A. ANDERSEN.

MEASURED SERVICE TELEPHONE SYSTEM.

APPLICATION FILED DEC. 5, 1913.

1,264,137.

Patented Apr. 30, 1918.

2 SHEETS—SHEET 1.

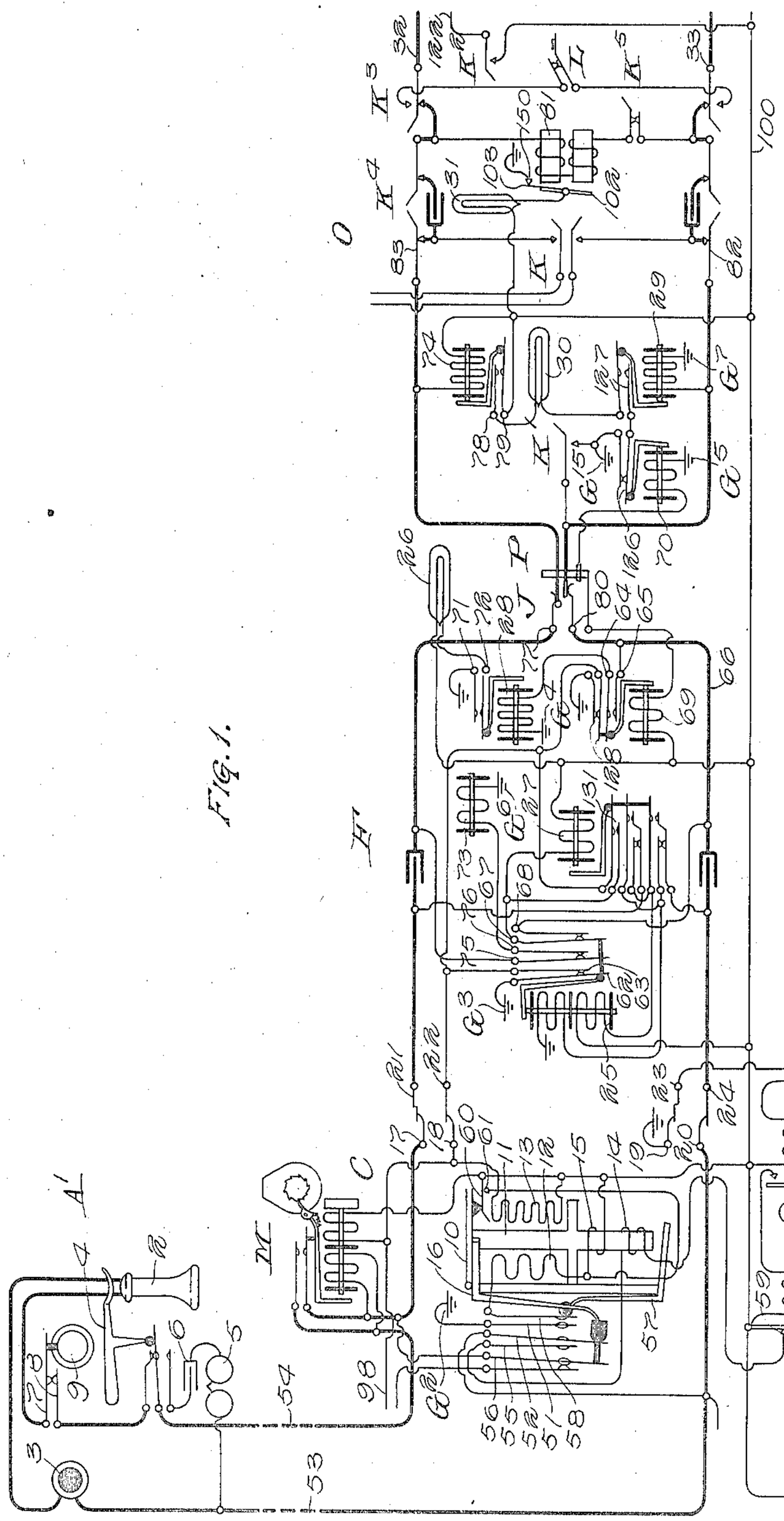

FIG. 1.

WITNESSES

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M. R. Morgan.

INVENTOR:

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By Bulkley & Sweata

ATTORNEYS

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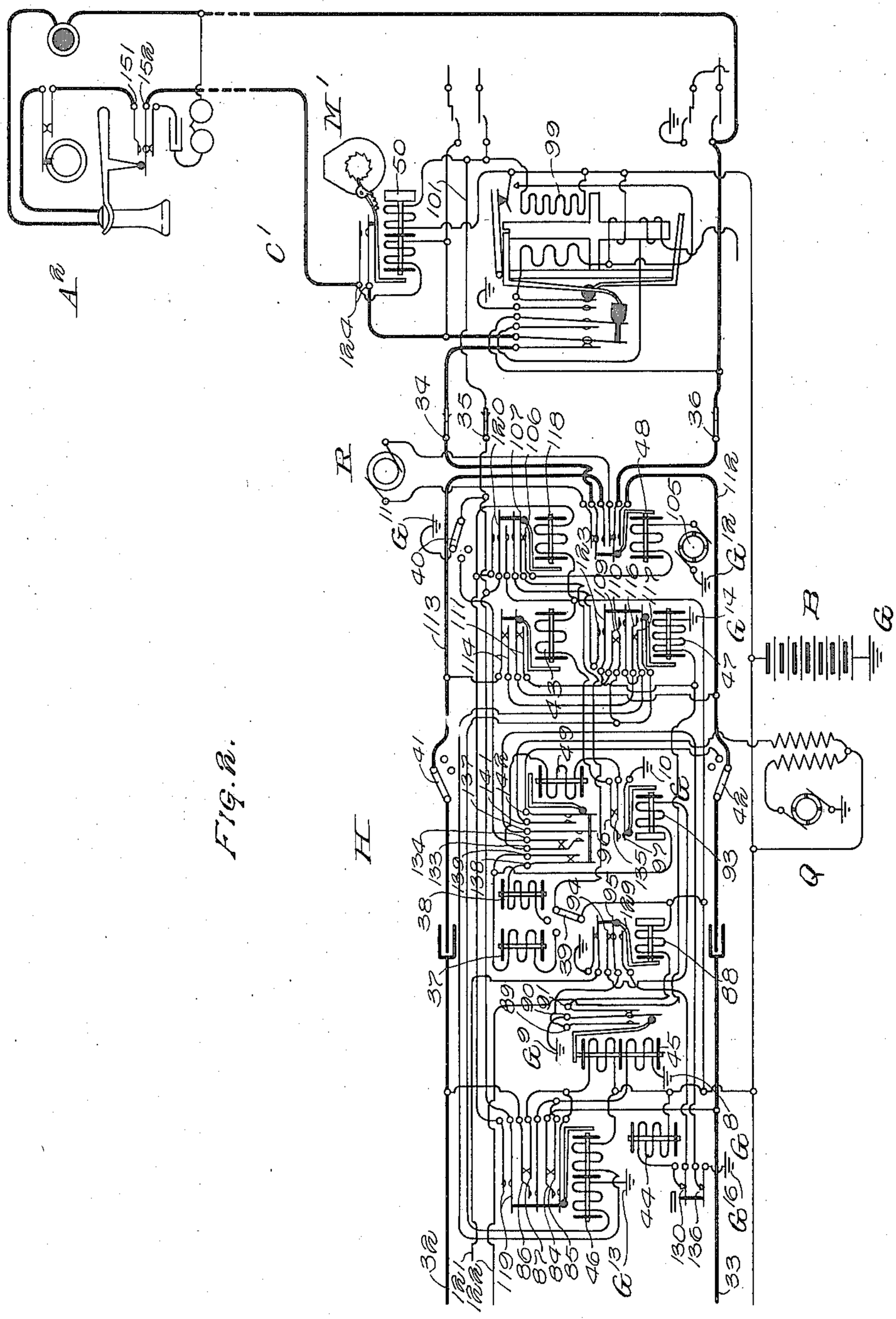

FIG. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

ALBERT ANDERSEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AUTOMATIC ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

MEASURED-SERVICE TELEPHONE SYSTEM.

1,264,137. Specification of Letters Patent. Patented Apr. 30, 1918.

Application filed December 5, 1913. Serial No. 804,902.

To all whom it may concern:

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

My invention relates to improvements in measured service telephone systems and has for its object the provision of means whereby a call can be charged to either the calling or the called subscriber.

This method of charging calls is quite common in manual systems and by my invention can be extended to semi-automatic systems. Heretofore, in such systems, the operator has only been able to control the meter on the calling line. I provide means, however, by which the operator, after a connection has been established, can cause the operation of either the meter on the calling or the called line, thus enabling the charges to be reversed if the called subscriber consents.

These and other features and objects of my invention will be more readily understood by reference to the accompanying drawings, in which I have illustrated one embodiment of my invention in connection with a semi-automatic telephone system of a well-known type.

Figures 1 and 2 taken together show a complete connection between a calling substation A′ and a called substation A^2 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 or line switch C. The line switch shown at C is one of a group of similar 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 the terminals of a trunk line leading through a group of relays F to a jack J. It will be clearly 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 principles of my invention. The said selector switches may be of a type similar to the selector switches shown in British patent to T. G. Martin No. 1419 of 1910.

At O there is shown a manual operator's cord circuit to which is added a calling device L, which is here represented by a pair of impulse springs. At H (Fig. 2) a connector switch is shown. The trunks leading to said switch are connected to the operator's cord circuit O. At C′ a line switch is shown which is similar in all respects to the one shown at C. The substation A^2 is similar to the substation A′.

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 switch shown in the British patent to R. W. James No. 26,301 of 1906, being, however, of the particular type disclosed in British Patent 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 10 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 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) 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 relay 14, as will be hereinafter more fully explained.

The master switch D is of the same general type as that disclosed in British Patent No. 26,301 of 1906, referred to above, being, however, of the particular type disclosed in said British Patent No. 1419 of 1910. The function of the master switch as is well known, is to maintain the plungers of all the idle line switches in position to engage the terminal of an idle trunk line.

The device F consists of a group of relays, together with the ordinary line signal 26. These relays control the battery current fed to the calling subscriber's substation. The relay 27 is a marginal relay, *i. e.*, it will not operatively energize when in series with either the relay 28 or the relay 29.

The operator's cord circuit O is provided with the usual answering and calling supervisory signals 30 and 31 and the necessary relays for controlling the same. The signal 31 is controlled by a polarized relay 81 which is bridged across the trunk conductors 32 and 33 through the key K^5. The cord circuit is also provided with the keys K′ and K^2 for controlling the meters at the calling substation and at the called substation, in a manner to be hereinafter described.

The connector switch H (Fig. 2) is of the same general type of connector switch as 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 magnet 44 is the usual release magnet. The line relay 45 is connected with the calling line through the reversing springs of the so-called back-bridge relay 46. The said back-bridge relay 46 is connected with the called line through the reversing springs of the relay 47. The ringing relay 48 is the means through which ringing current is applied to the called line. At Q there is shown a busy signaling machine which provides a busy signal, said busy signal being applied to the calling line through the medium of the busy relay 49 in case the called line is in use. For the purpose of supplying battery current for operating the apparatus and for talking purposes, there is shown a battery B. The substation A^2 and the line switch C′ are similar in all respects to the substation A and the line switch C.

The substation A^2 is provided with a call register or meter M′, which is controlled by a double-wound slow acting magnet 50. The windings of the magnet 50 are so proportioned that it requires the energization of both windings in the same direction to attract the armature, said armature being unaffected by the energization of either winding alone, or by the energization of the two windings in opposition to each other. I preferably make the magnet 50 slow acting so that it will not respond to alternating current when the substation is called.

The substation A′ is also provided with a meter M that is similar in all respects to the meter M′.

Having given a general description of the apparatus, it will now be explained how the calling subscriber at the substation A′ may obtain connection with the subscriber at the called substation A^2, and how the call may be charged either to the substation A′ or to the substation A^2. 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, this circuit extending from ground G^2 through the contact of springs 51 and 52, conductor 53, transmitter and receiver of the calling substation, back over the conductor, 54, left-hand winding of the meter M, contact of springs 56 and 55, line winding 14 and the contact 59 to the battery lead 100. Upon the line winding becoming energized, the armature 57 operates to close the contact of springs 51 and 58, thereby closing a circuit extending from ground G^2 through the contact of said springs, pull-down winding 12 and the auxiliary winding 15 in series to the battery lead 100. The winding 12 energizes and attracts the plunger arm 10, together with the arm 16, which latter breaks the contact of the springs 51 and 52, 55 and 56, thus opening the circuit of the line winding 14, the armature of which, however, does not fall back at this time because the auxiliary 15 is still energized in series with the winding 12. Upon the plunger arm 10 being completely drawn down, the plunger of the line switch is thrust into the bank terminals, pressing the springs 17, 18, 19 and 20 into contact with the springs 21, 22, 23 and 24, respectively. By the same operation the springs 60 and 61 make contact to short-circuit the auxiliary winding 15, which allows its armature to fall back, opening the circuit of the pull-down winding 12. This

does not take place, however, until after the hold-down coil 13 has been supplied with a holding ground from the group of relays F.

Upon the springs 17 and 20 making contact with the springs 21 and 24, the line connection is extended to the line relay 25 of the relays F, which thereupon energizes. The relay 25, upon energizing, closes a holding circuit for the holding winding 13 of the line switch C, said circuit extending from ground G^3 through the contact of springs 62 and 63, bank contact 22, spring 18 and the holding coil 13 to the battery lead 100. A guarding ground potential is supplied to the connector private bank contacts over the above traced circuit to the springs 18 and from there over the conductor 98 to the private bank contact. The energization of the relay 25 also closes a circuit for the relay 28, the said circuit extending from ground G^4 through the relay 28, contact of springs 64 and 65, conductor 66, springs 68 and 67 and the relay 27 to the battery lead 100. The relay 28 being of a rather high resistance does not permit sufficient current to flow to operatively energize the relay 27. The energization of the relay 28 causes the lamp 26 to glow, thus notifying the operator that a call is desired. The operator immediately inserts the plug P into the jack J, which operation causes three different circuits to be closed. The first extends from ground G^5 through the relay 70, sleeve of the plug P, bush of the jack J and the relay 69 to the battery lead 100. The energization of the relay 70 at this time has no function, but the energization of the relay 69 operates to open the circuit of the relay 28 at the springs 64 and 65. The said relay in turn deënergizes and opens the circuit of the lamp 26 at the springs 71 and 72. The second circuit extends from ground G^6 through the impedance coil 73, springs 76 and 75, spring contact 77 of the jack J, tip of the plug P and the relay 74 to the battery lead 100. The energization of the relay 74 operates to open the circuit of the lamp 30 at the springs 78 and 79. The third circuit extends from ground G^7 through the relay 29, ring of the plug P, spring contact 80 of the jack J, springs 68 and 67 and the relay 27 to the battery lead 100. The relay 29 being of rather high resistance does not permit sufficient current to flow to operatively energize the relay 27.

The operator answers by throwing the key K to bridge her talking set across the line and takes the calling subscriber's order. We will assume that the subscriber A^2 is desired, whose number is 20, and that the calling subscriber wishes to have the call charged to the substation A^2. The operator presses the key K^4 in a direction to break contact at the springs 82 and 83, thus disconnecting the calling line from the conductors 32 and 33. The operator's calling device L is bridged across the conductors 32 and 33 by the operation of the key K^3, which closes a circuit through the line relay 45 of the connector H (Fig. 2). This circuit extends from ground G^8 through the lower winding of said relay 45, springs 85 and 84 of the back-bridge relay 46, conductor 33, key K^3, calling device L, key K^3, conductor 32, springs 86 and 87 of the relay 46 and the upper winding of the relay 45 to battery B. The relay 45, upon energizing, closes a circuit through the relay 88. The said circuit extends from ground G^9 through the springs 90 and 91 and the relay 88 to battery B. The operator now operates her calling device for the first digit 2, whereby the impulse springs of the calling device are twice momentarily operated, each time breaking the circuit of the line relay 45. Since the relay 88 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^9 through the springs 90 and 89, springs 95 and 94, relay 93, vertical magnet 37 and the side switch wiper 39 (in first position) to the battery B. The vertical magnet 37 receives two impulses over the circuit and operates to raise the switch wipers 34, 35 and 36 to a position opposite the second level of bank contacts. The relay 93, 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. The circuit extends from ground G^{10} through the springs 97 and 96 and the magnet 43 to battery B. After the last impulse is delivered, the relay 93 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 the impulses through the rotary magnet 38 in series with the relay 93, 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 93 after the last impulse is delivered to the rotary magnet. The deënergization of the magnet 43 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 99 of the line switch C′, the connection

is completed with the called substation. The circuit for the bridge-cut-off winding 99 of the line switch C′ extends from ground G[11] through the side switch wiper 40 (in third position), private wiper 35, conductor 101 and the winding 99 to battery B. A guarding ground potential is 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 right-hand winding of the meter M′. This circuit extends from ground G[11] through the side switch wiper 40 (in third position), private wiper 35, conductor 101 and the right-hand winding of the meter M′ to the battery B. The meter M′ does not operate, as it will be remembered that it takes the combined strength of both of its windings to operate this meter. The operator's key K[3] is restored to normal, thus bridging the polarized relay 81 across the conductors 32 and 33. The current through the said polarized relay is in the direction to cause the armature 102 to make contact between the springs 103 and 150, thus causing the lamp 31 to glow. By the engagement of the side switch wiper 39 with its third-position contact point, the circuit of the ringing relay 48 is closed. This circuit extends from ground G[12] through the interrupter 105, relay 48, springs 106 and 107, 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 generator R across the called line. The ringing relay is deënergized intermittently through the medium of the interrupter 105. Upon the response of the called subscriber his line is provided with talking current through the back-bridge relay 46. The circuit extends from ground G[13] through the left-hand winding of the relay 46, springs 110 and 109, springs 111, over the heavy conductor 112, through the substation A[2] and the left-hand winding of the meter M′, over the return heavy conductor 113, springs 114, springs 116 and 117 and the right-hand winding of the relay 46 to the battery B. The relay 46, upon energizing, closes the circuit of the ringer cut-off relay 118. This circuit extends from ground G[11] through the side switch wiper 40 (in third position), springs 119 and the relay 118 to the battery B. The relay 118, upon energizing, interrupts the circuit of the ringer relay 48 at the springs 106 and 107 and closes a locking circuit for itself through the springs 120 independent of the springs 119. A further result of the energization of the back-bridge relay 46 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 battery B, whereby the direction of the current in the calling line is reversed. The reversing of the current in the calling line causes the polarized relay 81 of the cord circuit O to operate its armature to open the circuit of the supervisory lamp 31. The lamp 31 ceasing to glow notifies the operator that the called party has answered. She now communicates with the called subscriber at the substation A[2] and inquires if they will receive a call from substation A′ and have the said call charged to their meter. Assuming that the called subscriber has agreed to receive the said call, the operator presses the key K[2], which causes the meter M′ to be operated. The circuit closed by pressing the key K[2] extends from ground G[14] (Fig. 2) through the relay 47, conductor 122 and the key K[2] to the battery lead 100. The relay 47, upon energizing, reverses the battery on the called line and also forms a locking circuit for itself through the springs 123 independent of the circuit closed at the key K[2]. The reversing of the current over the called line causes the current in the windings of the magnet 50 of the meter M′ to assist each other and as a consequence the armature of said magnet is attracted and operates to register the call upon the meter M′. The magnet 50, upon energizing, also closes the contact of springs 124, whereby the left-hand winding is short-circuited. The armature of the magnet then remains held in its operated position by means of the energization of the right-hand winding alone, which, although not strong enough to operate the armature, is strong enough to hold it in its operated position. The key K[4] having been restored to normal, the subscribers may carry on a conversation over the heavy conductors shown.

The replacing of the receivers at the called and calling substations signals the operator that the conversation has been terminated. When the receiver at the substation A′ is restored to the switch-book, the separation of the hook-switch springs destroys the energizing circuit of the line relay 25. The line relay 25, upon deënergizing, opens the circuit of the relay 29 at the springs 68 and 67 and also opens the circuit of the relay 74 at the springs 75 and 76. The relays 29 and 74, upon deënergizing, complete a circuit through the supervisory lamp 30. The said circuit extends from ground G[15] through the contact of springs 126, springs 127, the lamp 30 and the springs 78 and 79 to the battery lead 100. The replacing of the receiver at the called substation A[2] opens the circuit of the back-bridge relay 46 at the hook-switch springs 151 and 152. The deënergization of the relay 46 reverses the current back to normal in the conductors 32 and 33, which causes the polarized relay 81 to attract its armature in the opposite direction, causing the

lamp 31 to glow again. The operator having received the disconnect signal now removes the plug P from the jack J, which allows the relays 69 and 70 to deënergize. The deënergization of the relay 69 opens the circuit of the holding winding 13 of the line switch C at the springs 128. The winding 13 of the line switch, upon becoming deënergized, allows the plunger arm 10 to return to normal. The deënergization of the relays 70 opens the circuit of the disconnect lamp 30 at the springs 126. The opening of the key K^5 destroys the energizing circuit of the connector line relay 45 and the polarized relay 81. The relay 45 is thereupon deënergized and opens the circuit of the relay 88. The relay 88, upon deënergizing, closes the circuit of the connector release magnet 44. The circuit extends from ground G^9 through the springs 90 and 89, springs 95 and 129, off-normal springs 130 and the release magnet 44 to battery B. The release magnet, upon energizing, restores the switch shaft and side switch wipers to normal position and its own circuit is broken at the springs 130 when the shaft reaches its lowest position. The polarized relay 81, upon returning to normal, opens the circuit of the supervisory lamp 31 at the springs 103 and 150.

If the subscriber at the substation A′ had not asked that the charges be reversed, the connection would have been the same as before, but the charge made to the calling substation meter M in the following manner: The operator completes the connection in the same manner as before; then as soon as the called subscriber answers, the key K′ is pressed, which closes a circuit through the relay 27. The circuit extends from ground G^{15} through the ring of the plug P, contact springs 80 of the jack J, conductor 66 and the springs 68 and 67 and the relay 27 to the battery lead 100. The relay 27, upon energizing, completes a locking circuit for itself through the springs 131 independent of the springs 68 and 67. A further result of the energization of the relay 27 is the transposition of the battery connections of the winding of the line relay 25 with regard to the battery B, whereby the direction of the current in the calling line is reversed. The reversing of the current over the calling line causes the meter M to operate in the same manner as the meter M′ operated at the substation A^2.

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 ground potential upon the connector private bank contacts. The connector private wiper, upon engaging this guarding contact, and before the side switch wipers have 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, side switch wiper 40 (in second position), springs 134 and 133, relay 49, springs 135 and 96 and the magnet 43 to battery B. The private magnet is thus held energized, which disconnects the wipers 34 and 36 from battery and hold the side switch in second position. The relay 49, upon energizing, completes a locking circuit for itself and for the magnet 43 independent of the ground at the private bank contact. The locking circuit for the relay 49 and the magnet 43 extends from ground G^{16} through the off-normal springs 136, springs 137 and 133, relay 49, springs 135 and 96 and the magnet 43 to battery B. The circuit of the rotary magnet 38 is opened at the springs 138 and 139 to prevent a further rotation of the shaft and wipers. A further result of the energization of the relay 49 is to supply a busy signal to the calling subscriber. This circuit extends from ground through the busy machine Q, springs 141 and 142, side switch wiper 42 (in second position), conductor 33, over the heavy conductor through the substation A′, over the return heavy conductor, conductor 32, springs 86 and 87, upper winding of the relay 45 to the battery B and through battery B to ground. The subscriber hearing the busy signal replaces his receiver upon the receiver hook and the release of the apparatus takes place as before described.

If it is desired to insert so-called selector switches between the cord circuit O and the connector switch H, the said selectors will each carry a fourth wiper and be provided with a fourth bank. The said extra apparatus is the means for extending the conductor 122 from the cord circuit O through the said selectors to the relay 47 of the connector H. The conductor 121 is the usual third conductor or released trunk, the function of which, as is well known, is to provide a holding circuit for the line-switching relays of the selector switches and to control the release of the same.

While I have illustrated my invention in connection with a semi-automatic telephone system of a particular type and in which certain types of connector switches are employed, it is, of course, to be understood that my invention is not limited to use in connection with such systems, but that it is capable of use in connection with many other semi-automatic systems in which various types of automatic switches are employed.

Furthermore, calls that are assessed against the calling substation may be completed automatically, *i. e.*, by the use of automatic switches, while only calls that

are assessed against the called subscriber need be completed through the medium of an operator.

What I claim as my invention is:—

1. In a telephone system, talking conductors for a calling line and talking conductors for a called line, means for establishing a talking circuit over said conductors between said lines and for applying current thereto, a meter associated with the conductors of the called line, an auxiliary circuit, and means in said auxiliary circuit for varying the current in the talking conductors of the called line after the called subscriber answers for operating the meter.

2. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, and means for operating either of said meters after said connection has been established, said means operating the meter of the called line by reversal of current when said line is called.

3. In a telephone system, a calling and a called subscriber's line, means including an operator's cord circuit for establishing a connection between said lines, a meter associated with each of said lines, and means controlled by said operator for operating either of said meters by reversal of current before the subscribers' lines are disconnected.

4. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with the called line, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition when the meter line is called, whereby said magnet is prevented from operating, and means for then reversing the current in one winding to thereby cause the operation of said meter magnet.

5. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition when the meter line is called, whereby said magnet is prevented from operating, and means for then reversing the current in one winding to thereby cause the operation of said meter magnet.

6. In a telephone system, a calling and a called subscriber's line, means including an operator's cord circuit for establishing a connection between said lines, a meter associated with the called line, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition, whereby said magnet is not operated, and means under the control of the operator for then reversing the current in one winding to thereby cause the operation of said meter magnet.

7. In a telephone system, a calling and a called subscriber's line, means including an operator's cord circuit for establishing a connection between said lines, a meter associated with each of said lines, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition, whereby said magnet is not operated, and means under the control of the operator for then reversing the current in one winding to thereby cause the operation of said meter magnet.

8. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing a connection between said lines, a meter associated with said called line, means controlled by said operator for operating said meter after said connection has been established, and means for releasing said switches controlled over the talking circuit.

9. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing a connection between said lines, a meter associated with each of said lines, means controlled by said operator for operating either of said meters and means for releasing said switches controlled over the talking circuit.

10. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing a connection between said lines, a meter associated with the called line, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition, whereby said magnet is not operated, means under the control of the operator for then reversing the current in one winding to thereby cause the operation of said meter magnet and means for releasing said switches controlled over the talking circuit.

11. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing a connection between said lines, a meter associated with each of said lines, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means for initially energizing said windings in opposition, whereby said magnet is not operated, and means under the control of the operator for then reversing the current in one winding to thereby cause the operation of said meter magnet.

12. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, and means for operating either of said meters after said connection has been established, said means comprising a relay for reversing the current to operate the meter of the called line when said line is called.

13. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, and means for operating either of said meters by reversal of current after said connection has been established and before the subscribers' lines are disconnected, said means comprising an auxiliary circuit separate from the talking circuit for controlling the continuity of the talking circuit.

14. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, and means for operating either of said meters after said connection has been established by reversal of current, said connection divided into two inductively connected sections, one for the calling line and one for the called line, and a relay for controlling the continuity of the called section for operating the meter.

15. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a meter associated with each of said lines, and means for operating either of said meters by reversal of current after said connection has been established and before the subscribers' lines are disconnected.

16. In a telephone system, a calling and a called subscriber's line, means including an operator's cord circuit for establishing a connection between said lines, calling terminals and an answering plug for said cord circuit, a meter associated with each of said lines, means controlled over said calling terminals for operating one of said meters by reversal of current after the called subscriber has answered and before the subscribers' lines are disconnected.

17. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing connection between said lines, calling terminals and an answering plug for said cord circuit, a meter associated with said called line, means controlled over said calling terminals for operating said meter after said connection has been established, and means for releasing said switches controlled over the talking circuit.

18. In a telephone system, a calling and a called subscriber's line, means including automatic switches and an operator's cord circuit for establishing a connection between said lines, calling terminals and an answering plug for said cord circuit, a meter associated with each of said lines, means controlled over said calling terminals for operating the meter at the called line, means controlled over the answering plug for operating the meter at the calling line, and means for releasing said switches controlled over the talking circuit.

19. In a semi-automatic telephone system, a calling and a called line, automatic progressively movable switches for connecting said lines in a talking circuit, automatic release means for said switches controlled over said talking circuit, and electromagnetic means for charging a call to either a calling or a called line after the called subscriber answers.

Signed by me at Chicago, Illinois, this 26th day of November, 1913.

ALBERT ANDERSEN.

Witnesses:
HERBERT W. KRACKE,
M. R. MORGAN.