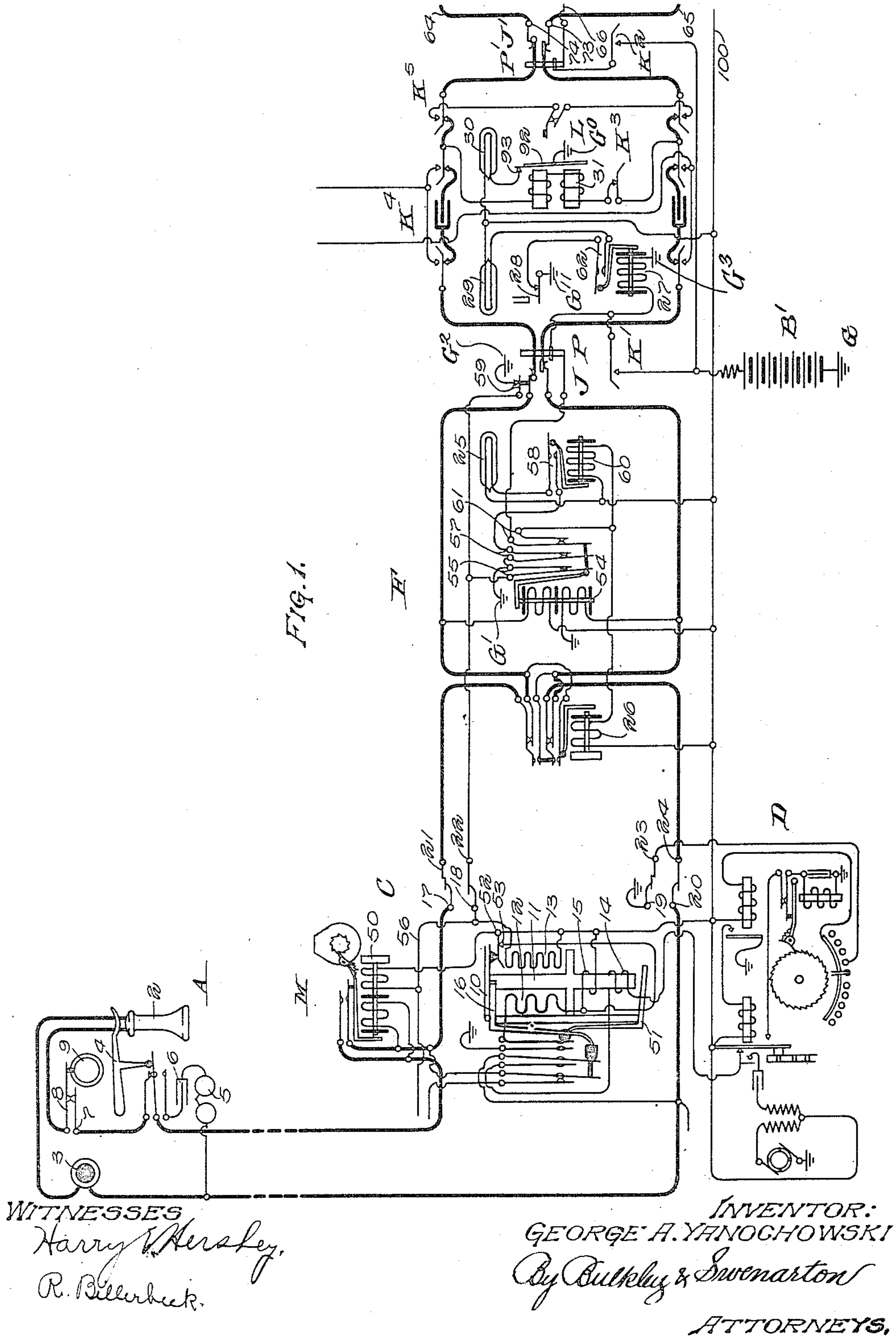


G. A. YANOCHOWSKI.
 MEASURED SERVICE TELEPHONE SYSTEM.
 APPLICATION FILED FEB. 4, 1914. RENEWED APR. 30, 1917.

1,265,716.

Patented May 7, 1918.

3 SHEETS—SHEET 1.



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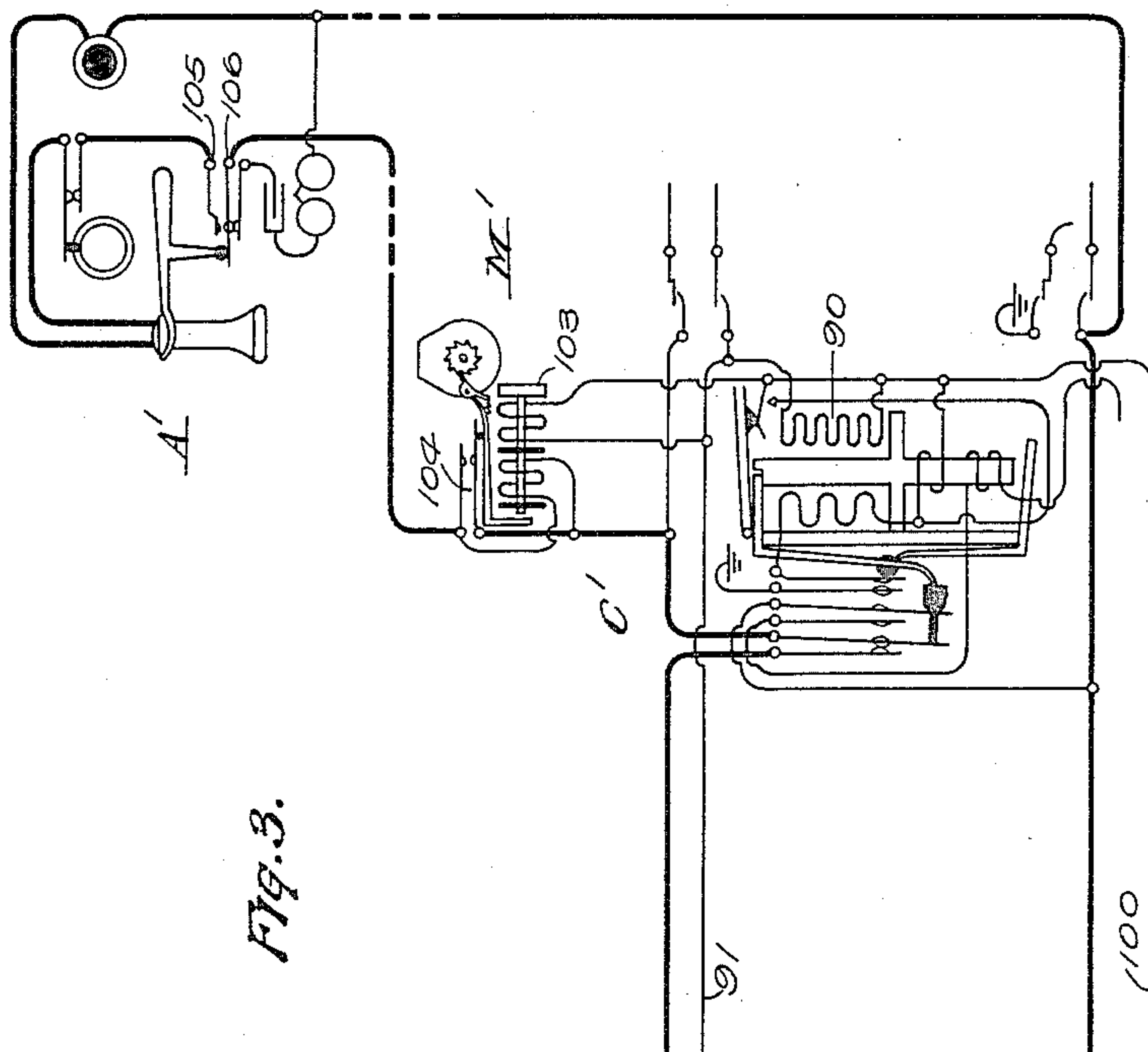


Fig. 3.

WITNESSES

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MEASURED-SERVICE TELEPHONE SYSTEM.

1,265,716.

Specification of Letters Patent.

Patented May 7, 1918.

Application filed February 4, 1914, Serial No. 816,404. Renewed April 30, 1917. Serial No. 165,609.

To all whom it may concern:

Be it known that I, GEORGE A. YANOSCHOWSKI, a citizen of the United States of America, and resident of Chicago, Cook
5 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 measured service
10 telephone systems and has for its object the provision of a system in which a call can be charged to either the calling or the called subscriber.

My invention is in the nature of an improvement on the system disclosed in the
15 application of Albert Andersen for improvement in measured service telephone systems, Serial No. 804,902, filed December 5, 1913.

The object of my present invention is to
20 provide improved means for operating the meters on either the calling or the called line, which means are controlled by an increased flow of current instead of by a reversed flow of current, as in the Andersen invention. Furthermore, my improved means
25 are operated over the trunk-release conductor, and in this manner I avoid the necessity of providing any extra wipers on the switch for the purpose of controlling the
30 operation of the measured service device.

A further feature of my invention is the provision of a simplified cord circuit for use in semi-automatic systems.

These and other objects of my invention
35 will be more clearly understood by reference to the accompanying drawings, in which I have illustrated my invention in connection with a semi-automatic telephone system employing switches of well-known types.

40 Figures 1, 2 and 3 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.

45 Fig. 4 discloses a selector switch of the type for use between the line switch C² and the connector switch H in a system so large as to require the use of such selector switch. This selector switch is disclosed in
50 the prior art and its operation is fully described in Newforth's Patent No. 1,078,690, granted November 18, 1913.

In Fig. 1 there is shown a subscriber's
55 substation A the line conductors of which terminate in the individual switch C, to-

gether 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
60 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 Q there is shown an operator's cord circuit to which
65 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 C² adapted to be seized by the before-mentioned cord circuit to extend a connection to the
70 connector switch H.

Fig. 3 represents the called line switch C', together with its individual meter M' and the called substation A'.

The subscriber's substation A is of any
75 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 de-
80 vice 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
85 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
90 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. This line switch comprises among other details a plun-
95 ger (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,
100 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
105 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
110

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—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 with 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.

Associated with the line switch C is a registering meter M which is operated 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 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 terminals of an idle trunk line.

The device F consists of a group of relays, together with the usual line signal lamp 25. These relays control the battery current fed to the calling subscriber's substation. The relay 26 is a marginal relay—that is, it does not receive sufficient current when energized in series with the relay 27 to operatively energize, but takes the combined strength of the batteries B and B' to operatively energize. However, when the said relay is once energized it receives sufficient current through the relay 27 to remain operatively energized.

The operator's cord circuit O is provided with the usual supervisory signals 29 and 30. The signal 30 is controlled by a polarized relay 31 bridged across the conductors 32 and 33, which bridge includes the key K³. The signal 29 is controlled by the relay 27 and the springs 28. The springs 28 are plug seat springs—that is, they are normally separated when the cord circuit is not in use.

The cord circuit is also provided with the keys K' and K², each of which controls means to operate the meters at the calling and called substations in a manner to be

hereinafter more fully described. The usual listening key K⁴ is also provided, together with the key K⁵ for bridging the calling device L across the cord.

The line switch C² (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 shaft 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 relay 47 is a marginal relay—that is, it will not operatively energize when it receives current only over the circuit including the high resistance winding 48 of the line switch C² and the battery B in series, but when the key K² is operated at the cord circuit O, the said relay 47 receives sufficient current from the battery B' over a path of comparatively low resistance to operatively energize. The batteries B and B' are adapted to be connected in series with the winding 48—that is, one has its negative pole grounded and the other has its positive pole connected to ground. The ringing relay 49 is the means through which ringing current is applied to the called line.

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

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 at substation A may obtain connection with the subscriber at the 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 armature 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 armature 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 a holding circuit for the cut-off or holding winding 13 to be closed in the switch ahead. The engagement of the springs 17 and 20 with the springs 21 and 24, respectively, extends the subscribers' lines to the line relay 54 of the group of relays F. The line relay 54 is thereupon energized and closes the said holding circuit. This circuit extends from ground G' through the contact of springs 55, bank springs 22 and 18 and the said holding winding 13 to the battery lead 100, thence through battery B to ground. The winding 13, upon energizing, holds the armature 16 and the armature 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 54 is energized. This circuit extends over the above circuit to the bank spring 18, thence over the conductor 56 to the said private bank contact. The magnet 50 is now carrying current in both of its windings but is not operatively energized, as the two windings are energized in opposition to each other. A further result due to the energization of the relay 54 is the closure of a circuit through the line signal 25. The said circuit extends from ground G' through the contacts of springs 57, springs 58 and the said line signal to the battery lead 100, thus causing the said lamp to glow and signal the operator that a connection is desired.

The operator immediately inserts the plug P into the jack J, which operation causes the springs 59 to close contact and form a new holding circuit for the holding winding of the line switch C. This circuit extends from ground G² through contact of springs 59, springs 22 and 18, holding winding 13 to battery lead 100. A further result due to the inserting of the plug P into the jack J is the closure of a circuit through the relays 27 and 60. The said circuit extends from ground G³ through the relay 27, sleeve of the plug P, bush of the jack J, springs 61 and the relays 60 and 26 in multiple to the battery lead 100. The relay 27, upon energizing, opens the circuit of the supervisory

lamp 29 at the springs 62. The relay 60, upon energizing, opens the circuit of the line signal lamp at the springs 58. The relay 26 does not receive sufficient current over this circuit to operatively energize. The operator answers by throwing the key K⁴ to bridge her talking set across the line. The operator now takes the calling 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 the substation A'. The operator then inserts the plug P' into the jack J' and operates the key K⁵ to bridge the calling device L across the conductors 64 and 65 leading to the line switch C². The line switch C² operates in the same manner as 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 G⁴ through the lower winding of said relay, springs 67 of the back-bridge relay 47, bank springs 68 and 69, conductor 65, springs 73 of the jack J, ring of the plug P', key K⁵, calling device L, key K⁵, 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. This circuit extends from ground G⁶ through contacts of springs 83 and 84, winding of relay 75 to battery lead 100. The relay 75, upon energizing, closes a holding circuit for the holding winding 48 of the line switch C². This circuit extends from ground G⁵ through the marginal relay 47, springs 76, bank springs 77 and 78 and the said holding winding of the line switch C² to battery B. A further result due to the energization of the relay 75 is the preparation of a circuit for the vertical magnet 37 through the springs 80 and 79 and opening 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 deenergize during the momentary interruptions of its circuit by the relay 45, so that each time the latter relay is deenergized, a circuit is closed extending from ground G⁶ through the contacts of springs 83 and 82, 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^3 through the springs 89 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 deenergizing, 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 deenergizes when its circuit is broken by the relay 85 after the last impulse is delivered to the rotary magnet. The deenergization 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^5 through the side switch wiper 40 (in third position), private wiper 35, conductor 91 and the winding 90 to the battery lead 100. A guarding ground potential is supplied to the contacts of all connector private banks which are multiplied to 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' which extends over the above-traced circuit and from the conductor 91 through the right-hand winding of the meter M' to the battery lead 100. The meter M' does not operate at this time, as it takes the combined strength of both of its windings for it to operatively energize. The operator's key K^5 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 lamp 30 to glow. This circuit extends from ground G^0 through contacts 92 and 93 and lamp 30 to battery lead 100. 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, breaks 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 battery B, 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^2 , thereby closing a circuit from battery B' through the relay 47 at the connector H. This circuit extends from ground G through battery B' , key K^2 , sleeve of the plug P' , bush of the jack J' , conductor 66, bank springs 78 and 77, springs 76 and the right-hand winding of the relay 47 to ground G^5 . This circuit being of comparatively low resistance sufficient current passes through the relay 47 to cause it to operatively energize. The winding 48 of the line switch C^2 is maintained energized while the key K^2 is being pressed over a circuit extending from ground G through battery B' , over the above-traced circuit to the bank spring 78, 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 locking circuit for itself extending from ground G^5 through the left-hand winding of said relay, contact of springs 102, side switch wiper 39 (in third position) to battery B. A further result of the energization of the relay 47 is the trans-

position of the battery connection of the windings of the back-bridge relay 46 with regard to battery B, whereby the direction of the current over the called line is reversed. The reversing of the current over the called line causes the current in the windings of the magnet 103 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 103, upon energizing, also closes the contact of springs 104, whereby the left-hand winding is short-circuited and the magnet remains held in its operated position by the right-hand winding alone, which, although it is not strong enough to operate the armature alone, is strong enough to hold it in its operated position. The subscribers may now carry on an uninterrupted conversation over the heavy conductors shown.

At this point in the operation, attention is called to the circuit for operating the relay 47 in a system wherein the selector M is used. When the operator presses the key K², this circuit extends from ground G through battery B', key K², sleeve of the plug P', bushing of the jack J', conductor 66, bank springs 78 and 77, conductor 201 (Fig. 4), springs 202, side switch arm 203, springs 204, side switch arm 205, wiper 206, conductor 207, spring 76 (Fig. 2), and the right hand winding of the relay 47 to ground G⁵. Relay 47 operates over this circuit the same as before described to accomplish the same result.

The replacing of the receivers at the called and calling substations signals the operator that the conversation has terminated. When the receiver at the substation A is restored to the switch-hook, the separation of the hook-switch spring destroys the energizing circuit of the line relay 54. The line relay 54, upon deenergizing, opens the circuit of the relays 27 and 60 at the springs 61. The relay 27, upon deenergizing, completes a circuit through the supervisory lamp 29. The said circuit extends from ground G¹¹ through the plug seat springs 28, springs 62 and the said supervisory lamp 29 to the battery lead 100. The replacing of the receiver at the called substation A' opens the circuit of the back-bridge relay 46 at the switch-hook springs 105 and 106. The deenergization of the relay 46 reverses the current back to normal in the conductors 64 and 65, which causes the polarized relay 31 to attract its armature in the opposite direction, causing the supervisory lamp 30 to again glow. The operator having received the disconnect signal removes the plug P from the jack J, thereby destroying the holding circuit for the holding winding of the line switch C. The holding winding of the line switch C,

upon deenergizing, allows the plunger arm 10 to return to normal position. The plug P returning to normal position opens the circuit of the supervisory lamp 29 at the springs 28. The removing of the plug P' from the jack J' destroys the energizing circuit of the line relay 45 of the connector H. The relay 45 is thereupon deenergized and opens the circuit of the relay 75. The relay 75, upon deenergizing closes the circuit of the release magnet 44. This circuit extends from ground G⁶ through the contact of springs 83 and 82, springs 80 and 81, off-normal springs 107 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 107 when the shaft reaches its lowest position. The relay 75, upon deenergizing, also opens the holding circuit for the winding 48 of the line switch C² at the springs 76. The line switch C² releases in the same manner as explained in connection with 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 explained above, but the charge would have been made to 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 relay 26 to be operatively energized. The said circuit extends from ground G through the battery B', key K', sleeve of the plug P, bush of the jack J, springs 61 and the relay 26 to battery B, thence through battery B to ground G. The two batteries operating in series cause the relay 26 to be operatively energized. The relay 26, upon energizing, causes the transposition of the battery connections to the calling line, whereby the direction of 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 that the meter M' operated at the substation A' to register the said call.

In case a line is already busy when called, the calling subscriber is given a busy signal from the busy machine Q in the usual and well-known manner.

It will thus be seen that I have devised a very efficient measured service system in which the call can be charged against either the meter on the calling line or the one on the called line. Furthermore, this means is operated over the private wiper, thus avoiding the necessity of the addition of a special wiper to any of the switches. While in the system I have illustrated I have shown certain types of automatic telephone switches

and a certain form of cord circuit, it will, of course, be understood that I do not wish to be limited to the type of switches employed, as my invention is equally as well adapted for use in connection with other forms of switches and cord circuits. Likewise, it will be readily understood that if desired selector switches of any well-known type can be inserted between the line switch and the connector for the purpose of increasing the capacity of the system. The use of such selectors being well known in the art, it is not thought necessary to further describe the manner in which they are employed. Various other changes and modifications will readily suggest themselves to those skilled in the art and come within the contemplated scope of my invention.

What I claim as my invention is:—

1. In a telephone system, a calling and a called subscriber's line, a registering device associated with said called line, means including an automatic switch for establishing connection between said lines, said switch including a pair of line wipers and a private wiper, a trunk-release circuit including said private wiper, and means controlled over said private wiper for operating the meter on the called line after said connection has been established.

2. In a telephone system, a calling and a called subscriber's line, a registering device on said called line, an operator's cord circuit adapted to be connected with the calling line, means including an automatic switch for extending connection from said cord to said called line, said switch including a pair of line wipers and a private wiper, a trunk-release circuit including said private wiper, and means controlled by said operator over said private wiper for operating the meter on the called line after the connection has been established.

3. In a telephone system, a calling and a called subscriber's line, a registering device on said called line, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means including a trunk-selecting switch for extending connection from said cord circuit to said connector, a holding circuit for said trunk-selecting switch, and means controlled by said operator over said holding circuit for operating the meter on the called line after said connection has been established.

4. In a telephone system, a calling and a called subscriber's line, a registering device on said called line, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means including a trunk-selecting switch for extending connection from said cord circuit to said connector, a holding circuit for said trunk-se-

lecting switch, means for increasing the flow of current in said holding circuit, and means controlled by said increased current for causing the operation of the meter on the called line after said connection has been established.

5. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means for extending a connection from said cord circuit to said connector, a relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, and means controlled by the operation of said relay for operating the registering device on the called line.

6. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means for extending a connection from said cord circuit to said connector, a relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, means controlled by the operation of said relay for operating the registering device on the called line, and a locking circuit for said relay for maintaining the same energized until the connection is released.

7. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for establishing connection with the called line, means including a trunk-selecting switch for extending the connection from said cord circuit to said connector switch, a relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, and means controlled by the operation of said relay for operating the meter on the called line after said connection has been established.

8. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operator's

cord circuit adapted to be connected with the calling line, an automatic connector switch for establishing connection with the called line, means including a trunk-selecting switch for extending the connection from said cord circuit to said connector switch, a relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, means controlled by the operation of said relay for operating the meter on the called line after said connection has been established, and a locking circuit for said relay for maintaining the same energized until the connection is released.

9. In a telephone system, a calling and a called subscriber's line, means for establishing connection between said lines, a relay, means controlled by the establishment of said connection for closing a circuit through said relay without operatively energizing the same, means for increasing the flow of current through said relay to thereby operate the same, a registering device for charging a connection to the called line, and means controlled by the operation of said relay for causing the operation of said registering device.

10. In a telephone system, a plurality of subscribers' lines, means including an operator's cord circuit for establishing a connection between two of said lines, a relay, means controlled by the establishment of said connection for closing a circuit through said relay without operatively energizing the same, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, a registering device for charging a connection to the called line, and means controlled by the operation of said relay for operating said registering device.

11. In a telephone system, a calling and a called subscribers' line, a meter associated with the called line, a meter magnet having a pair of energizing windings for controlling the operation of said meter, means including an automatic switch for establishing a connection between said lines, said switch including a pair of line wipers and a private wiper, a trunk-release circuit including said private wiper, means for initially energizing the windings of said meter magnet in opposition, whereby said magnet is not operated, and means controlled over said private wiper for 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, a meter associated with the called line, a meter magnet having

a pair of energizing windings for controlling the operation of said meter, an operator's cord circuit adapted to be connected with the calling line, means including an automatic switch for extending connection from said cord to said called line, said switch including a pair of line wipers and a private wiper, a trunk-release circuit including said private wiper, means for initially energizing the windings of said meter magnet in opposition, whereby said magnet is not operated, and means controlled by said operator over said private wiper for reversing the current in one winding to thereby cause the operation of said meter magnet.

13. In a telephone system, a calling and a called subscriber's line, a registering device on said called line, an operating magnet therefor having a pair of energizing windings, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means including a trunk-selecting switch for extending connection from said cord circuit to said connector, a holding circuit for said trunk-selecting switch, means for initially energizing the windings of said register operating magnet in opposition, and means controlled by said operator over said holding circuit for reversing the current in one winding of said magnet to thereby cause the operation of said registering device.

14. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operating magnet therefor having a pair of energizing windings, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means for extending connection from said cord circuit to said connector, means for initially energizing the windings of said magnet in opposition, a relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, and means controlled by the operation of said relay for reversing the current in one winding of said magnet to thereby cause the operation of said registering device.

15. In a telephone system, a calling and a called subscriber's line, a registering device associated with the called line, an operating magnet therefor having a pair of energizing windings, an operator's cord circuit adapted to be connected with the calling line, an automatic connector switch for connecting with the called line, means for extending connection from said cord circuit to said connector, means for initially energizing the windings of said magnet in opposition, a

relay in said connector, means for closing a circuit through said relay without operatively energizing the same when connection is established with said connector, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, means controlled by the operation of said relay for reversing the current in one winding of said magnet to thereby cause the operation of said registering device, and a locking circuit for said relay for maintaining the same energized until the connection is released.

16. In a telephone system, a calling and a called subscriber's line, means for establishing connection between said lines, a relay, means controlled by the establishment of said connection for closing a circuit through said relay without operatively energizing the same, means for increasing the flow of current through said relay to thereby operate the same, a registering device, an operating magnet therefor having a pair of energizing windings, means for initially energizing said windings in opposition, whereby said magnet is not operated, and means controlled by the operation of said relay for reversing the current in one winding to thereby cause the operation of said registering device.

17. In a telephone system, a plurality of subscribers' lines, means including an operator's cord circuit for establishing connection between two of said lines, a relay, a registering device, an operating magnet therefor having a pair of energizing windings, means controlled by the establishment of said connection for closing a circuit through said relay without operatively energizing the same and for closing a circuit through the windings of said magnet in opposition, whereby said magnet is not operated, means controlled by said operator for increasing the flow of current through said relay to thereby operate the same, and means controlled by the operation of said relay for reversing the current in one winding of said magnet to thereby cause the operation of said registering device.

18. In a telephone system, a plurality of subscribers' lines, means including an operator's cord circuit for establishing connection between two of said lines, a registering device, an operating magnet therefor having a pair of energizing windings, means for initially energizing said windings in opposition, whereby said magnet is not operated, and means controlled by said operator by an increased flow of current for reversing the current in one winding of said magnet to thereby cause the operation of said registering device.

19. In a telephone system, a plurality of subscribers' lines, means including an operator's cord circuit for establishing connection between two of said lines, said cord circuit

including a plug having a pair of line contacts and a third contact, a plug seat switch, a relay connected to said third contact, a supervisory signal having normally closed contacts controlled by said relay and a normally open contact controlled by said plug seat switch, a polarized relay bridged across the called end of said cord, and a second supervisory signal controlled by said polarized relay, a meter, and means for energizing said meter over said third contact.

20. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter for charging the call to the called line, and a controlling circuit for said meter having a section individual to each link.

21. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter individual to the called line, and a controlling circuit for said meter having a section individual to each link.

22. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter for charging the call to the called line, and a controlling circuit for said meter having a section individual to the called line and to each link.

23. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter individual to the called line, and a controlling circuit for said meter having a section individual to the called line and to each link.

24. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, said links normally disconnected, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link.

25. In a telephone trunking system, a calling line, a called line, a plurality of link circuits for connecting the two, a meter for charging the call to the called line, a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

26. In a telephone trunking system, a calling line, a called line, a plurality of link circuits for connecting the two, a meter individual to the called line, a controlling circuit for said meter having a section individual to each link, a guarding potential circuit

for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

27. In a telephone trunking system, a calling line, a called line, a plurality of link circuits for connecting the two, a meter for charging the call to the called line, a controlling circuit for said meter having a section individual to the called line and to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

28. In a telephone trunking system, a calling line, a called line, a plurality of link circuits for connecting the two, a meter individual to the called line, a controlling circuit for said meter having a section individual to the called line and to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

29. In a telephone trunking system, a calling line, a called line, a plurality of talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

30. In a telephone trunking system, a calling line, a called line, a plurality of disconnected talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

31. In a telephone trunking system, a calling line, a called line, a plurality of normally disconnected talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

32. In a telephone trunking system, a calling line, a called line, a plurality of normally disconnected talking conductors for connecting the two, a meter individual to the called line and a controlling circuit for said meter having a section individual to the

called line and to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

33. In a telephone trunking system, a calling line, a called line, a plurality of normally disassociated and normally disconnected talking links for connecting the two, a meter individual to the called line and a controlling circuit for said meter having a section individual to the called line and to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common.

34. In a telephone trunking system, a calling line, a called line, a plurality of talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common, said guarding circuit being separate from the talking conductors.

35. In a telephone trunking system, a calling line, a called line, a plurality of disconnected talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common, said guarding circuit being separate from the talking conductors.

36. In a telephone trunking system, a calling line, a called line, a plurality of normally disconnected talking conductor links for connecting the two, a meter for charging the call to the called line and a controlling circuit for said meter having a section individual to each link, a guarding potential circuit for one of said links for making it busy while the two lines are connected, said guarding circuit and said controlling circuit using a conductor in common, said guarding circuit being separate from the talking conductors.

37. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter for charging the call to the called line, a controlling circuit for said meter having a section individual to each link, and a circuit controller for said control circuit at the cord whereby the operator may operate the meter over the control circuit.

38. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter individual to the called line, a controlling circuit for said meter having a section individual to each link, and a circuit controller for said control circuit at the cord whereby the operator may operate the meter over the control circuit.

39. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter for charging the call to the called line, a controlling circuit for said meter having a section individual to the called line and to each link and a circuit controller for said control circuit at the cord whereby the operator may operate the meter over the control circuit.

40. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, a meter individual to the called line, a controlling circuit for said meter having a section individual to the called line and to each link, and a circuit controller for said control circuit at the cord whereby the operator may operate the meter over the control circuit.

41. In a telephone system, a calling line, a called line, a manual cord circuit link and an automatic progressively movable switch link for connecting the two lines, said links normally disconnected, a meter for charging

the call to the called line and a controlling circuit for said meter having a section individual to each link, and a circuit controller for said control circuit at the cord whereby the operator may operate the meter over the control circuit.

42. In a telephone system, a line, a second line, a plurality of trunks terminating each in an automatic progressively movable switch, each trunk and corresponding switch constituting a link, said line having access to any one of said links, a plurality of other trunks terminating each in an automatic progressively movable connective switch, each one of said other trunks and its corresponding connective switch constituting a link, any trunking switch having access to any one of said other links, a meter for the second line, energizing circuits for said meter, said energizing circuits having a section individual to the second line and a branch in each of said second links, circuits for controlling the energizing circuits, the controlling circuits consisting of interchangeable sections one in each link whereby a circuit may be established between the two lines via any one of the first links and any one of the second links, and whereby the meter on the second line may be then controlled from the first line.

Signed by me at Chicago, Cook county, Illinois, this 27th day of January, 1914.

GEORGE A. YANOCHOWSKI.

Witnesses:

HARRY E. HERSHEY,
R. BILLERBECK.