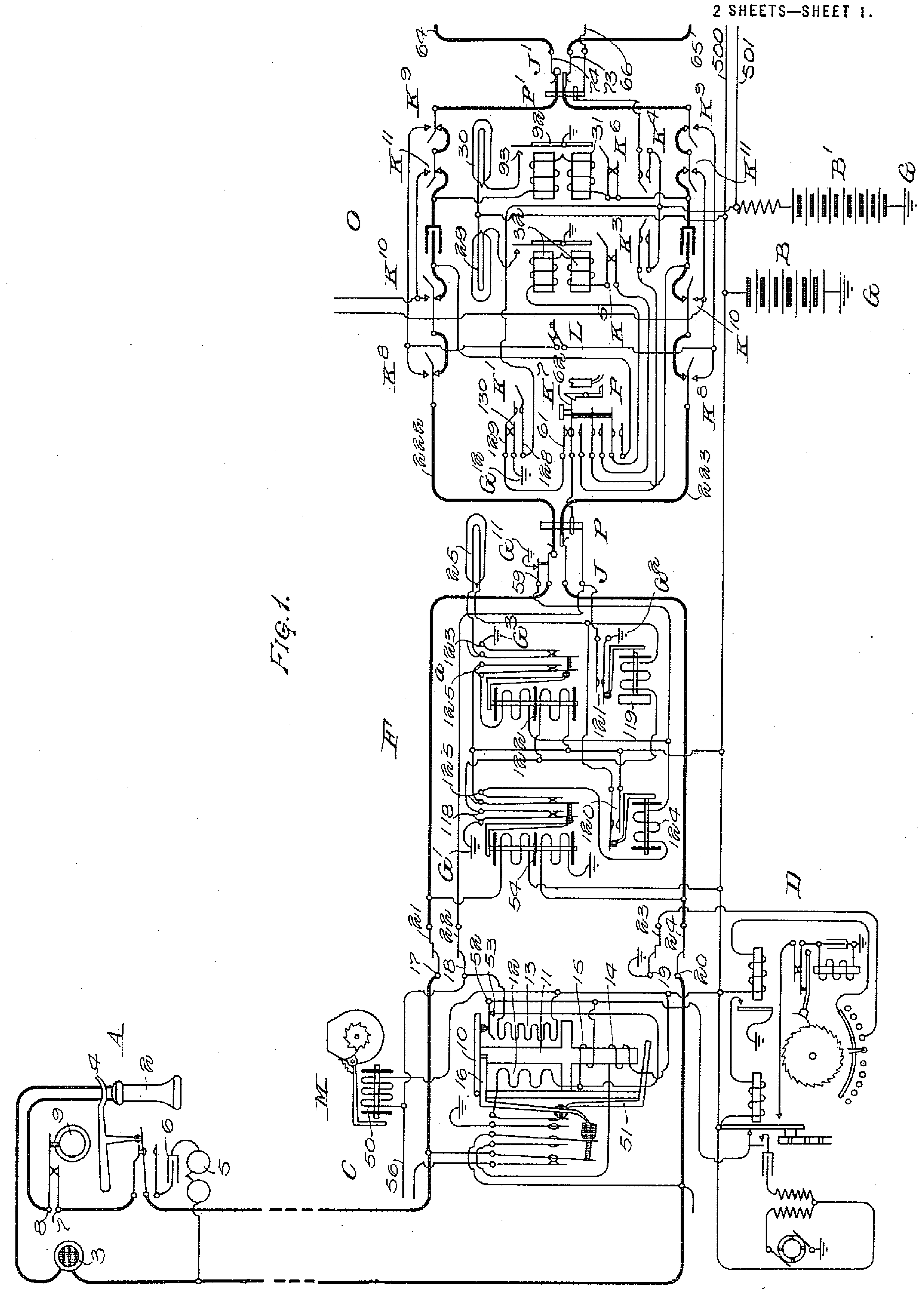
G. A. YANOCHOWSKI.

SEMI-AUTOMATIC TELEPHONE SYSTEM.

APPLICATION FILED AUG. 25, 1914. RENEWED APR. 8, 1918.

1,284,242. Patented Nov. 12, 1918.

2 SHEETS—SHEET 1.



WITNESSES
Chas. M. Candy
B. Garber

INVENTOR:
GEORGE A. YANOCHOWSKI,

ATTORNEYS

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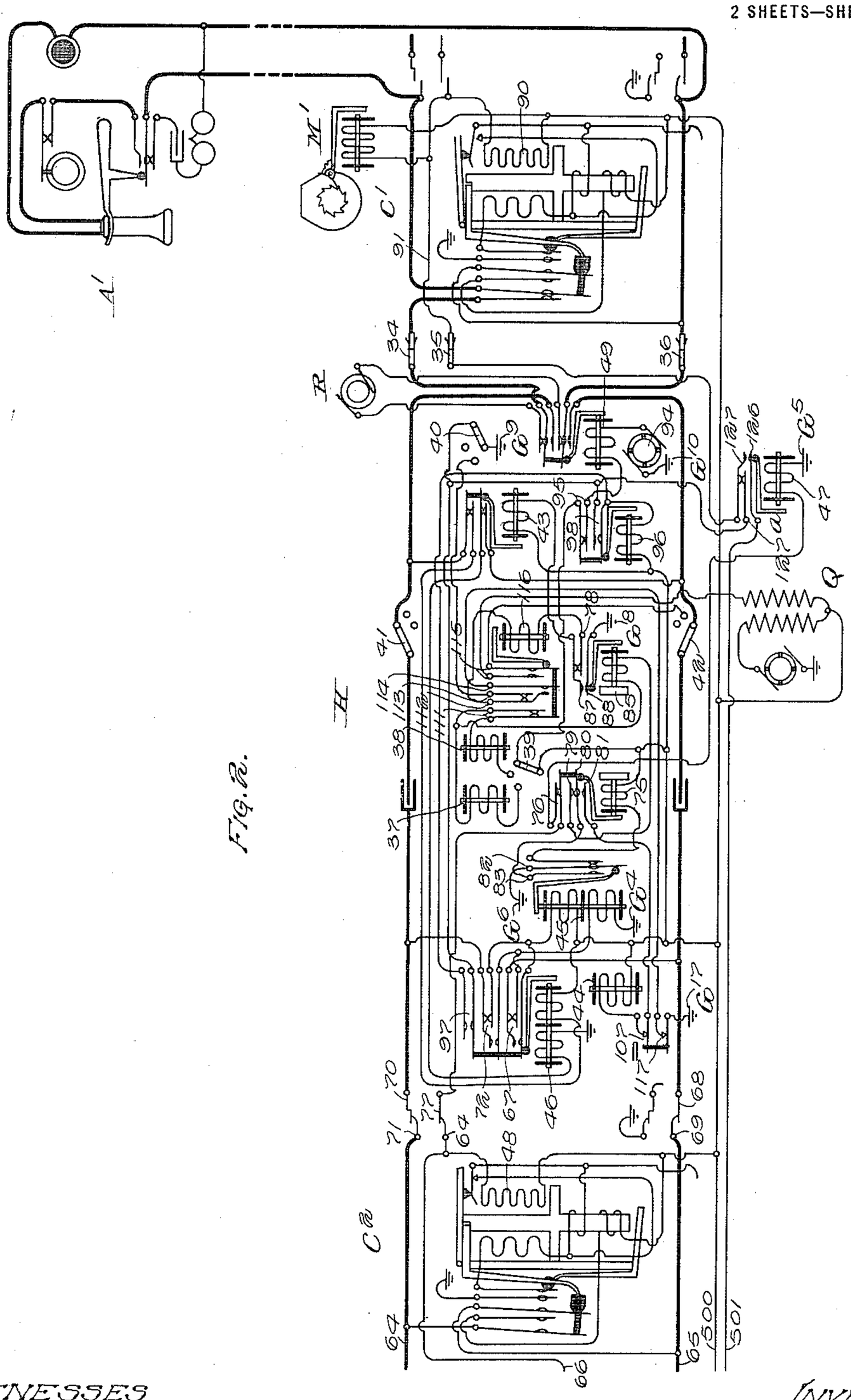

FIG. 2.

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UNITED STATES PATENT OFFICE.

GEORGE A. YANOCHOWSKI, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SEMI-AUTOMATIC TELEPHONE SYSTEM.

1,284,242. Specification of Letters Patent. Patented Nov. 12, 1918.

Application filed August 25, 1914, Serial No. 858,494. Renewed April 8, 1918. Serial No. 227,370.

To all whom it may concern:

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

My invention relates to improvements in semi-automatic telephone systems, and has for its object the provision of improved means for signaling the operator and also improved means for enabling the operator to register the call. By my invention the operator is enabled to operate the meter on either the calling or the called subscriber's line in order to charge the call to the corresponding line. This means is controlled by transmitting a booster impulse over the trunk-release conductor. Furthermore, by my invention the operator is enabled to disconnect from the calling line after receiving his order, and then after connection has been established automatically with the called line she can extend connection from the answering plug of the cord through automatic switches to the calling line, and then if desired can operate the meter on the calling line in order to charge the call to that line.

These and other features and objects of my invention will be more clearly understood by reference to the accompanying drawings, in which I have illustrated one embodiment of my invention in connection with automatic switches of well-known types.

Figures 1 and 2 taken together show a complete circuit connection between a calling substation A and a called substation A' in a system embodying the principles of my invention.

In Fig. 1 there is shown a subscriber's substation A, the line conductors of which terminate in the individual switch C, together with its individual meter M. The line switch C belongs to a group of similar line switches, the plungers (not shown) of which engage a shaft and are controlled by the operation of the master switch D in such a manner that they are, when in normal position, held directly in front of an idle trunk line leading through a group of relays F to the answering jack J. At O there is shown an operator's cord circuit, to which is added a calling device L which is herein represented by a pair of impulse springs.

In Fig. 2 there is shown a line switch C^2 adapted to be seized by the before-mentioned cord circuit to extend connection to the connector switch H, and there is also shown the called line switch C', together with its individual meter M' and called substation A'. It will be understood by those versed in the art that so-called selector switches may be inserted in the system, thereby increasing the capacity of the exchange, without departing from the principle of my invention. The said selector switches may be of a type similar to the switch disclosed in British patent to T. G. Martin No. 1419 of 1910.

The subscriber's substation A is of any suitable or approved type and comprises the usual receiver 2, transmitter 3, switch-hook 4, ringer 5 and condenser 6. Being an automatic substation it is also provided with an impulse transmitter or calling device, which is represented herein by a pair of impulse springs 7 and 8 and an impulse wheel 9, which latter is assumed to be controlled through the medium of a finger hole dial (not shown) in such a manner that the impulse springs 7 and 8 may be momentarily separated a number of times corresponding to the digit called.

The subscriber's individual switch C is of the general type of subscriber's line switch shown in British patent to R. W. James No. 26,301 of 1906, being however, of the particular type disclosed in British patent to T. G. Martin No. 1419 of 1910, above referred to. This line switch comprises, among other details, a plunger (not shown) attached to the end of a so-called plunger arm 10, which is controlled by the magnet 11. The magnet 11 comprises four windings, namely, a pull-down winding 12, a cut-off or holding winding 13, a line winding 14 and an auxiliary winding 15. The core of the magnet 11 is so constructed that the magnetic circuit of the windings 12 and 13 is separate from that of the windings 14 and 15. The winding 12 operates both the plunger arm 10 and the cut-off armature 16, while the winding 13 is only strong enough to operate the cut-off armature 16 and to hold the plunger arm 10 in its operated position. When the plunger arm 10 is operated, the plunger is forced into a bank of contact springs, forcing the

springs 17, 18, 19 and 20 into engagement with the springs 21, 22, 23 and 24, respectively. Although only one set of springs (17 to 24, inclusive) is shown, each line switch is provided with a plurality of such sets, each set forming the terminal of a trunk line leading to a group of relays F, which relays are in turn connected directly to the answering jack J. Each trunk line is connected in multiple with the corresponding springs of all the line switches of the group which is controlled by the master switch D. The switch C is controlled by the subscriber through the medium of the line winding 14, as will hereinafter be more fully explained.

Associated with the line switch C is a registering meter M which is operated by the magnet 50. The magnet 50 is a marginal magnet—that is, it does not receive sufficient current to be operatively energized when in a circuit with the battery B, but requires the combined strength of the battery B and the battery B′ to operatively energize.

The trunk circuit F is provided with a group of relays which control the battery current fed to the calling subscriber's substation, and in addition controls the operation of the lamp 25, which is a combined line and supervisory lamp.

The operator's cord circuit O is provided with the usual supervisory lamps 29 and 30 and the necessary relays for controlling the same. The lamps 29 and 30 are controlled by the polarized relays 32 and 31, respectively. The keys K′, K^3 and K^4 control means by which the meters at the calling and called substations may be operated. The keys K^5 and K^6 are release keys by means of which the operator may release the automatic switches without removing the plug from the jack. The key K^7 is arranged to convert the answering end of the cord circuit O into a calling end. As shown, should the key K^7 be depressed while the plug P is out of its plug seat, said key will be mechanically locked in an operated position until such time as the plug P is returned to its plug seat. By means of the keys K^8 and K^9 the calling device L may be connected with either end of the cord circuit. The keys K^{10} and K^{11} operate to bridge the operator's talking set across the answering and the calling ends of the cord, respectively.

The line switch C^2 (Fig. 2) is similar in all respects to the line switch C.

The connector H is of the same 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 to operate in a system in which the central office apparatus is controlled by impulses delivered over the two sides of the line in series. The connector is provided with a shaft (not shown) carrying the wipers 34, 35 and 36 which is controlled by the vertical magnet 37 and the rotary magnet 38. The usual side switch comprising the wipers 39, 40, 41 and 42 is controlled by the private magnet 43 in the usual well-known manner. The line relay 45 is connected with the calling line through the reversing springs of the so-called back-bridge relay 46. The relay 47 is a marginal relay—that is, it will not operatively energize with the amount of current received through the winding 48 of the line switch C^2; but when the key K^4 is operated at the cord circuit O, the said relay receives sufficient current from the battery B′ to operatively energize. The ringing relay 49 is the means through which ringing current is applied to the called line.

The line switch C′, meter M′ and called substation A′ are similar in all respects to the line switch C, meter M and calling substation A.

For the purpose of supplying battery current for operating the central office apparatus and for talking there is shown a battery B having its positive pole grounded at G. For the purpose of controlling the meters M and M′ there is shown a second battery B′ having its negative pole grounded. The busy signaling machine Q as herein represented comprises an induction coil or transformer, the primary winding of which is included in a local circuit with a battery and an interrupter of high frequency. Through the medium of this interrupter an intermittent current is supplied to the primary winding, which induces an alternating current in the secondary winding, whereby when said winding is connected with the subscriber's line a buzzing sound is heard in the receiver.

Having given a general description of the apparatus involved in the system, in order to give a complete understanding of my invention, I will now describe how the subscriber A may obtain connection with the subscriber at substation A′ and how the call may be charged either to the substation A or the substation A′.

Upon the removal of the receiver from the switch-hook 4 at the substation A, a circuit is closed through the line winding 14 of the individual switch C, thereby attracting the line armature 51. The armature, upon being attracted, closes a circuit through the pull-down coil 12 in series with the auxiliary winding 15. The pull-down coil, upon energizing, attracts the plunger arm 10 to force the plunger into the bank of springs 17 to 24, inclusive. It also operates the cut-off armature 16, thereby disconnecting the line winding 14 from the line. The armature 51 does not fall back immediately, however, owing to the fact that the winding

15 is still in series with the pull-down winding 12. Upon the plunger arm 10 being drawn down, the springs 52 and 53 are brought together to short-circuit the auxiliary winding 15, making the same slightly slow acting. The armature 51 being slow to fall back allows sufficient time for the holding circuit to be closed in the switch ahead for the cut-off or holding winding 13. The engagement of the springs 17 and 20 with the springs 21 and 24, respectively, extends the subscriber's line to the line relay 54 of the group of relays F. The line relay 54, upon energizing, closes a circuit from ground G^1 through the springs 118, relay 119 and the springs 120 to battery B. The relay 119, upon energizing, closes the before-mentioned holding circuit. This circuit extends from ground G^2 through the springs 121, springs 22 and 18 and the said holding winding 13 to battery B. The winding 13, upon energizing, holds the armature 16 and the plunger arm 10 in their operated positions after the circuit of the pull-down winding is broken by the falling back of the line armature 51. A guarding ground potential is supplied to the connector private bank contact of the calling line as soon as the relay 119 is energized. This circuit extends over the above traced circuit to the bank spring 18, thence over the conductor 56 to the said private bank contact. The magnet 50 is now in circuit between battery B and ground, but it is not operatively energized. A further result due to the energization of the relay 54 is the closure of a circuit extending from ground G^1 through the springs 118 and the lower winding of the relay 122 to battery B. The relay 122, upon energizing, closes a circuit extending from ground G^3 through the springs 123 and the lamp 25 to battery B, thus causing the lamp 25 to glow and signal the operator that a connection is desired.

The operator immediately inserts the plug P into the jack J, which operation affords a new holding ground for the winding 13. This circuit may be traced from ground G^{12} through the springs 130 and 129, springs 61 and 62, sleeve of the plug P and the bushing of the jack J, thence over the circuit previously traced and the winding 13 to battery B. Upon the insertion of the plug P, the contact of springs 59 is closed, thereby closing a circuit through the relays 124 and 122. This circuit extends from ground G^{11} through the springs 59. Here the circuit divides, one branch extending through the relay 124 and the springs 125 to battery B, and the other branch extending through the upper winding of the relay 122 and the springs 125^a to battery B. The relay 124, upon energizing, opens the circuit of the relay 119 and the lamp 25 at the springs 120. The deënergization of the relay 119 is without effect, as the new holding ground for the winding 13 has been formed at ground G^{12}. The operator answers by operating the key K^{10} to bridge her talking set (not shown) across the line. The operator now takes the subscriber's order. We will assume that the subscriber A′ is desired, whose number is 20, and that the calling subscriber wishes to have the call charged to substation A′. The operator then inserts the plug P′ into the jack J′ and operates the key K^9 to bridge the calling device L across the conductors 64 and 65 leading to the line switch C^2. The line switch C^2 operates in the same manner as before described for the line switch C to extend the line connection to an idle connector H. The line relay 45 of the connector H is immediately energized. This circuit extends from ground G^4 through the lower winding of said relay, springs 67 of the back-bridge relay 46, bank springs 68 and 69, conductor 65, springs 73 of the jack J′, ring of the plug P′, key K^9, calling device L, key K^9, tip of the plug P′, spring 74 of the jack J′, conductor 64, bank springs 71 and 70, springs 72 and the upper winding of the relay 45 to battery B. The relay 45, upon energizing, closes a circuit through the slow acting relay 75. The relay 75, upon energizing, closes a holding circuit for the holding winding 48 of the line switch C^2. This circuit extends from ground G^5 through the marginal relay 47, springs 76, bank springs 77 and 64 and the said holding winding of the line switch C^2 to battery B. A further result due to the energization of the relay 75 is to prepare a circuit for the vertical magnet 37 through the springs 80 and 79 and open the circuit of the release magnet 44 at the springs 80 and 81. The apparatus is now in readiness to receive impulses for the first digit 2.

The operator now operates her calling device for the first digit 2, whereby the impulse springs of the calling device are operated twice momentarily, each time breaking the circuit of the line relay 45. Since the relay 75 is slow acting it does not deënergize during the momentary interruptions of its circuit by the relay 45, so that each time the latter relay is deënergized, a circuit is closed extending from ground G^6 through the contact of springs 82 and 83, springs 80 and 79, relay 85, vertical magnet 37 and the side switch wiper 39 (in first position) to battery B. The vertical magnet receives two impulses over this circuit and operates to raise the switch wipers 34, 35 and 36 to a position opposite the second level of bank contacts. The relay 85, which was included in series with the vertical magnet, remains in its energized position during the entire time that impulses are being sent through it and operates to close the circuit of the private magnet 43. This circuit extends from

ground G^8 through the springs 88 and 87 and the said magnet 43 to battery B. After the last impulse is delivered the relay 85 opens the circuit of the private magnet 43, which, upon deënergizing, permits the side switch to advance from first to second position. The movement of the side switch wiper 39 from first to second position transfers the battery connection from the vertical magnet 37 to the rotary magnet 38. The operator now operates her calling device for the last digit 0, in response to which the connector line relay operates to transmit ten impulses through the rotary magnet 38 in series with the relay 85, whereby the shaft wipers are rotated onto the contacts of the desired line. If the called line is idle, the private magnet 43 deënergizes when its circuit is broken by the relay 85 after the last impulse is delivered to the rotary magnet. The deënergization of the private magnet allows the side switch to advance one more position—that is, from second to third position. By the engagement of the side switch wipers 41 and 42 with their third-position contact points, and by the energization of the bridge-cut-off winding 90 of the line switch C′, the connection is completed with the called substation. The said circuit for the bridge-cut-off winding extends from ground G^9 through the side switch wiper 40 (in third position), springs 126 and 127, private wiper 35, conductor 91 and the winding 90 to battery B. A guarding ground potential is thus supplied to the connector private bank contact of the called line, which prevents the called line from being seized by some other connector switch. A circuit is also closed through the meter M′, but the meter M′ does not operate, as it will be remembered that it takes the combined strength of both the battery B and the battery B′ to operatively energize it. The operator's key K^9 is restored to normal, thus bridging the polarized relay 31 across the conductors 64 and 65. The current through the said polarized relay is in the direction to cause the armature 92 to close contact with the spring 93, thus causing the lamp 30 to glow. By the engagement of the side switch wiper 39 with its third-position contact point, the circuit of the ringing relay 49 is closed. This circuit extends from ground G^{10} through the interrupter 94, relay 49, springs 95 and the side switch wiper 39 (in third position) to battery B. The ringing relay, upon energizing, disconnects the calling line from the called line and bridges the ringing current generator R across the called line. The ringing relay is energized only intermittently through the medium of the interrupter 94. Upon the response of the called subscriber his line is provided with talking current through the back-bridge relay 46. The relay 46, upon energizing, closes the circuit of the ringer cut-off relay 96. This circuit extends from ground G^9 through the side switch wiper 40 (in third position), springs 97 and the relay 96 to battery B. The relay 96, upon energizing, interrupts the circuit of the ringing relay 49 at the springs 95 and closes a locking circuit for itself through the springs 98 independent of the springs 97. A further result of the energization of the back-bridge relay upon the response of the called subscriber is the transposition of the battery connection of the windings of the line relay 45 with regard to conductors 70 and 68, whereby the direction of current in the trunk conductors 64 and 65 is reversed. The reversing of the current in the said line causes the polarized relay 31 of the cord circuit O to operate its armature in the opposite direction, thus causing the supervisory lamp 30 to cease glowing. The lamp 30 ceasing to glow notifies the operator that the called party has answered. She now communicates with the called subscriber at the substation A′ and inquires if he will receive a call from substation A and have the call charged to his meter. Assuming that the called subscriber has agreed to receive the call, the operator presses the key K^4, thereby causing the relay 47 at the connector H to be energized. This circuit extends from ground G through battery B′, key K^4, sleeve of the plug P′, bushing of the jack J′, conductor 66, bank springs 64 and 77, springs 76 and the relay 47 to ground G^5. The winding 48 of the line switch C^2 is maintained energized while the key K^4 is being pressed over a circuit extending from ground G through battery B′, over the above-traced circuit to the bank springs 64, then through the winding 48 to battery B, thence through battery B to ground G, the two batteries operating in series. The relay 47, upon energizing, completes a circuit from ground G through battery B′, springs 126 and 127, private wiper 35 and the magnet of the meter M′ to battery B. The winding 90 of the line switch C′ remains energized over a circuit extending from ground G through battery B′ to the private wiper 35, thence through the winding 90 to battery B. Since the two batteries are in series, the magnet of the meter M receives sufficient current to operatively energize it and advance the counting mechanism one step. Upon the restoration of the key K^4, the relay 47 deenergizes and upon so doing removes battery B′ from the circuit of the magnet of the meter M′, whereupon the armature of said magnet returns to normal. Thus it will be seen that the operator can advance the meter M′ any number of steps, depending upon the toll charged for the connection. The subscriber may now carry on an uninterrupted conversation over the heavy conductors shown.

Upon the completion of the conversation,

the replacing of the receiver upon the switch hook at the calling substation opens the circuit of the line relay 54. The deënergization of the relay 54 opens the circuit of the relay 124, and also the circuit through the lower winding of the relay 122, but the relay 122 does not deënergize at this time due to the locking circuit of its upper winding, previously traced. The deënergization of the relay 124 again closes the circuit through the lamp 25. The restoring of the receiver at the called substation causes the deënergization of the back-bridge relay 46, which upon deënergizing, again reverses the current in the conductors 64 and 65 in such a direction that the polarized relay 31 again operates to close the circuit of the lamp 30. The operator, upon seeing the lamps 25 and 30 glowing, knows that a disconnection is desired and withdraws the plugs P and P′ from their respective jacks. The withdrawal of the plug P causes the circuit of the winding 13 and of the upper winding of the relay 122 to be opened at the springs 59. The deënergization of the winding 13 allows the armature 16 and the plunger arm 10 to return to their normal positions. The removal of the plug P′ opens the circuit of the line relay 45 of the connector H. The relay 45, upon deënergizing, opens the circuit of the relay 75, which in turn, upon deenergizing, opens the circuit of the winding 48 of the line switch C^2, and in addition closes a circuit from ground G^6 through the springs 82 and 83, springs 80 and 81, off normal springs 107 and the release magnet 44 to battery B. The release magnet, upon energizing, operates to remove the retaining pawls from the shaft, and its own circuit is broken at the springs 107 when said shaft reaches its lowest position. The line switch C^2 releases in the same manner as the line switch C.

If the subscriber at substation A had not asked that the charges be reversed, the connection would have been the same as before, but the charge would have been made against the calling substation meter M in the following manner: The operator completes the connection in the same manner as before described; then, as soon as the called subscriber answers, the key K′ is pressed, which causes the magnet 50 of the meter M to be operatively energized and thus advance the counting mechanism one step in the manner described in connection with the meter M′. The said circuit extends from ground G through battery B′, springs 128 and 129 of the key K′, springs 61 and 62, sleeve of the plug P and bushing of the jack J, springs 22 and 18 and the magnet 50 to battery B. In case a line is already busy when called, the calling subscriber is given the busy signal in the following manner: As has been explained, whenever a line is busy there is a guarding potential upon the connector private bank contacts. The connector private wiper 35, upon engaging the guarding contact and before the side switch has passed to third position, completes a holding circuit through the private magnet 43, which in turn locks the side switch in second position. The holding circuit for the private magnet extends from ground at the private bank contact through the wiper 35, springs 127 and 127^a, side switch wiper 40 (in second position), springs 113 and 112, busy relay 116, springs 78 and 87 and the magnet 43 to battery B. The private magnet 43 is thus held energized disconnecting the line wipers 34 and 36 from the back-bridge relay 46 and locking the side switch in second position. The relay 116, upon energizing, completes a locking circuit for itself and for the magnet 43 independent of the ground at the private bank contact. This circuit extends from ground G^{17} through the contact of springs 117, springs 114 and 112, relay 116, springs 78 and 87, and the magnet 43 to battery B. The circuit of the rotary magnet is opened at the springs 111 to prevent a further rotation of the shaft and wipers. A further result of the energization of the relay 116 is to supply a busy signal to the calling subscriber. This circuit extends from ground through the busy machine Q, springs 115, side switch wiper 42 (in second position,) springs 68 and 69, conductor 65, over the heavy conductors, through the substation A, over the return heavy conductor 64, springs 71 and 70, springs 72, upper winding of the relay 45 to battery B and through battery B back to ground. The calling subscriber, upon hearing the busy signal, replaces his receiver upon the receiver hook and the operator releases the apparatus as hereinbefore described.

It is often desirable, in the case of toll work, to have the circuits so arranged that a subscriber may effect connection with a toll operator to give her his order and instructions to call him back as soon as she is able to obtain connection with the subscriber wanted. Assuming that the subscriber at substation A desires connection with the subscriber at substation A′, and that the conditions are as above described, the connection will be established in the following manner: As soon as the calling subscriber has effected connection with the toll operator and given his order, he immediately hangs up and the connection is released. The operator then plugs the plug P′ into a jack J′ and completes connection with the desired substation in the manner hereinbefore described. As soon as the called party has answered, the operator depresses the key K^7, thus bridging the polarized relay 32 across the calling end of the

cord circuit. The operator inserts the plug P into a jack similar to the jack J′ (not shown) and operates the key K⁸ to bridge the calling device across the conductors 222 and 223 and operates her calling device to effect connection with the substation A. After completing the connection, the operator restores the key K⁸ to normal, bridging the polarized relay 32 across the conductors 222 and 223. The flow of current through the polarized relay 32 is in a direction to cause the supervisory lamp 29 to glow. As soon as the subscriber at substation A answers, the supervisory lamp 29 ceases to glow, notifying the operator that both the subscribers have answered. The operator may now depress the key K³ or the key K⁴ and charge the call to either the calling or the called subscriber, according to the instructions she has received.

The release of the apparatus takes place in the following manner: As soon as the conversation has terminated, the replacing of the receivers at the calling and called substations upon their respective receiver hooks causes the supervisory lamps 29 and 30 to glow. The operator, noticing the supervisory lamps 29 and 30 glowing, removes the plugs P and P′ from their respective jacks and the apparatus is released in a manner hereinbefore mentioned. The plug P restores the key K⁷ to normal upon entering its recess or socket.

It will thus be seen that I have devised a very efficient system in which the operator can record the call on either the calling or the called subscriber's register. Furthermore, the operator can register the call on the called line in one way, and can register the call on the calling line in two different ways.

While I have illustrated and described my invention in connection with automatic telephone equipment of a particular type, it will, of course, be understood that I do not wish to be limited to the exact construction shown and described, but that various changes and modifications will readily suggest themselves to those skilled in the art.

What I claim as my invention:—

1. In a telephone system, a calling and a called subscriber's line, means including an operator's cord circuit and an automatic switch for establishing connection between said lines, a registering device on the called line, a trunk-release circuit for said automatic switch, a relay in said trunk-release circuit, means controlled by said operator for transmitting a booster impulse over said trunk-release circuit to operate said relay, and means controlled by the operation of said relay for transmitting an impulse from the booster battery to cause the operation of said registering device.

2. In a telephone system, a calling and a called subscriber's line, an operator's cord circuit terminating in a pair of plugs, means including a trunk line terminating in a jack for extending a connection from the calling line to said cord circuit, automatic switches for extending a connection from the cord circuit to the called line, a registering device on each of said lines, means controlled by the operator for transmitting a booster impulse to operate either of said registering devices, means under the control of the operator for extending a connection automatically from the answering plug to the calling line, and means for then causing the operation of said calling registering device.

3. In a telephone system, a calling and a called subscriber's line, means for connecting said lines, said means including an operator's cord circuit and an automatic connector switch, a test conductor for the called line seized by said connector switch when the connection is established, a call register for the called line, and operator controlled means for operating said register over said test conductor.

4. In a telephone system, a calling and a called subscriber's line, means for connecting said lines, said means including an operator's cord circuit and an automatic connector switch, a test conductor for the called line seized by said connector switch when the connection is established, a call register for the called line in a branch of said test conductor, and operator controlled means for transmitting a current impulse thereover to operate said register.

5. In a telephone system, a calling and a called subscriber's line, means for connecting said lines, said means including an operator's cord circuit and an automatic connector switch, a test conductor for the called line seized by said connector switch when the connection is established, a call register and a cut-off relay for the called line in a circuit including said test conductor, automatic means for causing a current flow in said circuit to operate said cut-off relay after the connection is established, said register remaining inoperative, and means for increasing the current flow in said circuit to operate said register.

6. In a telephone system, a calling and a called subscriber's line, operator controlled means including an automatic connector switch for establishing a talking connection between said lines, a third conductor not in the talking connection associated with the called line, a call register for the called line in a circuit including said conductor, and operator controlled means for transmitting a current impulse over said circuit to operate said register.

7. In a telephone system, a calling and a called subscriber's line, operator controlled

means including an automatic connector switch for establishing a talking connection between said lines, a third conductor not in the talking connection associated with the called line, a call register for the called line in a circuit including said conductor, a source of current in said circuit, and means for varying the current flow in said circuit to operate said register.

8. In a telephone system, a calling and a called subscriber's line, operator controlled means including an automatic connector switch for establishing a talking connection between said lines, a third conductor not in the talking connection associated with the called line, a call register for the called line in a circuit including said conductor, a source of current in said circuit, said register remaining normally inoperative, and operator controlled means for increasing the current flow in said circuit to operate said register.

9. In a telephone system, a calling and a called subscriber's line, operator controlled means including an automatic connector switch for connecting said lines, cut-off relays for said lines, an operator controlled circuit for each relay, and a meter for each line operable over the circuit of the associated cut-off relay.

10. In a telephone system, a calling and a called subscriber's line, operator controlled means including an automatic connector switch for connecting said lines, cut-off relays for said lines, a circuit for each cut-off relay, a meter in a branch of each circuit, and operator controlled means for transmitting a current impulse over either circuit to operate the meter associated therewith.

11. In a telephone system, a calling and a called subscriber's line, operator controlled means including an automatic connector switch for connecting said lines, an auxiliary circuit associated with each line and including a meter, and operator controlled means for operating either meter over the auxiliary circuit in which it is included.

12. In a telephone system, a calling and a called subscriber's line, a registering device on each of said lines, an operator's cord circuit, means for connecting the calling line with said cord circuit, means whereby the operator may then extend the connection to the called line, means whereby the operator can control the operation of the device on the called line, and means whereby the operator may operate the device on the calling line over two separate circuits without releasing the connection to the called line.

Signed me at Chicago, Cook county, Illinois, this 18th day of August, 1914.

GEORGE A. YANOCHOWSKI.

Witnesses:
CHAS. M. CANDY,
B. GARBER.