said automatic switch, a second automatic switch with which said first auto-

matic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch.

27. In a telephone system, a trunk line, a bridge across one end of said trunk, a second bridge across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to the mid point of one of said bridges, a source of current adapted to be connected to the mid point of the other of said bridges, means for controlling the connection of said source of current to said second bridge to thereby control the operation of said automatic switch, a second automatic switch with which said first automatic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch, the connection with said second line relay being independent of the talking circuit.

28. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, a second automatic switch with which said first automatic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch.

29. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, means for short-circuiting said last-mentioned resistances while said bridge is being operated, a second automatic switch with which said

first automatic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch.

30. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, a second automatic switch with which said first automatic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch, the connection with said second line relay being independent of the talking circuit.

31. In a telephone system, a trunk line, a pair of resistance coils bridged across said trunk, a second pair of resistance coils bridged across the opposite end of said trunk, an automatic switch having a line relay adapted to be connected to one of said bridges at a point between said resistance coils of that bridge, a source of current adapted to be connected to a point between the resistance coils of the other of said bridges, means for controlling the connection of said source of current to said last-mentioned bridge to thereby control the operation of said automatic switch, means for short-circuiting said last-mentioned resistances while said switch is being operated, a second automatic switch with which said first automatic switch is adapted to establish connection, a line relay for said second switch, and means for disconnecting said first line relay and connecting said second line relay to said bridge when said first switch establishes connection with said second switch, the connection with said second line relay being independent of the talking circuit.

32. In a telephone system, an automatic selecting switch, an automatic connector switch with which said selector is adapted to establish connection, a line relay for said connector, a pair of line wipers and a third wiper for said selector, and means for controlling said connector line relay over a circuit including said third wiper.

33. In a telephone system, a selector and a connector switch, said selector being

adapted to extend connection to said connector, a line relay for said connector for controlling the operation thereof, a pair of line wipers, a test wiper and a fourth wiper for said selector switch, and a circuit for said line relay including said fourth wiper.

34. In a telephone system, a connector switch, a trunk line extending to said switch, said trunk comprising a pair of talking conductors, a testing conductor, a fourth conductor, a line relay for said switch, and a circuit therefor including said fourth conductor.

35. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, and a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, and electromagnetic means for controlling the connection of said bridge sections.

36. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, and a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, and electromagnetic means for controlling the connection of said bridge sections.

37. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, and automatic electromagnetic means for connecting and disconnecting said terminals across the line.

38. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, and automatic electromagnetic means for automatically connecting and disconnecting said terminals across the line.

39. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit

cuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections
 5 for bridging the line circuit, electromagnetic means for controlling the connection of said bridge sections, means for seizing said line, and electromagnetic means responsive to said seizure for rendering said relay respon-
 10 sive to said impulse sender.

40. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the
 15 simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the
 20 mid-point of which the simplex circuit is connected, electromagnetic means for disconnecting said bridge sections, means for seizing said line, and electromagnetic means responsive to said seizure for rendering said
 25 relay responsive to said impulse sender.

41. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the
 30 simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections and electromagnetic means for bridging said sections across the line circuit, a plu-
 35 rality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

40 42. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a bat-
 45 tery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the
 50 mid-point of which the simplex circuit is connected, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any
 55 one of said circuits.

43. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the
 60 simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge
 65 consisting of a resistance conductor, to the

mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said
 70 circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

44. In a telephone system, a line, a simplex circuit associated with said line, a relay, a
 75 normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromag-
 80 netic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnect-
 85 ing one of said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said cir-
 90 cuits.

45. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex
 95 circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which
 100 the simplex circuit is connected, means for connecting and disconnecting said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay
 105 to extend a connection from said line to any one of said circuits.

46. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for
 110 the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a re-
 115 sistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting said terminals across the line, a plurality of circuits, and a progressively movable switch
 120 associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

47. In a telephone system, a line, a simplex circuit associated with said line, a relay, a
 125 normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electro-
 130

magnetic means for bridging said sections across the line circuit, means for seizing said line, and for rendering said relay responsive to said impulse sender, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

48. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for seizing said line, and for rendering said line responsive to said impulse sender, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

49. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

50. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

51. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor to the mid-point of which the simplex circuit is connected, means for

connecting and disconnecting one of said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

52. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting one of said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

53. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend connection from said line to any one of said circuits.

54. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting said terminals across the line, a plurality of circuits, and a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

55. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections, electromagnetic means for bridging said sections

across the line circuit, means for seizing said line, and for closing said operating circuit to render said relay responsive to said impulse sender, a plurality of circuits, and
 5 a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

56. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections,
 10 electromagnetic means for bridging said sections across the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is
 15 connected, means for seizing said line, and for closing said operating circuit to render said relay responsive to said impulse sender, a plurality of circuits, and a progressively
 20 movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits.

57. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections
 30 for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, and release
 35 apparatus for restoring the switch controlled by said relay.

58. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each
 45 bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively
 50 movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, and release apparatus for restoring the switch controlled by said
 55 relay.

59. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex
 60 circuit, an impulse sender, a battery for

operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, another relay for controlling an automatic switch, and means controlled by said first relay for substitut-
 70 ing said second relay in said operating circuit in place of the first relay to the control of the impulse sender.

60. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each
 75 bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across
 80 the line, another relay for controlling an automatic switch, and means controlled by said first relay for substituting said second relay in said operating circuit in place of the first relay to the control of the impulse
 85 sender.

61. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by
 90 said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting
 95 said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch.

62. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is
 110 connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with
 115 one of said circuits, another relay for controlling said second switch for further extending connection from said line, and

means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch.

- 5 63. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery
10 for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by
15 said relay to extend a connection from said line to any one of said circuits, an automatic progressively movable switch associated with one of said circuits, a plurality of other circuits associated therewith, a second relay
20 for controlling said last automatic switch, and means for substituting said second relay for the first relay in said operating circuit to the control of the impulse sender when the connection is extended by the first switch.
- 25 64. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a bat-
30 tery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is
35 connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connec-
40 tion from said line to any one of said circuits, an automatic progressively movable switch associated with one of said circuits, a plurality of other circuits associated therewith, a second relay for controlling said last
45 automatic switch, and means for substituting said second relay for the first relay in said operating circuit to the control of the impulse sender when the connection is extended by the first switch.
- 50 65. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a
55 battery for operating said relay, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an au-
60 tomatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay
65 to the control of the impulse sender when

connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking
70 thereover.

66. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a
75 battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and con-
80 trolled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending
85 connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first
90 switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

67. In a telephone system, a line, a simplex circuit associated with said line, a re-
95 lay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for
100 bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, a plurality of circuits, a progressively movable switch associated with said
105 circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for
110 further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended
115 by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

68. In a telephone system, a line, a simplex circuit associated with said line, a re-
120 lay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for
125 bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across the line,
130

a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

69. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

70. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the

first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

71. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

72. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, means for seizing said line, and for rendering said relay responsive to the impulse sender, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

73. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, means for seizing said line, and for rendering said relay responsive to said impulse sender, a plurality of circuits, a progressively movable

switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

74. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for seizing said line, and for rendering said line responsive to said impulse sender, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

75. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

76. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for

the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when a connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

77. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

78. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuits, each bridge consisting of a resistance conductor to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control

trol of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

79. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the midpoint of which the simplex circuit is connected, means for automatically connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

80. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which, the simplex circuit is connected, means for connecting and disconnecting said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

81. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridg-

ing the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for automatically connecting and disconnecting said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

82. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, means for seizing said line, and for closing said operating circuit to render said relay responsive to said impulse sender, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

83. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, means for seizing said line, and for closing said operating circuit to render said relay responsive to said impulse sender, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic switch associated with one of said circuits, another relay for controlling said second switch for further extending connection from said line, and means for substituting said second relay for the first relay to the control of the impulse sender when connection is extended by the first switch, means for completing a

talking circuit via said line and said extensions, and a central battery for supplying current for talking thereover.

84. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for seizing said line, and for closing said operating circuit to render said relay responsive to said impulse sender, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, means for completing a talking circuit via said line and said circuits, and a central battery for supplying current for talking thereover.

85. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic progressively movable switch associated with one of said circuits, a plurality of other circuits associated therewith, a second relay for controlling said last automatic switch, means for substituting said second relay for the first relay in said operating circuit to the control of the impulse sender when the connection is extended by the first switch and release apparatus associated with said switches controlled by the second relay.

86. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, said simplex circuit having two terminal bridge-sections for bridging the line circuit, each bridge consisting of a resistance conductor, to the mid-point of which the simplex circuit is connected, means for connecting and disconnecting one of said terminals across the line, a plurality of circuits, a progressively movable switch associated with said circuits and controlled by said relay to extend a connection from said line to any one of said circuits, an automatic progressively movable switch associated with one of said circuits, a plurality of other circuits associated there-

with, a second relay for controlling said last automatic switch, and means for substituting said second relay for the first relay in said operating circuit to the control of the impulse sender when the connection is extended by the first switch and release apparatus associated with said switches controlled by the second relay.

87. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, means for placing said relay under operative control of said impulse sender, and means under the control of said relay for making terminals in the other group busy.

88. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, automatic means for placing said relay under operative control of said impulse sender, and automatic means under the control of said relay for making terminals in the other group busy.

89. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal in one group, signals associated with said other terminals of the same group, automatic means for displaying said signals when the line is seized, means for placing said relay under operative control of said impulse sender, and means under the control of said relay for making terminals in the other group busy.

90. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal in one group, signals associated with said other terminals of the same group, automatic means for displaying said signals when the line is seized, automatic means for placing said relay under operative control of said impulse sender, and

automatic means under the control of said relay for making terminals in the other group busy.

91. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, means for placing said relay under operative control of said impulse sender, and means under the control of said relay for making terminals in the other group busy.

92. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, automatic means for placing said relay under operative control of said impulse sender, and automatic means under the control of said relay for making terminals in the other group busy.

93. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal in one group, signals associated with said other terminals of the same group, automatic means for displaying said signals when the line is seized, means for placing said relay under operative control of said impulse sender, and means under the control of said relay for making terminals in the other group busy.

94. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal in one group, signals associated with said other terminals of the same group, automatic means for displaying said signals when the line is seized, automatic means for placing said relay under operative control of said impulse sender, and automatic means under the control of said relay for making terminals in the other group busy.

95. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for

the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, a signal for said line associated with a terminal of the other group, means for operating said signal without operating said relay, means for seizing the line via the terminal associated with said signal in response thereto, and means for making other terminals of the same group busy and for affecting the operating circuit of said relay.

96. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, manual means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, a signal for said line associated with a terminal of the other group, electrical means for operating said signal without operating said relay, manual means for seizing the line via the terminal associated with said signal in response thereto, and automatic means for making other terminals of the same group busy and for breaking the operating circuit of said relay.

97. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group, signals associated with the terminals of said last group, means for displaying said signals when the line is seized, a signal for said line associated with a terminal of the second group, means for operating said signal without operating said relay, means for connecting with the terminal associated with said signal, other signals associated with other terminals of the second group, and means for displaying said signals when the line is seized in the second group, and for breaking the operating circuit of said relay.

98. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group, signals associated with the terminals of said last group, automatic means for displaying said signals when the line is seized, a signal for said line associated with a terminal of the second

group, electrical means for operating said signal without operating said relay, manual means for connecting with the terminal associated with said signal, other signals associated with other terminals of the second group, and automatic means for displaying said signals when the line is seized in the second group and for breaking the operating circuit of said relay.

99. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, a signal for said line associated with a terminal of the other group, means for operating said signal without operating said relay, means for seizing the line via the terminal associated with said signal in response thereto, and means for making other terminals of the same group busy and for affecting the operating circuit of said relay.

100. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, manual means for seizing said line via a terminal of one group and for making the line busy at other terminals of the same group, a signal for said line associated with a terminal of the other group, electrical means for operating said signal without operating said relay, manual means for seizing the line via the terminal associated with said signal in response thereto, and automatic means for making other terminals of the same group busy and for breaking the operating circuit of said relay.

101. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group, signals associated with the terminals of said last group, means for displaying said signals when the line is seized, a signal for said line associated with a terminal of the second group, means for operating said signal without operating said relay, means for connecting with the terminal associated with said signal, other signals associated with other terminals of the second group, and means for displaying said signals when the line is seized in the second group, and for breaking the operating circuit of said relay.

102. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group, signals associated with the terminals of said last group, means for displaying said signals when the line is seized, a signal for said line associated with a terminal of the second group, means for operating said signal without operating said relay, means for connecting with the terminal associated with said signal, other signals associated with other terminals of the second group, and means for displaying said signals when the line is seized in the second group, and for breaking the operating circuit of said relay.

plex circuit associated with said line, a relay, a normally open operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group, signals associated with the terminals of said last group, automatic means for displaying said signals when the line is seized, a signal for said line associated with a terminal of the second group, electrical means for operating said signal without operating said relay, manual means for connecting with the terminal associated with said signal, other signals associated with other terminals of the second group, and automatic means for displaying said signals when the line is seized in the second group and for breaking the operating circuit of said relay.

103. In a telephone system, a line, a simplex circuit associated with said line, a relay, a normally inoperative operating circuit for the relay involving said line and the simplex circuit, an impulse sender, a battery for operating said relay, two groups of terminals for said line, means for seizing said line via a terminal of one group and for making other terminals of the same group busy, a signal for said line associated with a terminal of the second group, means for breaking the operating circuit of said relay and for operating said signal without operating said relay.

104. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated with said line, and means for operating said switch over said simplex circuit.

105. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated with said line, and means for operating said switch over said simplex circuit, said means comprising a relay in said circuit and call mechanism for transmitting current impulses thereover.

106. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated

with said line, means for operating said switch over said simplex circuit, said means comprising a relay in said circuit and call mechanism for transmitting current impulses thereover, and automatic means for short circuiting one of said coils during the transmission of impulses.

107. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, means for short circuiting one of said coils, an automatic progressively movable switch associated with said line, and means for operating said switch over said simplex circuit.

108. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated with said line, means for operating said switch over said simplex circuit, and magnetic means for connecting and disconnecting said bridges to and from the line.

109. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated with said line, means for operating said switch over said simplex circuit, said means comprising a relay in said circuit and call mechanism for transmitting current impulses thereover, and magnetic means for connecting and disconnecting said bridges to and from the line.

110. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extending a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, an automatic progressively movable switch associated with said line, means for operating said switch over said simplex circuit, said means comprising a relay in said circuit and call mechanism for transmitting current impulses thereover, automatic means for short circuiting one of said coils during the transmission of impulses and magnetic means for connecting and disconnecting said bridges to and from the line.

111. In a telephone system, a line, manual equipment for extending a connection to said line, manual equipment for extend-

ing a connection from said line, a simplex circuit including resistance coils bridged across said line at two points and the two conductors of said line in parallel, means for short circuiting one of said coils, an automatic progressively movable switch associated with said line, means for operating said switch over said simplex circuit, and magnetic means for connecting and disconnecting said bridges to and from the line.

112. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, and means including said first terminal and the said switch for extending calls over said trunk line in the same direction.

113. In a telephone system, a trunk line, operator's equipment comprising manual connective terminals at each end of said trunk line and a call signal at one end thereof for extending calls over said trunk line in one direction manually, and means including the operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending calls over said trunk line in the same direction semi-automatically.

114. In a telephone system, a trunk line having at one end two branches terminating, respectively, in an automatic switch and in a manual connective terminal, a call signal associated with said terminal, a second manual connective terminal at the other end of said trunk line, means including operator's equipment and the said terminals and call signal for completing connections over said trunk line manually, and means including operator's equipment and the said second terminal and automatic switch for completing connections over said trunk line semi-automatically.

115. In a telephone system, a trunk line, operator's equipment for connecting calling lines to said trunk line at one end manually, means at the other end of said trunk line for receiving calls and for extending them to called lines manually, and an automatic switch associated with said last means and controllable over said trunk line for extending connections to called lines automatically.

116. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said

manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, and means for disconnecting said call signal when the said switch is operated.

117. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, and means for rendering the said second connective terminal busy to operators when the said switch is operated.

118. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, a visual busy signal associated with said second terminal and means for actuating said signal when the said switch is operated.

119. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, a line relay for said switch, and means for disconnecting said relay from the trunk line when the said second terminal is connected with manually.

120. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, a busy signal associated with said second terminal, and means for actuating said busy signal and for discon-

necting said call signal when the said switch is operated.

121. In a telephone system, a trunk line provided with a manual connective terminal at one end, and a second manual connective terminal and a call signal at the other end, an automatic switch associated with said second terminal and controllable over said trunk line, means including said manual equipment for extending calls over said trunk line in one direction, means including said first terminal and the said switch for extending calls over said trunk line in the same direction, multiples of said second terminal in different operators' positions, and a circuit multiplied in each position and controlled in the operation of said switch for rendering the trunk line busy to operators.

122. In a telephone system, a trunk line, operator's equipment comprising manual connective terminals at each end of said trunk line and a call signal at one end thereof for extending calls over said trunk line in one direction manually, means including the operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending calls over said trunk line in the same direction semi-automatically, and means for disconnecting said call signal when the said switch is operated.

123. In a telephone system, a trunk line, operator's equipment comprising manual connective terminals at each end of said trunk line and a call signal at one end thereof for extending calls over said trunk line in one direction manually, means including the operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending calls over said trunk line in the same direction semi-automatically, and means controlled in the operation of said switch for rendering the manual connective terminal at the same end of said trunk line busy to an operator.

124. In a telephone system, a trunk line, operator's equipment comprising manual connective terminals at each end of said trunk line and a call signal at one end thereof for extending calls over said trunk line in one direction manually, means including the operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending calls over said trunk line in the same direction semi-automatically, a line relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

125. In a telephone system, a trunk line having at one end two branches terminating, respectively, in an automatic switch and in a manual connective terminal, a call

signal associated with said terminal, a second manual connective terminal at the other end of said trunk line, means including operator's equipment and the said terminals and call signal for completing connections over said trunk line manually, means including operator's equipment and the said second terminal and automatic switch for completing connections over said trunk line semi-automatically, and means for disconnecting said call signal when the said switch is operated.

126. In a telephone system, a trunk line having at one end two branches terminating, respectively, in an automatic switch and in a manual connective terminal, a call signal associated with said terminal, a second manual connective terminal at the other end of said trunk line, means including operator's equipment and the said terminals and call signal for completing connections over said trunk line manually, means including operator's equipment and the said second terminal and automatic switch for completing connections over said trunk line semi-automatically, and means controlled in the operation of said switch for rendering the manual connective terminal at the same end of said trunk line busy to an operator.

127. In a telephone system, a trunk line having at one end two branches terminating, respectively, in an automatic switch and in a manual connective terminal, a call signal associated with said terminal, a second manual connective terminal at the other end of said trunk line, means including operator's equipment and the said terminals and call signal for completing connections over said trunk line manually, means including operator's equipment and the said second terminal and automatic switch for completing connections over said trunk line semi-automatically, a line relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

128. In a telephone system, a trunk line, operator's equipment for connecting calling lines to said trunk line at one end manually, means at the other end of said trunk line for receiving calls and for extending them to called lines manually, an automatic switch associated with said last means and controllable over said trunk line for extending connections to called lines automatically, a line relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

129. In a telephone system, a trunk line, operator's equipment for connecting calling lines to said trunk line at one end manually, means at the other end of said trunk line for receiving calls and for extending them to called lines manually, an automatic switch

associated with said last means and controllable over said trunk line for extending connections to called lines automatically, and a circuit closed in the operation of said switch for rendering the said trunk line busy to an operator at the same end thereof.

130. In a telephone system, a trunk line, operator's equipment at both ends of said trunk line for extending connections thereover in either direction manually, and means including the said operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending connections over said trunk line semi-automatically.

131. In a telephone system, a trunk line, a manual connective terminal and call signal at each end of said trunk line for handling calls thereover manually in either direction, and an automatic switch at one end of said trunk line controllable from the other end thereof for extending connections over said trunk line semi-automatically.

132. In a telephone system, a trunk line, manual equipment including a call signal at each end of said trunk line for receiving calls and for extending them to called lines manually, and an automatic switch at one end of said trunk line controllable thereover for extending connections to called lines automatically.

133. In a telephone system, a trunk line, operator's equipment at both ends of said trunk line for extending connections thereover in either direction manually, means including the said operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending connections over said trunk line semi-automatically, a line relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

134. In a telephone system, a trunk line, operator's equipment at both ends of said trunk line for extending connections thereover in either direction manually, means including the said operator's equipment at one end of said trunk line and an automatic switch at the other end of said trunk line controllable thereover for extending connections over said trunk line semi-automatically, and a circuit closed in the operation of said switch for rendering the said trunk line busy to an operator at the same end thereof.

135. In a telephone system, a trunk line, a manual connective terminal and call signal at each end of said trunk line for handling calls thereover manually in either direction, an automatic switch at one end of said trunk line controllable from the other end thereof for extending connections over said trunk line semi-automatically, a line

relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

136. In a telephone system, a trunk line, a manual connective terminal and call signal at each end of said trunk line for handling calls thereover manually in either direction, an automatic switch at one end of said trunk line controllable from the other end thereof for extending connections over said trunk line semi-automatically, and a circuit closed in the operation of said switch for rendering the said trunk line busy to an operator at the same end thereof.

137. In a telephone system, a trunk line, a manual connective terminal and call signal at each end of said trunk line for handling calls thereover manually in either direction, an automatic switch at one end of said trunk line controllable from the other end thereof for extending connections over said trunk line semi-automatically, and means effective when the said switch is operated to disconnect the call signal at the same end of said trunk line.

138. In a telephone system, a trunk line, manual equipment including a call signal at each end of said trunk line for receiving calls and for extending them to called lines manually, an automatic switch at one end of said trunk line controllable thereover for extending connections to called lines automatically, a line relay for said switch, and means for disconnecting said relay from the trunk line when an operator at the same end extends a connection thereto.

139. In a telephone system, a trunk line, manual equipment including a call signal at each end of said trunk line for receiving calls and for extending them to called lines manually, an automatic switch at one end of said trunk line controllable thereover for extending connections to called lines automatically, and a circuit closed in the operation of said switch for rendering the said trunk line busy to an operator at the same end thereof.

140. In a telephone system, a trunk line, manual equipment including a call signal at each end of said trunk line for receiving calls and for extending them to called lines manually, an automatic switch at one end of

said trunk line controllable thereover for extending connections to called lines automatically, and means effective when the said switch is operated to disconnect the call signal at the same end of said trunk line.

141. In a telephone system, means for connecting a calling and called line including serially related trunk lines each terminating in an automatic switch, a third conductor in each trunk line separate from the talking conductors thereof, and means for controlling the operation of each switch over its associated third conductor.

142. In a telephone system, means for connecting calling and called line comprising serially related trunk lines each terminating in an automatic switch, line and test conductors in each trunk line, a separate fourth conductor in each trunk line, and means for controlling the operation of each switch over the associated fourth conductor.

143. In a telephone system, a temporarily established connection including serially related trunk lines each terminating in an automatic switch, a third conductor in each trunk line separate from the talking conductors thereof, and a controlling circuit for operating the last switch in the series including all of said third conductors in series.

144. In a telephone system, a two conductor metallic circuit trunk line terminating at one end in an automatic progressively movable switch, a control circuit for operating and releasing said switch superimposed on the two conductors of said trunk line, and calling mechanism for transmitting current impulses over said control circuit.

145. In a telephone system, a two conductor metallic circuit trunk line terminating at one end in an automatic progressively movable switch, a control circuit for operating and releasing said switch including the two conductors of said trunk line in parallel and a ground return, and calling mechanism for transmitting current impulses over said control circuit.

Signed by me at Chicago, Cook county, Illinois, this 8th day of October, 1913.

BERNARD D. WILLIS.

Witnesses:

HARRY V. HERSHEY,
GEO. YANOWSKI.