

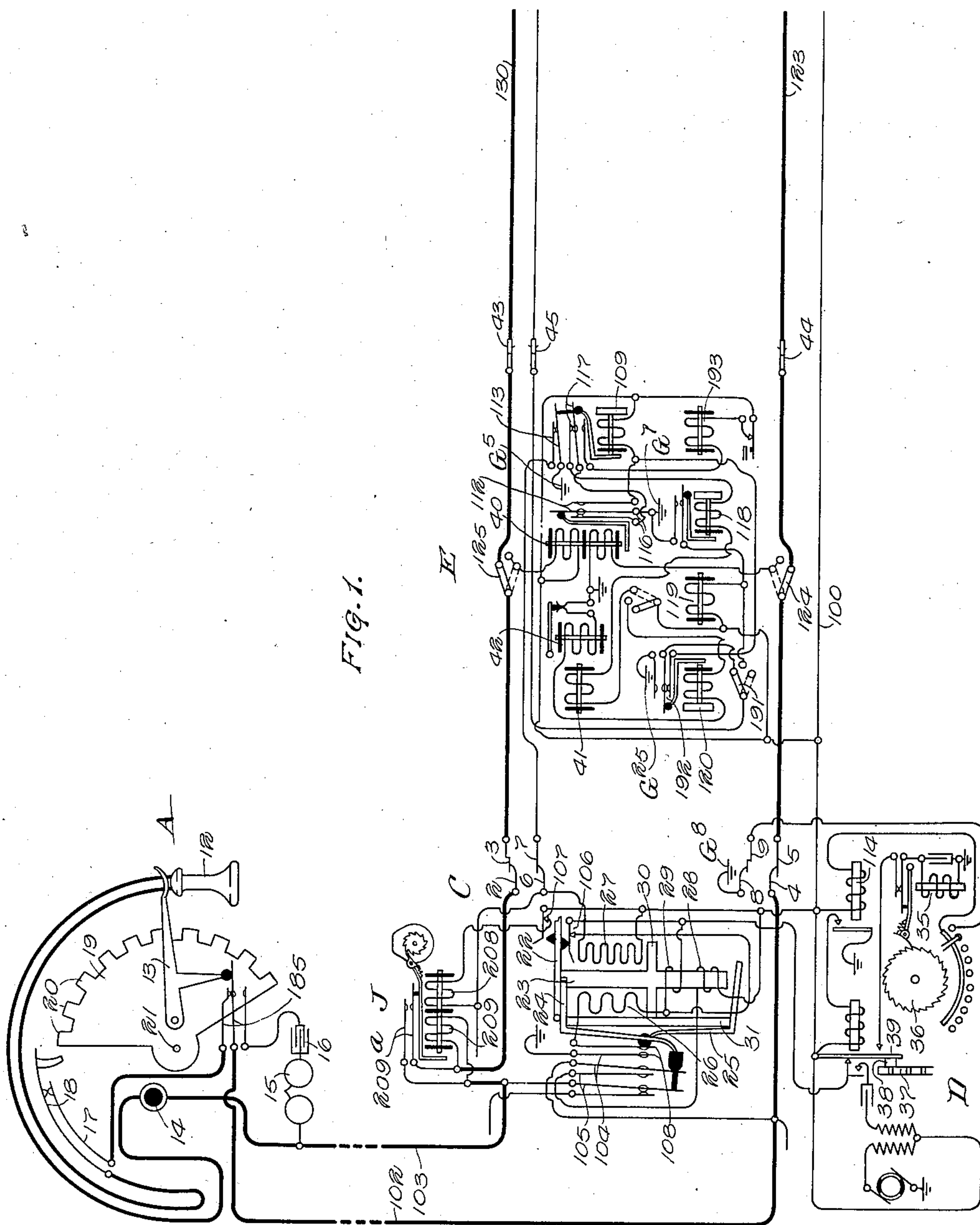
T. G. MARTIN.
TELEPHONE SYSTEM.

APPLICATION FILED OCT. 7, 1913. RENEWED OCT. 22, 1917.

1,267,784.

Patented May 28, 1918.

2 SHEETS—SHEET 1.



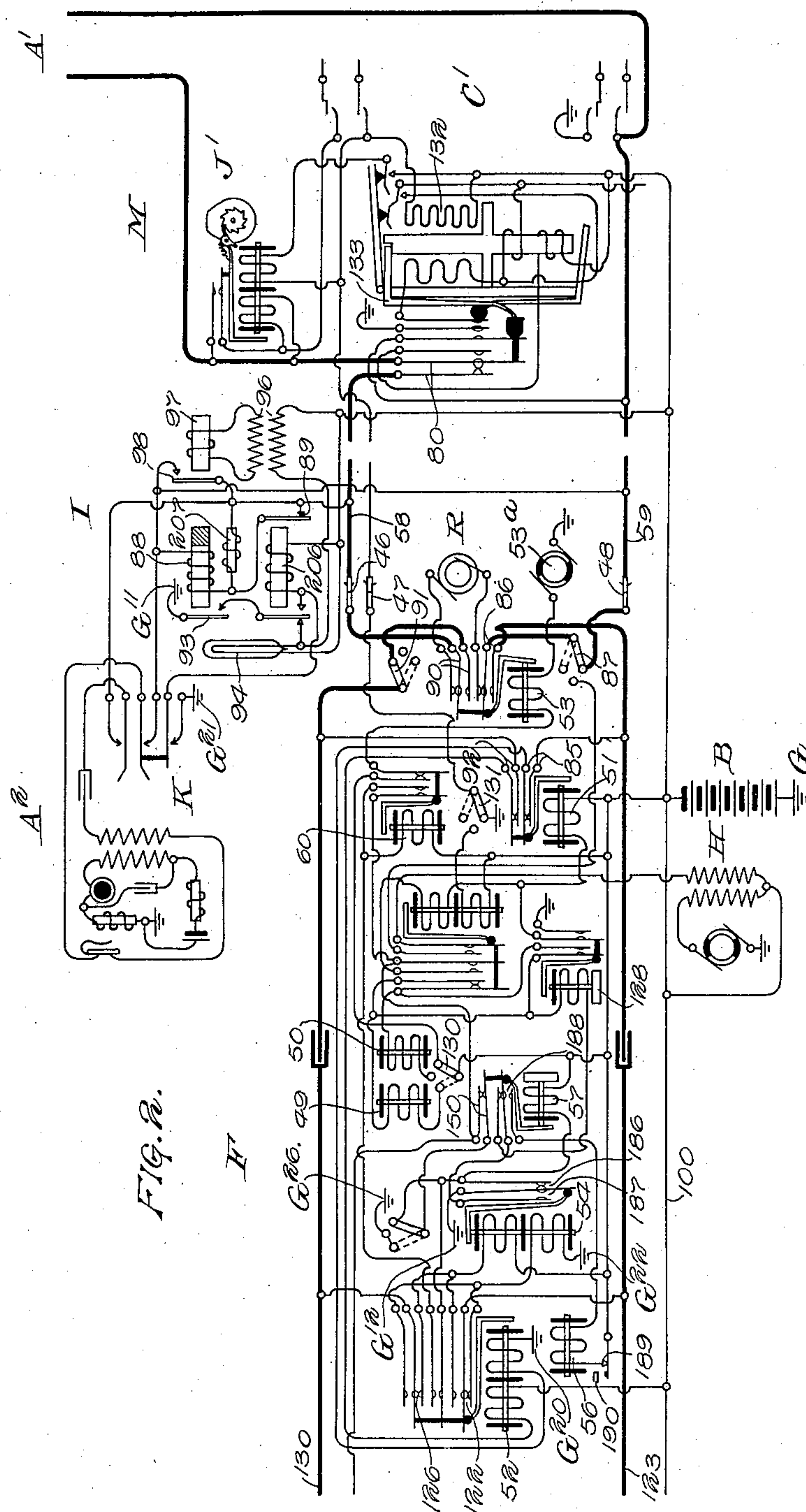
WITNESSES
E. Janochowski
A. V. Hershey.

INVENTOR:
T. G. Martin
By Bulkeley & Greenman
ATTORNEYS

APPLICATION FILED OCT. 7, 1913. RENEWED OCT. 22, 1917.

Patented May 28, 1918.

2 SHEETS—SHEET 2.



Es. Yanachowski
A. W. Hershey.

Gallot & Martin
Bulley & Swanton
ATTORNEYS.

UNITED STATES PATENT OFFICE.

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

TELEPHONE SYSTEM.

1,267,784.

Specification of Letters Patent.

Patented May 28, 1918.

Application filed October 7, 1913, Serial No. 793,945. Renewed October 22, 1917. Serial No. 197,994.

To all whom it may concern:

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

My invention relates to improvements in automatic or semi-automatic telephone systems—that is, systems in which a connection between a calling and a called subscriber's line is established wholly or in part through the medium of automatic switches.

In telephone systems, when a subscriber's telephone is taken out of service, or his number is changed, or if for any other reason his line cannot be called by the number allotted to it in the directory, the connector bank contacts of the line are connected with a so-called traffic trunk leading to an operator's switchboard. Thus any subscriber who attempts to call this line will obtain connection with this traffic trunk and signal the operator, who can then inform the calling subscriber as to the reason why he cannot obtain connection with the desired subscriber, or can indicate to him the manner in which he can obtain such connection if the called subscriber's number has merely been changed.

In providing such an arrangement in automatic systems in which the ringing current is automatically applied to the called line when the connector makes connection therewith, certain difficulties are experienced. Ordinarily the ringing current is cut off from the line by the energization of the back-bridge relay in the connector upon the response of the called subscriber. When the subscribers' lines are provided with meters, the energization of this back-bridge relay also causes the operation of the meter of the calling subscriber's line to thus register the call. When, however, a connection is established with a traffic trunk, it is not advisable to have the meter operate to register such a call, and accordingly means must be provided to cut off the ringing current when connection is established with such a trunk without operating the meter on the calling line.

The object of my invention is to provide such means whereby when connection is established over a traffic trunk to the operator's position, the ringing current is automatically cut off from the traffic trunk by

the energization of the back-bridge relay without causing the meter on the calling line to operate.

The more specific object of my invention is to provide a subscriber's meter which operates upon the reversal of the current caused by the energization of the back-bridge relay, which meter is so arranged that it will not operate upon a comparatively short impulse of current. When connection is established with a called line, the current is reversed and flows in a reverse direction a sufficient length of time to operate the meter. When, however, connection is established with a traffic trunk the current is reversed for but a short interval of time, which reversal is sufficient to cut off the ringing current from the called line, but is not sufficient to operate the meter on the calling line.

My invention will be more clearly understood by reference to the accompanying drawings, in which I have illustrated an automatic system comprising switches of a well-known type, although it will be understood that my invention is not in any way limited to such an automatic system, but is equally as well adapted for use in connection with other automatic or semi-automatic systems in which various forms or types of switches are employed.

In the accompanying drawings Figures 1 and 2 show a complete connection between a calling and a called line A and A', respectively. The telephone of the called line is not shown in order to indicate that it has been disconnected from service, said line being shown connected to the traffic trunk M terminating at the information operator's desk set A².

It will be seen that the subscriber's telephone A is connected to an individual or line switch C at the central office which, by means of the usual plunger (not shown) and the bank springs 2 to 9, inclusive, can extend the line of the calling subscriber to a first selector E, as shown. There is shown in connection with the line switch C a meter J for the purpose of registering the calls made by the calling subscriber. At D there is shown a master switch for controlling the line switch C and other similar switches in the same group. The line switches of this group have common access to a number of trunk lines leading to first selectors (only one of which is shown) terminating in the above-mentioned first selector E. These se-

lectors in turn have access in the usual manner to a certain number of connector switches (only one (F) of which is shown) by means of which connection may be completed with subscribers' lines. Associated with the connector F there is shown a ringing current generator R and a busy signaling apparatus H. Current for the purpose of operating the central office apparatus and for talking is supplied from the battery B, one pole of which is grounded at G. Associated with the connector F is the traffic trunk M, in connection with which there are shown relays I for the purpose of cutting off the ringing current without operating the calling subscriber's meter J. The meter and its action in connection with the line switch are the same as that described in British patent to S. G. S. Dicker No. 1298 of 1910. The line switch C' and the meter J' are the same in every detail as the line switch C and the meter J.

The substation A may be of any suitable common battery type. As shown herein, it comprises the usual receiver 12, switch hook 13, transmitter 14, ringer 15 and condenser 16. Being an automatic substation, it is also provided with impulse springs 17 and 18 and an impulse wheel 19. The impulse wheel 19 carries upon its periphery the impulse teeth 20 and is secured to a shaft 21 to which there is also attached a dial (not shown) provided with finger holds, through the medium of which holds the impulse wheel may be rotated. As the impulse wheel is returned to normal position by a spring (not shown) after it has been rotated for any digit, each of the teeth 20 which passes the end of the spring 17 forces said spring out of engagement with the spring 18. The number of times these springs are separated depends upon the digit called.

The line switch C, which is individual to the line of the substation A, and the master switch D are modified forms of the general type of line switch and master switch disclosed in British patent to R. W. James No. 26,301 of 1906, being of the particular type shown in British patent to T. G. Martin No. 1419 of 1910.

As herein represented, the line switch C comprises, among other details, a plunger (not shown) attached to the end of a so-called plunger arm 22 which is controlled by the magnet 23. The magnet 23 also controls the armatures 24 and 25 and is composed of four windings, namely, a pull-down winding 26, a holding or cut-off winding 27, a line winding 28 and an auxiliary winding 29. The core of the magnet is provided near the center of its length with a lateral projection 30 by means of which the magnet is mounted upon the bracket 31, upon which latter the armatures 24, 25 and 22 are pivoted. With this method of mounting the magnet, the

magnetic circuit of the windings 26 and 27 is maintained separate from that of the windings 28 and 29, so that the armatures at one end are not affected by the energization of the windings upon the other end of the magnet. Only the winding 26 is strong enough to attract the plunger arm 22 from its normal position. The winding 27 is not strong enough to operate the plunger arm alone, but is strong enough to hold it in an operated position after it has been drawn down by the winding 26. When the plunger arm 22 is drawn down by the magnet 23, the plunger of the switch is forced into a bank of contact springs, forcing the springs 2, 4, 6 and 8 into engagement with the springs 3, 5, 7 and 9, respectively. Although only one set of springs (2—9) is shown, each line switch C is provided with a number of such groups of springs, each group forming the terminal of a trunk line leading to a selector E.

The plungers of the line switches normally engage with a so-called plunger guide shaft (not shown), and through the medium of the master switch D are normally maintained opposite the terminals of an idle trunk line.

The master switch consists essentially of a motor magnet 35 for rotating the ratchet wheel 36. The ratchet wheel 36 is attached to the plunger guide shaft in such a manner that a rotary motion of the wheel imparts an oscillatory motion to the plunger guide shaft to move the plungers back and forth in front of the trunk terminals. To the plunger guide shaft there is also secured a locking plate 37 provided with a number of openings adapted to be engaged by the pin 38 on the end of the armature 39. The holes in this plate are so spaced that the pin 38 can engage one of them and allows the armature to drop back only when the idle plungers are directly opposite the trunk terminals.

The selector E is of the general type of selector disclosed in British Patent No. 1419 of 1910, above referred to, and comprises, among other details, a line relay 40, which is normally connected to the line, and vertical and rotary magnets 41 and 42 for the purpose of raising and rotating the shaft wipers 43, 44 and 45 onto an idle trunk line leading to a connector F.

The connector F is of the general type of connector switch disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, the circuits, however, being modified to adapt the switch for operation in a two-wire system. Like the selector, the connector is provided with a shaft (not shown) carrying the wipers 46, 47 and 48 and is controlled by the vertical magnet 49 and the rotary magnet 50. The usual side switch is con-

trolled by the private magnet 51 in the usual manner. The connector is provided with a so-called back-bridge relay 52 through which the called subscriber is provided with talking current, which relay is also the means by which the flow of current in the calling line may be reversed in order to operate the meter on said line. Ringing current is supplied to the called line through the medium of the ringer relay 53. Connected with the line through the springs of the back-bridge relay 52 is the line relay 54, which operates in response to the impulses sent over the line from the calling substation. The usual release magnet 56 and release relay 57 are provided, the former, as is well known, operating directly to release the switch.

The traffic trunk M and its associated equipment I are bridged across the conductors 58 and 59. The equipment I is for the purpose of operating the ringing cut-off relay 60 of the connector, through the medium of the back-bridge relay 52, in such a manner that the meter at the calling end of the line does not get time in which to operate to register the call when a disconnected line is called—that is, a line connected to the traffic trunk. The terminals 58 and 59 of the subscriber's line are connected to the traffic trunk M and this trunk terminates in a key K at the operator's desk, and when the line A' is called, the operator informs the calling subscriber of the change. The equipment I comprises a slow-acting coil 88 (that is, a coil which is slow to deenergize when the circuit of said coil has been broken) bridged across the traffic trunk through the contact 89. A so-called "kick" coil is shown at 97 which is only energized momentarily when a current is induced in the secondary winding of the coil 96. Upon the operation of the key K the coil 206 is energized, breaking the circuit of the lamp 94 and bridging across the line the coil 88, together with the impedance coil 207.

Having given a general description of the apparatus involved in my invention, I will now explain how a subscriber at substation A, in attempting to call a subscriber at substation A', obtains connection with the operator's set A² in the central office, who answers and instructs the calling subscriber without operating the meter J.

We will assume that the subscriber at substation A is calling a subscriber's line whose number is 220. Upon the removal of the receiver 12 from the switch-hook 13, the talking circuit is bridged across the line conductors 102 and 103, whereby an energizing circuit is closed through the line winding 28 of the line switch C. Upon the line relay 28 becoming energized, the armature 25 is attracted to close the circuit of the pull-down coil 26, which, when energized, at-

tracts the plunger arm 22 to thrust the plunger into the bank terminals of the line switch. At the same time the smaller armature 24 is attracted, disconnecting battery current from the line relay 28 at the springs 104 and 105. The armature 25 does not fall back, however, at this time on account of the auxiliary winding 29 being still energized in series with the winding 26. Upon the plunger arm 22 being drawn down completely, together with the plunger, the springs 2, 4, 6 and 8 are brought into contact with the springs 3, 5, 7 and 9, respectively. By the same operation the springs 106 and 107 make contact, the former to short-circuit the winding 29 and the latter to close the circuit of the winding 208 of the meter J. The flow of current through the winding 208 is in the opposite direction to that of the winding 209, which is also included in a circuit at this time through the line relay 40 of the first selector E due to the closure of contact between the springs 2 and 3 and 4 and 5. Therefore said meter does not operate. Upon the auxiliary winding 29 being short-circuited, the armature 25 falls back to open the circuit of the pull-down coil 26 at the springs 108. This has not taken place, however, until after a circuit has been closed at the first selector from ground G⁵ through the hold-down coil 27 to battery, and also through the winding 208 of the meter magnet, as a result of the energization of the relay 40, which in turn energizes the relay 109. Upon the springs 2 and 4 making contact with the springs 3 and 5, it will be seen that the line connection is extended through the winding 209 of the meter magnet J to the first selector E and through the line relay 40, which relay energizes to close the circuit of the slow acting relay 109 from ground G⁷, contact 112 and through said relay to the battery lead 100. Upon the springs 6 and 7 making contact, and the engagement of springs 113 by the energization of relay 109 the circuit is closed for the coils 27 and 208. The said circuit extending from ground G⁵ through the contact of springs 113 and springs 7 and 6, through the coil 27 along one branch and through the coil 208 along another branch to battery. The line switch plunger, upon closing the springs 8 and 9, sets up a circuit through the start relay 114 in the master switch D, which in turn is the means for energizing the motor magnet 35. Upon the motor magnet 35 energizing, the ratchet wheel 36 is rotated, which imparts an oscillatory motion to the plunger guide shaft (not shown) to move all the idle plungers of the group of line switches, of which the switch C is one, opposite an idle trunk. At the same time battery current is removed from the above-mentioned group of line switches to prevent any one of them operat-

ing while the plungers are being moved over the busy trunks, and a busy tone is sent back to any subscriber that might be trying to call at this time. The above-mentioned operations take place upon the subscriber at substation A removing his receiver from the switch-hook.

The selector E is now in position to receive the impulses for the first digit 2. Upon the subscriber operating the dial of the calling device, the impulse springs 17 and 18 are caused to twice momentarily open the circuit of the line relay 40. Since the relay 109 is slow acting, it does not deenergize during the momentary deenergizations of the relay 40, and the circuit from ground G⁷ through the private relay 118, in series with the vertical magnet 41, to the battery lead 100 is closed twice. The vertical magnet 41 thereupon energizes and operates to raise the shaft wipers 43, 44 and 45 two steps, opposite the row of contacts in which the trunk lines leading to the connector F terminate. At this time the side switch is released from the first to the second position under the influence of the private magnet 119, whereby a circuit is closed through the rotary magnet 42 in series with the slow acting relay 120, which former operates in the usual manner to rotate the shaft wipers 43, 44 and 45 onto an idle trunk line. After the wipers come to rest, the side switch is moved to the third position, whereby the connection is extended through the wipers 43, 44 and 45 to the connector F, energizing the line relay 54 (Fig. 2). The circuit for the relay 54 extends from ground G²² through the lower winding of the relay 54, through the springs 122, conductor 123, line wiper 44, side switch wiper 124, bank springs 5 and 4, through the telephone at substation A, back over the conductor 103, bank springs 2 and 3, side switch wiper 125, line wiper 43, contact of springs 126 (Fig. 2) and through the upper winding of the line relay 54 to the battery lead 100. Upon the relay 54 energizing, a circuit is closed through the slow acting relay 57 in the same manner as in the selector E. The relay 120 (Fig. 1) being slow to deenergize after the side switch passes to third position, a guarding potential is placed on the private wiper 45 from ground G²⁵ the instant the wipers 43, 44 and 45 come to rest on the first idle trunk terminal, so as to insure against any other selector occupying the same trunk before the release relay 57 of the connector F has time to operate its springs 150 to extend the guarding potential from ground G²⁶. The apparatus is now in readiness to receive the second series of impulses corresponding to the second digit 2, whereupon the subscriber operates his calling device accordingly, deenergizing the line relay 54 of the connector twice to operate the vertical magnet 49 to raise the shaft two steps in the

usual manner. Upon the last impulse of this series being delivered, the slow acting private relay 128 deenergizes, thereby breaking the circuit of the private magnet 51, which allows the side switch to pass from first to second position, transferring battery current from the vertical magnet 49 to the rotary magnet 50.

The calling device is now operated for the third digit 0, transmitting over the line ten impulses and operating the rotary magnet 50 to rotate the shaft wipers 46, 47 and 48 ten steps. After the last impulse of this series has been delivered, the private magnet again deenergizes and the side switch passes to third position. At this time the wipers 46, 47 and 48 are resting on the desired contacts, and upon the side switch wiper 131 passing to third position, a circuit is closed through the hold-down coil 132 of the line switch C', which energizes to press together the springs 80. As soon as the ringing relay 53 deenergizes, if it happens to be energized at the time, a circuit including the traffic trunk and back bridge relay 52 may be traced from ground G²⁰ through one winding of the back-bridge relay 52, through the contacts of springs 85 and 86, side switch wiper 87, line wiper 48, conductor 59, through the relay 88 and contact of springs 89, back over the conductor 58, line wiper 46 and the contact of springs 90, side switch wiper 91, contact of springs 92 and through the other winding of the relay 52, and through battery B to ground G. Owing to the fact that the relay 88 is of high resistance, the back-bridge relay does not get sufficient current for its energization. However, the relay 88 energizes and closes a circuit from ground G¹¹ through the contact 93 and lamp 94 to battery. There is also another circuit extending from ground G¹¹ through the primary winding of the induction coil 96 to battery B. The former circuit lights the lamp 94 to signal the operator, while the latter induces a current in the secondary winding of the induction coil 96 to momentarily energize the so-called "kick" coil 97. The momentary energization attracts the armature 98 and releases it immediately, whereby the coil 88 is momentarily short-circuited, but does not fall back owing to the fact that it has a copper slug on one end, making it slow acting for reasons that will be given later. The short-circuiting of the coil 88 permits sufficient current to flow through the battery-reversing relay 52 to operatively energize it, but the time is of such short duration that the springs at said relay are not operated long enough to permit a sufficient flow of current in the reverse direction to pass through the meter J to enable it to attract its armature, due to the tension of the springs 209^a and the distance between the

armature and the coil. Therefore the call is not registered by the meter J. This momentary energization of the relay 52, however, is sufficiently long to close the circuit of the ring cut-off relay 60 and to operate it to permanently open the circuit of the ringer relay 53, which circuit is closed upon the side switch passing to third position. The function of the back-bridge relay 52 ordinarily, in addition to supplying talking current to the called subscriber, is to reverse the flow of current through the line winding of the meter of the calling subscriber so as to have the flow of current through both windings in the same direction, thus operating said meter to register the call, but, as has already been stated, the length of time in which said relay 52 is energized is too short to permit the meter J to operate. Upon the lamp 94 flashing, the operator at substation A² operates the key K to close the circuit of the relay 206 from ground G²¹ through said relay 206 to battery B. Upon this relay becoming energized the lamp 94 is extinguished and a short-circuit, which is normally maintained across an impedance coil 207, is removed. This coil, with the slow acting relay 88, remains across the line during the conversation. Said coil 207 is inserted to prevent the voice currents from being short-circuited, the necessity for which being due to the fact that the relay 88 is provided with a copper slug to make said relay non-responsive to ringing current. The reason for this is to eliminate the possibility of the "kick" coil 97 being operated by the ringing current should the interrupter 53^a be in position to cause the circuit of the ringing relay to be closed immediately upon the engagement of the side switch wiper 130 with its third-position contact point, as otherwise the relay 88 might be operated while the connector back-bridge relay 52 was disconnected from the called line. When the relay 206 is energized by the operator at the key K, it is locked, so that should she return her key to normal after giving the desired information and the subscriber should still have his receiver off the switch-hook, the lamp 94 would not again light. To release the connection the calling subscriber replaces his receiver upon the switch-hook, thereby opening the circuit of the line relay 54 in the connector switch F at the springs 185. Upon the line relay 54 deenergizing, its armature falls back, breaking the contact 186 and thereby opening the circuit of the release relay 57. The relay 57, upon deenergizing, closes a circuit through the release magnet 56 from ground G¹² through contacts 187 and 188 of the line and release relays, respectively, through said magnet and the off normal springs 189 to battery B. Upon the release magnet 56 energizing, its armature (not shown) is attracted to mechanically release

the connector switch F by returning the shaft and its wipers 46, 47 and 48, together with the side switch, to their normal positions. When the shaft reaches its lowest point, a projection thereon, part of which is shown at 190, causes the circuit of the release magnet to be broken at the off normal springs 189. By the breaking of the contact 186 of the relay 54 the circuit of relay 109 in the selector E is also broken, said circuit extending from ground G¹² through the contacts 186 and 150, private wiper 45, side switch wiper 191, contact 192 and through the relay 109 to battery B and to ground G. Upon the release of relay 109 deenergizing, the circuit for the released magnet 193 is closed and the selector switch E is released in the same manner in which the connector F is released. Also, upon the relay 109 deenergizing and breaking the contact 113, the ground connection at ground G⁵ is taken off the holding coil 27 of the line switch C, whereby said coil deenergizes, allowing the plunger to be retracted from the bank terminals of the line switch and leaving the central office apparatus in position to be again operated for another call.

It will thus be seen that I have devised a very efficient system in which, when connection is established with the traffic trunk, the back-bridge relay is energized momentarily to energize the ringing cut-off relay, but the back-bridge relay does not remain energized a sufficient length of time to permit the meter on the calling line to operate.

While I have illustrated my invention in connection with one particular type of system, and have illustrated one particular manner in which the ringing current is cut off from the calling subscriber's line without operating the subscriber's meter, it will be understood that I do not wish to limit myself to the exact construction shown and described.

What I claim as my invention is:—

1. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter for said calling line, means for automatically applying ringing current to the called line, means for automatically disconnecting said ringing current from the called line and for operating said calling line meter when connection has been established with the called line, a traffic trunk terminating in an operator's board, said first means also for establishing connection from said calling line to said traffic trunk and for automatically applying ringing current thereto, and means responsive to the establishment of a connection with said traffic trunk for automatically disconnecting the ringing current therefrom without operating said calling meter.

2. In a telephone system, a plurality of

subscribers' lines, an automatic connector switch provided with bank contacts in which a plurality of said lines terminate, a traffic trunk connected with certain of said bank contacts, means for extending connection from one of said lines to said connector, means for then operating said connector to establish a connection with another of said subscribers' lines, means in said connector for automatically applying ringing current to said called line, a meter on the calling line, means controlled by the response of the called subscriber for automatically disconnecting the ringing current from the called line and for operating the meter, means for operating said connector to establish connection with said traffic trunk and applying ringing current thereto, an operator's set adapted to be connected with said trunk, and means responsive to the establishment of a connection with said traffic trunk for automatically disconnecting the ringing current therefrom without operating said calling meter.

3. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk terminating in said connector switch, a meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay and means for automatically preventing said first relay from operating said meter.

4. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk line extending to said connector switch, a meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for applying ringing current to said line when connection is established therewith, and means controlled by the energization of said first relay for disconnecting said ringing current from the line and for preventing the operation of said meter.

5. In a telephone system, an automatic connector switch, a line with which said

switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for automatically connecting ringing current to said line when connection is established therewith, a trunk line extending to said switch, a meter associated with said trunk, means controlled by the energization of said first relay for disconnecting said ringing current from the line and for reversing the current in said trunk and means for preventing the reversal of said current from operating said meter.

6. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk terminating in said connector, a meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for intermittently applying ringing current to said line when connection is established therewith, means for rendering said second relay non-responsive to said ringing current, and means controlled by the energization of said first relay for disconnecting said ringing current from the line and for preventing the operation of said meter.

7. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for automatically connecting ringing current to said line when connection is established therewith, means for rendering said second relay non-responsive to said ringing current, a trunk line extending to said switch, a meter associated with said trunk, means controlled by the energization of said first relay for

disconnecting said ringing current from the line and reversing the current in said trunk and means for preventing the reversal of said current from operating said meter.

5 8. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, a meter associated with said trunk, a line with which said switch is adapted to make connection, a relay in said
10 switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said
15 second relay being of high resistance to prevent energization of said first relay when the two are connected in series, and means controlled by the energization of said second
20 relay to only momentarily short-circuit said second relay to thereby cause only the momentary operation of said first relay to prevent the operation of said meter.

9. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, a meter associated with said
25 trunk line, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector es-
30 tablishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second
35 relay, and means for momentarily energizing said third relay to thereby close only momentarily said short-circuit upon the energization of said second relay to thereby cause the operation of said first relay to pre-
40 vent the operation of said meter.

10. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, a meter associated with said trunk line, a line with which said switch is
45 adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said sec-
50 ond relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, and means for transmitting an in-
55 duced impulse through said third relay upon the operation of said second relay to thereby cause said third relay to momentarily short-circuit said second relay to thereby cause only the momentary operation of said
60 first relay to prevent the operation of said meter.

11. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a re-
15 lay in said switch, a second relay bridged

across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when
70 the two are connected in series, means controlled by the energization of said second relay to momentarily short-circuit said second relay to thereby cause the operation of said first relay, a trunk line extending to
75 said switch, a meter associated with said trunk, means controlled by the operation of said first relay for reversing the current in said trunk and means for preventing the reversal of said current from operating said
80 meter.

12. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a re-
85 lay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connections with said line, said second relay being of high resistance to prevent energization of said first relay when
90 the two are connected in series, a third relay controlling a short-circuit about said second relay, means for momentarily energizing said third relay to thereby close said short-circuit upon the energization of said second
95 relay to thereby cause the operation of said first relay, a trunk line extending to said switch, a meter associated with said trunk, means controlled by the operation of said first relay for reversing the current in said
100 trunk and means for preventing the reversal of said current from operating said meter.

13. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay
105 in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to
110 prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, means for transmitting an induced impulse through said third relay upon the
115 operation of said second relay to thereby cause said third relay to momentarily short-circuit said second relay to thereby cause the operation of said first relay, a trunk line extending to said switch, a meter associated
120 with said trunk, means controlled by the operation of said first relay for reversing the current in said trunk and means for preventing the reversal of said current from operating said meter.
125

14. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay
130 in said switch, a second relay bridged across said line and adapted to be connected in

series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, means controlled by the energization of said second relay to momentarily short-circuit said second relay to thereby cause the operation of said first relay, means for automatically connecting ringing current to said line when connection is established therewith, a trunk line extending to said switch, a meter associated with said trunk, means controlled by the energization of said first relay for disconnecting said ringing current from the line and for reversing the current in said trunk and yet prevent the operation of said meter.

15. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, means for momentarily energizing said third relay to thereby close said short-circuit upon the energization of said second relay to thereby cause the operation of said first relay, means for automatically connecting ringing current to said line when connection is established therewith, a trunk line extending to said switch, a meter associated with said trunk, means controlled by the energization of said first relay for disconnecting said ringing current from the line and for reversing the current in said trunk and yet prevent the operation of said meter.

16. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, means for transmitting an induced impulse through said third relay upon the operation of said second relay to thereby cause said third relay to momentarily short-circuit said second relay to thereby cause the operation of said first relay, means for automatically connecting ringing current to said line when connection is established therewith, a trunk line extending to said switch, a meter associated with said trunk, and means controlled by the energization

of said first relay for disconnecting said ringing current from the line and for reversing the current in said trunk and yet prevent the operation of said meter.

17. In an automatic telephone system, an automatic connector switch provided with bank terminals, means for operating said connector to establish connection with one of said terminals and for establishing connection with another of said terminals, a trunk line extending to said connector switch, a meter operable over said trunk, a relay in said connector, and automatic means for holding said relay energized while the connector maintains connection with the first one of said terminals to reverse the current in the trunk line for operating said meter, and automatic means for only momentarily energizing said relay responsive to the establishment of a connection with the other of said terminals to prevent the operation of said meter.

18. In a telephone system, an automatic connector switch provided with bank contacts, a plurality of subscribers' lines connected with certain of said contacts, a traffic trunk connected with other of said contacts, an operator's set adapted to be connected with said traffic trunk, a source of ringing current, means for automatically connecting said ringing current with said contacts when said connector establishes connection therewith, a trunk terminating in said connector, a meter associated with said trunk, a relay in said connector, means for holding said relay energized while the subscribers are talking for operating said meter, automatic means for only momentarily energizing said relay responsive to the establishment of a connection with the traffic trunk to prevent the operation of said meter and yet automatically disconnect the ringing current from said contacts.

19. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk terminating in said connector switch, an electromagnetic meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, and means for automatically preventing said first relay from operating said electromagnetic meter.

20. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across

said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk line extending to said connector switch, an electromagnetic meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for applying ringing current to said line when connection is established therewith, and means controlled by the energization of said first relay for disconnecting said ringing current from the line and for preventing the operation of said electromagnetic meter.

21. In a telephone system, an automatic connector switch, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay, a trunk terminating in said connector, an electromagnetic meter associated with said trunk, means for automatically short-circuiting said high resistance relay responsive to the establishment of a connection with said line to thereby cause the operation of said first relay, means for intermittently applying ringing current to said line when connection is established therewith, means for rendering said second relay non-responsive to said ringing current, and means controlled by the energization of said first relay for disconnecting said ringing current from the line and for preventing the operation of said electromagnetic meter.

22. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, an electromagnetic meter associated with said trunk, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, and means controlled by the energization of said second relay to only momentarily short-circuit said second relay to thereby cause only the momentary operation of said first relay to prevent the operation of said electromagnetic meter.

23. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, an electromagnetic meter associated with said trunk line, a line with which said switch is adapted to make connec-

tion, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, and means for momentarily energizing said third relay to thereby close only momentarily said short-circuit upon the energization of said second relay to thereby cause the operation of said first relay to prevent the operation of said electromagnetic meter.

24. In a telephone system, an automatic connector switch, a trunk line terminating in said switch, an electromagnetic meter associated with said trunk line, a line with which said switch is adapted to make connection, a relay in said switch, a second relay bridged across said line and adapted to be connected in series with said first relay when said connector establishes connection with said line, said second relay being of high resistance to prevent energization of said first relay when the two are connected in series, a third relay controlling a short-circuit about said second relay, and means for transmitting an induced impulse through said third relay responsive to the operation of said second relay to thereby cause said third relay to momentarily short-circuit said second relay to thereby cause only the momentary operation of said first relay to prevent the operation of said electromagnetic meter.

25. In a telephone system, a subscriber's line, a trunk line, a connector switch accessible to said line for connecting with said trunk line, automatic ringing equipment in said connector switch, a measured service device associated with said subscriber's line, a device in said connector for preventing the operation of said equipment, said device having different time constants, a relay in said connector for operating said devices, and means responsive to the establishment of a connection with said trunk line for closing a bridge across the same to operate said relay in said connector, said means also for opening said bridge before said measured service device is operated.

26. In a telephone system, a subscriber's line, a trunk line, a connector switch accessible to said line for connecting with said trunk line, automatic ringing equipment in said connector switch, a measured service device associated with said subscriber's line, a device in said connector for preventing the operation of said equipment, said devices having different time constants, a relay in said connector for operating said devices, a high resistance relay in bridge of said trunk line and adapted to be connected in

series with the said first relay upon the seizure of the trunk line by said connector, said first relay remaining inoperative, and means controlled by said second relay for closing a low resistance bridge across said trunk line to operate said first relay, said means also for opening said low resistance bridge to deenergize said first relay before the slower of said devices has operated.

27. In a telephone system, a subscriber's line, a trunk line, a connector switch accessible to said line for connecting with said trunk line, automatic ringing equipment in said connector switch, a measured service device associated with said subscriber's line, a device in said connector for preventing the operation of said equipment, said devices having different time constants, a relay in said connector for operating said devices, a high resistance relay in bridge of said trunk line and adapted to be connected in series with the said first relay upon the seizure of the trunk line by said connector, said first relay remaining inoperative, and means controlled by said second relay for closing a low resistance bridge across said trunk line to operate said first relay to operate one of said devices, said means also for opening said low resistance bridge to deenergize said first relay before the other of said devices has operated.

28. In a telephone system, a subscriber's line, a trunk line, a connector switch accessible to said subscriber's line for connecting with said trunk line, automatic ringing equipment in said connector switch, a meter associated with said subscriber's line, a relay in said connector for preventing the operation of said equipment, said relay operating more rapidly than said meter, a second relay in said connector for operating said meter and for initiating the operation of said first relay, and means responsive to the establishment of a connection with said trunk line for closing a bridge across the same to operate said second relay, said means also for opening said bridge to deenergize said second relay before said meter has been operated.

29. In a telephone system, a subscriber's line, a trunk line, a connector switch accessible to said line for connecting with said trunk line, automatic ringing equipment in said connector switch, a meter associated with said subscriber's line, a relay in said connector for preventing the operation of said equipment, said relay operating more rapidly than said meter, a second relay in said connector for operating said meter and for initiating the operation of said first relay, a high resistance relay in bridge of said trunk line and adapted to be connected in

series with the said second relay when said lines are connected by said connector, said second relay remaining inoperative, and means controlled by said high resistance relay for closing a low resistance bridge across said trunk line to operate said second relay, said means also for immediately opening said low resistance bridge to deenergize said second relay, whereby said first relay may be operated without actuating said meter.

30. In a telephone system, the combination with a calling subscriber's line and a measured service device associated therewith, of a trunk line leading to an operator's position, a link circuit for connecting said subscriber's line and said trunk line, automatic ringing equipment associated with said link circuit, a relay associated with said link circuit for preventing the operation of said ringing equipment, a second relay associated with said link circuit for operating said device and for initiating the operation of said first relay, said first relay adjusted to operate more quickly than said device, and means responsive to the establishment of a connection with said trunk line for closing a bridge across the same to operate said second relay, said means also for opening said bridge to deenergize said second relay before said device is operated.

31. In a telephone system, the combination with a calling subscriber's line and a measured service device associated therewith, of a trunk line to an operator's position, a link circuit for connecting said link and trunk line, automatic ringing equipment associated with said link circuit, a relay associated with said link for preventing the operation of said ringing equipment, a second relay associated with said link for operating said device and for initiating the operation of said first relay, said first relay adjusted to operate more quickly than said device, a high resistance relay in bridge of said trunk line and adapted to be connected in series with the said second relay when said lines are connected by said link circuit, said second relay remaining inoperative, and means controlled by said high resistance relay for closing a low resistance bridge across said trunk line to operate said second relay, said means also for immediately opening said low resistance bridge to deenergize said second relay, whereby said first relay may be operated without actuating said device.

Signed by me at Chicago, Cook county, Illinois, this 29th day of September, 1913.

TALBOT G. MARTIN.

Witnesses:

G. YANOSCHOWSKI,
H. E. HERSHEY.