

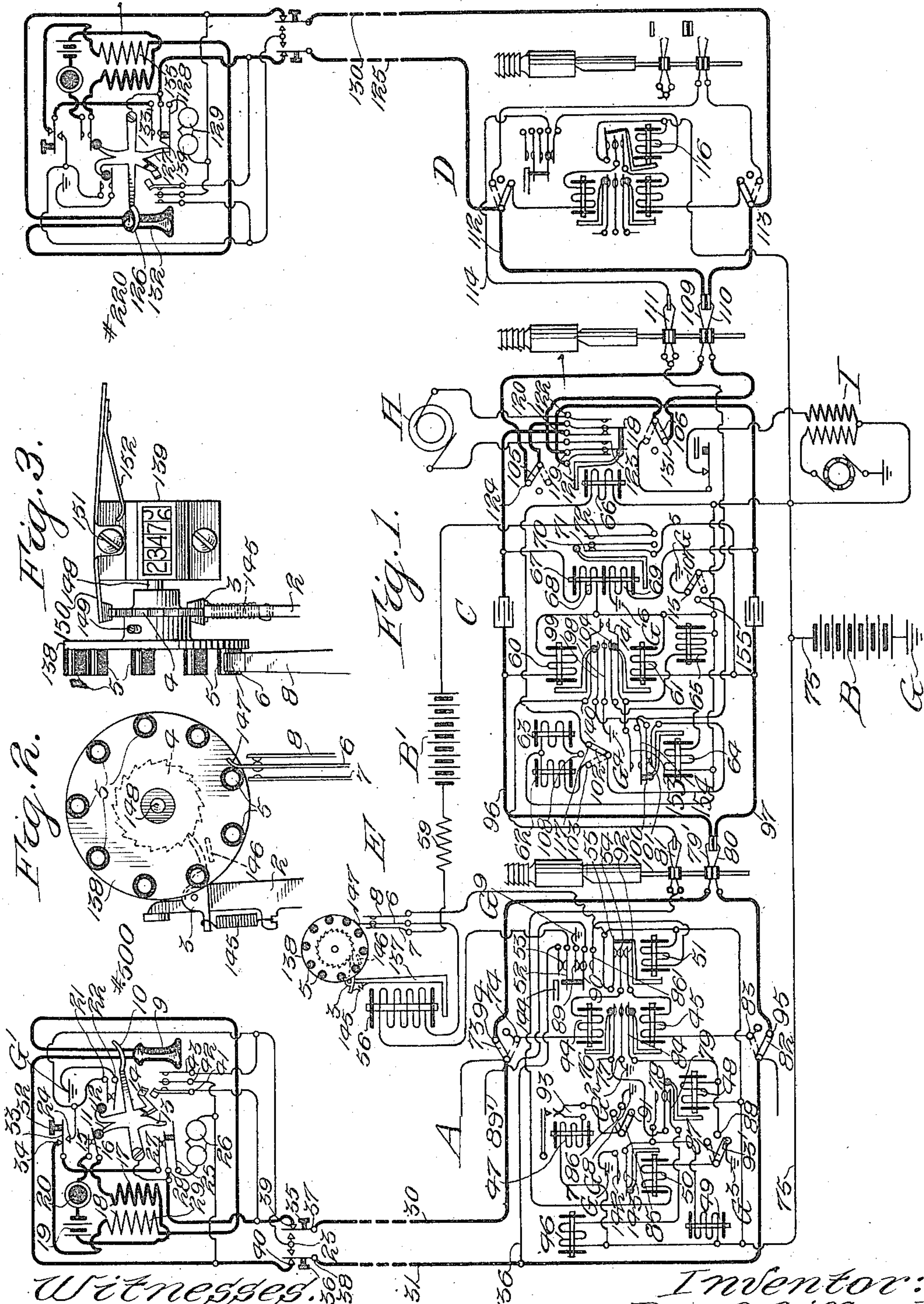
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MEASURED SERVICE TELEPHONE SYSTEM.

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1,239,587.

Patented Sept. 11, 1917.



Witnesses.

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UNITED STATES PATENT OFFICE.

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MEASURED-SERVICE TELEPHONE SYSTEM.

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Specification of Letters Patent.

Patented Sept. 11, 1917.

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To all whom it may concern:

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

My invention relates to measured service telephone exchange systems in general. There are many ways in which to measure service or levy toll in a telephone system. Coin devices or call-registering means can be provided at the subscribers' stations, or meters or call-registering devices can be employed at the exchange or central station. In any event, however, and broadly considered, a measured-service system is one in which suitable toll-levying means are provided for those subscribers who pay a fixed price for each call.

Generally stated, and in its broader aspect, my invention contemplates an improved measured-service telephone system; and more specifically considered it contemplates an automatic system in which meters or call-registering devices are allotted to the subscribers' lines at the exchange or central station, and in which provision is made for enabling the called subscriber to exercise a control over said meters or devices, whereby no toll can be levied except and unless the called subscriber answers.

To the foregoing and other useful ends, my invention consists in matters hereinafter disclosed and claimed.

In the accompanying drawings, Figure 1 shows diagrammatically a calling substation and a called substation connected through a central office equipped with my improved call-registering meter, and with other switches. In the said office the calling substation #500 has allotted to it the first-selector A of the general type disclosed in United States Patent No. 815,321. It will be noticed that there is also a central battery B having its positive terminal preferably grounded. In addition to the said first-selector there is shown a connector C, a call-registering meter with its circuit connections at E, a non-grounded battery at B', and the first-

selector D allotted to the called line. The said meter device comprised in my invention may be considered as an attachment having suitable terminals which may be electrically connected with the central office switches.

Fig. 2 is an end view of the register, showing the positions of the operating armature 2 and the pawl 3 with reference to the ratchet wheel 4. The bushing 5 is shown in operative engagement with the spring 6, thereby breaking the contact between springs 6 and 7 and closing the springs 6 and 8 in contact.

Fig. 3 is a top view of the register showing the meter.

The substations may be of any suitable or approved type. The substation shown at #500, for instance, is provided with the receiver 9, switch-hook 10, the latter having radiating from its body a number of cams 11, 12, 13 and 14. When the receiver is off the hook the cam arm 11 closes in contact the springs 15 and 16, thereby closing a local circuit including the primary winding 17 of the induction-coil 18, local battery 19 and transmitter 20. The cam 12 controls the coöperative ground springs 21 and 22 which, when the switch-hook 10 is up, engage and thus place the substation ground G' in connection with the ground post 23 and contact point 24. When the switch-hook is down the cam 13 engages the spring 25, which bridges the ringer 26 across the line. The said cam, when the receiver is removed, permits the springs 27 and 28 to engage, bridging the receiver 9 instead of the ringer 26 in series with the secondary winding 29 of the induction-coil 18 across the line conductors 30 and 31. The signaling device whereby one subscriber may signal another comprises a push-button 32 secured to the spring 33 which is normally in contact with the point 34; but when the button 32 is pressed the said spring comes into contact with the ground contact point 24. Means by which the subscriber may operate the central office switches consists of the push-buttons 35 and 36 which are secured to the springs 37 and 38, respectively. Said springs 37 and 38, when the buttons 35 and

36 are pressed, leave the contact points 39 and 40, respectively, and come into engagement with the ground post 23, thereby grounding the line conductors 30 and 31, respectively. The springs 41 and 42, when pressed into contact by the cam arm 14 on the downward course of the switch-hook 10, engage the spring 43, which latter is connected to the substation ground G' , thus grounding both line conductors 30 and 31 simultaneously and releasing the central office apparatus. The first-selector A is provided with the vertical and rotary line relays 44 and 45 and vertical and rotary magnets 46 and 47, respectively, private magnet 48, release magnet 49, release relay 50 and the bridge-cut-off relay 51; in fact the first-selector A is the same as the first-selector disclosed in United States Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson, with the addition of the normal springs 52 and 53. The springs 52 and 53 are provided for connecting the rotary line conductor 31 with the motor relay 56 of the meter apparatus. Said relay is in turn connected with the battery B' through the springs 6 and 7 and the resistance-coil 59. The connector C, which is a modification of the connector disclosed in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, is provided with the vertical and rotary relays 60 and 61, vertical and rotary magnets 62 and 63, respectively, private magnet 64, release magnet 65 and ringer relay 66. In addition the connector C is provided with the relay 67 having the two windings 68 and 69. This relay becomes energized when the called subscriber removes his receiver from the switch-hook, thus completing an energizing circuit through both windings of the relay. The energization of the said relay causes its armature to operate and shift the spring 70 from contact with the spring 71 to engagement with the spring 72. During this shifting there is a short interval in which the spring 70 is in contact with the springs 71 and 72 simultaneously. The momentary engagement of the said springs connects the rotary trunk conductor of the connector C with the positive terminal of the battery B' . This will be more fully described hereinafter. If the subscriber #500 wishes to call the subscriber at substation #220 he first removes the receiver 9 from the switch-hook 10, thereby placing the ground post 23 in connection with the substation ground G' . He then operates the vertical push-button 35 twice and the rotary push-button 36 once; again the first push-button is pressed twice and the second button once, and for the last time the button 35 is pressed ten times and the button 36 once. By press-

ing the button 35 twice for the first digit of the number desired, the shaft and shaft wipers of the first-selector A are raised two steps to the second level of the line and private banks. The operation is as follows: When the spring 37 engages the ground post 23 an energizing circuit is established through the vertical relay 44 of the first-selector A, extending from ground G' through the springs 22 and 21 to the ground post 23, spring 37, vertical line conductor 30, side switch wiper 73, contact point 74 to the vertical line relay 44, bridge-cut-off springs 54 and 55 to the battery lead 75, thence through battery B to ground G. Each time the vertical relay 44 is energized the springs 76 and 77 are carried into engagement, thereby closing an energizing circuit through the vertical magnet 46. This energizing circuit extends from ground G^2 through the springs 77 and 76 to the private magnet springs 78 and 79, vertical magnet 46 to the battery lead 75, and thence through battery B to ground G. The vertical magnet being operated twice the first-selector switch shaft wipers 79', 80 and 81 are carried to a level with the contact points that constitute the terminals of the trunk lines leading to the connector C. Furthermore, upon the first vertical impulse the normal springs 52 and 53 engage, likewise the springs 89 and 90. When the subscriber presses the rotary impulse spring 38 onto the ground post 23 the rotary line relay 45 of the first-selector A is in turn energized. This energizing circuit extends from ground G' through the springs 22 and 21, ground post 23, spring 38 to the rotary line conductor 31, side switch wiper 82, contact point 83 to the rotary line relay 45, bridge-cut-off springs 92, 54 and 55 to the battery lead 75, and through battery B to ground G. The said relay operates to close an energizing circuit through the private magnet 48. This circuit extends from ground G^2 through the springs 77 and 84 to the private magnet 48, thence to the battery lead 75, and through battery B to ground G. The private magnet 48 upon energizing operates to shift the side switch wipers from first to second position, whereby an energizing circuit is closed through the rotary magnet 47 when the side switch wiper 85 engages the contact point 86. The said energizing circuit extends from ground G^3 , contact point 86, side switch wiper 85, interrupter springs 93, through the rotary magnet 47 to the battery lead 75, thence through battery B to ground G. The rotary magnet is energized, rotating the shaft one step, and the shaft wipers 79', 80 and 81 are carried into engagement with the bank contacts that constitute the terminal of a trunk leading to the connector switch C. Assum-

ing that the trunk leading to the said connector leads off from the first set of contacts of the second level, then if the first trunk line is busy an energizing circuit is established through the private magnet 48, when the private wiper 81 strikes the grounded private contact, thereby maintaining the energizing circuit through the private magnet 48, which in turn remains energized; retaining the side switch in second position, and maintaining the energizing circuit through the rotary magnet 47. This energizing circuit through the private magnet 48 extends from the grounded contact point to the private wiper 81, to the release relay 50, side switch wiper 87, contact point 88, through the private magnet winding 48 to the battery lead 75, thence through battery B and to ground G. The rotary magnet by intermittent magnetization thus causes the shaft to rotate step-by-step, carrying the wipers past the last busy trunk line. However, as soon as the private wiper 81 leaves the last busy contact the private magnet 48 becomes deenergized, the side switch is tripped to third position, and the energizing circuit through the rotary magnet 47 is broken. The side switch wipers 73, 82, 85 and 87 engage their respective contact points 94, 95, 91 and 93'. This operation results in disconnecting the line conductors 30 and 31 from the vertical and rotary relays 44 and 45 and extending the said conductors to the switch-shaft wipers 79' and 80, respectively. But if there are no busy contacts to be passed over, as assumed in the first instance, the shaft wipers 79', 80 and 81 come to rest upon the first contact of the second level, as stated. A guarding potential is established at the private wiper contact 81 extending from ground G³, side switch wiper 87, contact point 93', through the release relay 50 to the private wiper 81. This guarding potential protects the connector C from being seized by any other first-selector. Furthermore, the potential for protecting the calling line extends from ground G⁹ through the springs 89 and 90, thence to the private normal conductor 89', which leads to the connector bank. The second digit is called after the subscriber has established connection with the connector C by way of the trunk conductors 96 and 97. For the second digit the vertical button 35 is pressed twice, thus grounding the vertical line conductor 30 twice and energizing the vertical line relay 60 of the connector C twice. The energizing current flows from substation ground G' through the ground post 23 and spring 37, line conductor 30, side switch wiper 73, contact point 94 to the shaft vertical line wiper 79', trunk conductor 96 to the relay 60, thence to the battery lead 75, and through battery

B to ground G. Each time the vertical relay 60 is energized the relay springs 98 and 99 are pressed into contact, thereby closing an energizing circuit through the vertical magnet 62 over the following path: from ground G⁴ to the springs 98 and 99, private magnet springs 100 and 101, side switch wiper 102, contact point 103, vertical magnet 62 to the battery lead 75, thence through battery B and to ground G. Each time that the vertical magnet is energized it operates to raise the shaft and shaft wipers one step at a time, until the said wipers are carried up two steps to the level in which are located the terminal contacts of the line #220. When the rotary line conductor 31 is grounded the rotary line relay 61 of the connector C becomes energized over the following path: from ground G' to the ground post 23, spring 38, rotary line conductor 31, through the side switch wiper 82, contact point 95 to the rotary shaft wiper 80, trunk conductor 97, rotary relay 61 to the battery lead 75, thence through battery B and to ground G. The energization of the rotary line relay 61 causes the energization of the private magnet 64 over a circuit extending from ground G⁴ through the springs 98 and 104, private magnet 64 to the battery lead 75, thence through battery B and to ground G, and the release of the side switch from first to second position, thus placing the wipers 105, 106, 107 and 102 in connection with their respective contact points in the second position. The last digit being naught the subscriber presses the vertical button 35 ten times, grounding the vertical line conductor 30 ten times and the rotary line conductor 31 once. The vertical and rotary line relays 60 and 61 are operated over previously traced circuits. However, when the line relay springs 98 and 99 engage, a circuit is closed through the rotary magnet 63 instead of through the vertical magnet 62. The energizing circuit extends from ground G⁴ through the springs 98 and 99, private magnet springs 100 and 101, side switch wiper 102, contact point 108, rotary magnet 63 to the battery lead 75, thence through battery B and to ground G. Each time that the rotary magnet is energized it rotates the shaft and shaft wipers 109, 110 and 111 one step at a time until the said wipers are carried into engagement with the normal conductors 112, 113 and 114, respectively, that lead to the line switch D of the desired subscriber. The energization of the rotary line relay 61, as previously stated, completes an energizing circuit through the private magnet 64, which now operates with one of two results, namely the release of the side switch from second to third position, or the so-called busy-release of the connector, as will be explained. Suppose the for-

mer result to occur and the side switch to pass to third position, thus placing the side switch wipers 105, 106, 107 and 102 in contact with their respective contacts in the third position. Furthermore, when the side switch passes to third position a guarding potential is established for protecting the called line. This potential extends from ground G^5 to the contact point 115, side switch wiper 107, to the private wiper 111 which engages the private contact of the called line. The said guarding potential also closes an energizing circuit through the bridge-cut-off relay 116 of the first-selector D, thus removing the bridge formed by the vertical and rotary line relays of the first-selector D. To signal the called subscriber the calling subscriber presses the signaling button 32, thus placing the spring 33 in contact with the substation ground and thereby energizing the vertical relay 60 of the connector C. The path of the energizing current extends from the substation ground G' through the springs 22 and 21 to the contact point 24, spring 33, springs 27 and 28, contact point 39, spring 37, vertical line conductor 30, through the side switch wiper 73, contact point 94, first-selector shaft wiper 79', trunk conductor 96, vertical relay 60 to the battery lead 75, thence through battery B and to ground G. It will be remembered that the connector side switch has passed from second to third position and that the side switch wiper 102 is in engagement with the contact point 117, thereby placing the ringer relay 66 under the control of the line relay 60. Therefore, when the vertical line relay 60 presses the springs 98 and 99 into contact the ringer relay 66 is energized by a flow of current from ground G^4 through the springs 98 and 99, private magnet springs 100 and 101, side switch wiper 102, contact point 117, ringer relay 66 to the battery lead 75, thence through battery B to ground G. The ringer relay upon energizing shifts the springs 118 and 119 from in contact with the springs 120 and 121 to engagement with the springs 122 and 123, respectively. This results in bridging across the called subscriber's line the terminals of the ringer generator H. A signaling current is, therefore, sent from the generator H to the ringer relay springs 122 and 118, to the side switch wiper 105, contact point 124, connector shaft wiper 109, normal conductor 112, line conductor 125 to the switch-hook 126, cam 127 to the spring 128, thence through the ringer 129 to the rotary line conductor 130, normal conductor 113, connector shaft wiper 110, contact point 131, side switch wiper 106, ringer relay springs 119 and 123 and back to the ringer generator H. As soon as the calling subscriber ceases to press the signaling button 32 the ringer relay 66 becomes deenergized and the

springs 118 and 119 resume their normal position. The subscriber at substation #220, in response to the signal, removes the receiver 132 from the switch-hook 126, which allows the springs 133 and 134 to engage and the cam 127 and spring 128 to disengage, thereby removing the ringer 129 from across the line and bridging instead the secondary winding 135 in series with the receiver 132. Furthermore, when the springs 133 and 134 engage an energizing circuit is established through the relay windings 68 and 69 of the connector C. This energizing circuit extends from ground G^6 through the winding 69 of the relay 67, thence to the ringer relay springs 121 and 119, side switch wiper 106, contact point 131, shaft wiper 110, normal conductor 113, rotary line conductor 130, receiver 126, secondary winding 135, through the signaling device to the springs 133 and 134, to the vertical line conductor 125, normal conductor 112, shaft wiper 109, contact point 124, side switch 105, ringer relay springs 118 and 120, through the winding 68 of the relay 67 to the battery lead 75, thence through battery B to ground G. The relay 67 upon energization operates to shift the spring 70 from in contact with the spring 71 into engagement with the spring 72. As previously explained, there is an instant in which the spring 70 is in contact with both springs 71 and 72 simultaneously, and during this instant in which all three springs are in contact a circuit is established through the motor relay 56. This circuit may be traced from the spring 70 to the spring 71, rotary trunk conductor 97, first-selector shaft wiper 80, through the contact point 95 and side switch wiper 82, conductor 136, normal springs 53 and 52, through the winding of the motor relay 56, springs 6 and 7, resistance-coil 59, thence through battery B' to the springs 72 and 70. The motor relay 56 upon energization attracts its armature 137, which in turn advances the wheel 138 one step, thus carrying the bushing 5 (Fig. 2) into contact with the spring 6. The said spring 6 now disengages from the spring 7 and comes into contact with the spring 8. The disengagement of the springs 6 and 7 removes the battery B' from the motor relay 56, and the engagement of the springs 6 and 8 connects the motor relay 56 with the battery lead 75 of the battery B. Now when the calling subscriber #500 restores his receiver 9 to the switch-hook 10, grounding the line conductors 30 and 31, an energizing circuit is established through the motor relay 56. This second energizing circuit extends from the substation ground G' to the rotary line conductor 31, conductor 136, normal springs 53 and 52, through the winding of the motor relay 56 to the springs 6 and 8, to the battery lead 75, thence through battery B to ground G. The motor relay

56 again attracts its armature 137 and advances the wheel 138 another step. The bushing 5 is accordingly carried from beyond the spring 6, and the said spring 6 again comes to its normal position in contact with spring 7; thus the motor relay becomes energized twice, once by the called subscriber when the receiver 132 is removed from the switch-hook, and again by the calling subscriber when the receiver 9 is restored to the switch-hook. The motor magnet having been energized twice causes its armature 137 to advance the wheel 138 two steps, which is sufficient for advancing the meter register 139 one unit.

The release of the central office switching apparatus is brought about when the calling subscriber restores the receiver 9 and grounds both line conductors 30 and 31 simultaneously, thereby energizing the vertical and rotary relays 60 and 61 simultaneously, which operate and place the trunk-release springs 140 and 141 in contact. The engagement of the said springs closes an energizing circuit through the release relay 50 of the first-selector A in series with the release magnet 65 of the connector C. This circuit extends from ground G³ at the selector A, contact point 93', side switch wiper 87, release relay 50, private wiper 81 to the trunk-release springs 140 and 141, release magnet 65 to the battery lead 75, thence through battery B and to ground G. The release magnet 65 upon energization attracts its armature and releases the connector in the well-known manner. The release relay 50 upon energization operates to place the springs 142 and 143 in contact, which closes an energizing circuit through the release magnet 49 extending from ground G⁷, release relay springs 142 and 143, through the winding of the release magnet 49 to the battery lead 75, thence through battery B and to ground G. The release magnet 49 in turn operates in the well-known manner to restore the shaft and shaft wipers of the first-selector A to normal position, when the release springs 41, 42 and 43 separate. When the first-selector A is fully restored to normal position the normal arm 144 separates the springs 89 and 90 and springs 53 and 52, and places the springs 90 and 86' in contact, thereby connecting the private normal 89' and bridge-cut-off relay 51.

The meter or call-registering device comprises a motor relay 56 and an armature 137 at one end of which is suitably secured the pawl 3. The spring 145 is provided for returning the pawl to its normal position after the said pawl has engaged the ratchet wheel 4. The relay 56 upon energizing attracts its armature 137 and causes the pawl 3 to engage a tooth of the wheel 4 and thus advance the wheel one step, or until the

pawl 3 comes into contact with the stop 146. The said pawl when in its advanced position serves as a lock to prevent the momentum of the rotating parts from carrying the disk or wheel 138 more than one step. Upon the disk or wheel are suitably mounted a number of insulating bushings 5. The bushings engage with and carry the spring 6 from in contact with the spring 7 to engagement with the spring 8, at the first step of the disk or wheel 138, which occurs when the called subscriber removes his receiver from the switch-hook, as previously explained. At the next step of the disk 138, when the calling subscriber hangs up his receiver, the bushing 5 slides off from the round end 147 of the spring 8, thus permitting the spring 6 to again close in contact with the spring 7. The disk 138 and toothed wheel 4 are secured to the meter shaft 148 by means of the set-screw 149. The rocker-arm 150 is provided for maintaining the ratchet wheel 4 in its advanced position. Said arm is suitably mounted upon the meter by the screw 151. The spring 152 provides the means for maintaining the arm 150 in contact with the teeth of the wheel 4.

It is obvious from the foregoing that the meter only operates the first step if the called subscriber answers—that is, if a call has been completed; and then when the switching apparatus of the central station has been restored the last step is completed—that is, the motor relay 56 cannot be energized when the calling subscriber releases, unless the spring 6 has previously been carried into engagement with the spring 8, which latter operation is altogether under the control of the called subscriber. Of course, if a line is busy, for the above reasons the meter does not register, because the connector side switch does not pass to third position, as already stated. If the called line is busy, as is well known, the desired line is protected by a guarding potential at the private bank contact; then when the last rotary impulse is sent in for completing the final connection the private magnet 64 is operated as usual, carrying the springs 153 and 154 into contact, while the side switch is in second position, and after the private wiper 111 has been carried onto the grounded contact. As a result an energizing circuit is set up through the release magnet 65 from the grounded guarded contact point through the private wiper 111, thence through the side switch wiper 107, contact point 155, private magnet springs 154 and 153 to the release magnet 65, and through said magnet to the battery lead 75, thence through battery B and to ground G. Of course, the connector switch shaft and side switch are restored, which incidentally destroys the energizing circuit for the re-

lease magnet. It will be evident, then, that if the called subscriber does not answer because his line is busy, or because he is not at home, the meter cannot register. When-
 5 ever a connection is established with the called line, it has been explained, the cut-off relay 116 of the selector of said line is energized; but, of course, that energizing circuit is destroyed whenever the connector switch
 10 is released.

The relay 56 may be wound to any suitable resistance, but with a central battery of fifty volts good results have been obtained when the said relay is wound to a
 15 resistance of five hundred ohms. The resistance-coil 59 may be wound to a resistance of one-half ohm.

It will be seen that I provide a toll-levying device which is under the control of the
 20 called subscriber, so that no toll can be levied if the call is not successful. The meter or call-registering device is, of course, individual to the calling subscriber's line, and one is provided for each subscriber
 25 using measured service.

The connectors can be employed on a percentage basis, and are, therefore, preferably less in number than the subscribers. The first-selectors can also be reduced to a per-
 30 centage basis in any suitable or known manner, and intermediate selectors can be employed if necessary. Thus provision is made for automatic trunking between lines in a system by which the service is metered
 35 or measured at the exchange or central station.

It will be seen that the condensers of the connector C serve to exclude the battery current from the calling line during conver-
 40 sation. At the same time, however, current is maintained on the line of the called subscriber.

What I claim as my invention is:—

1. In a telephone exchange system, the
 45 combination of means for automatically trunking one line into connection with another, responsive to the calling subscriber, and call-registering devices comprising ratchet mechanism controlled first by the
 50 called subscribers and then by the calling subscribers.

2. In a telephone exchange system, the combination of means for automatically trunking one line into connection with an-
 55 other, responsive to the calling subscriber, and call-registering devices comprising ratchet mechanism located at the exchange or central station, controlled by the called subscribers.

3. A call-registering device, means by
 60 which the called subscriber partially actuates said device in answering, and means by which the calling subscriber then completes the operation thereof when he hangs
 65 up his telephone.

4. A call-registering device, means by which the called subscriber partially ac-
 tuates said device in answering, means by which the calling subscriber then completes the operation thereof, and automatic means
 70 for trunking one line into connection with another.

5. A call-registering device, means by which the called subscriber partially ac-
 tuates said device in answering, means by
 75 which the calling subscriber then completes the operation thereof when he hangs up his telephone, and automatic means for trunking one line into connection with another.

6. A call-registering device, means by
 80 which the called subscriber partially actuates said device in answering, means by which the calling subscriber then completes the operation thereof, and subscriber-controlled automatic means for connecting one
 85 line with another.

7. A call-registering device, means by which the called subscriber partially ac-
 tuates said device in answering, means by which the calling subscriber then completes
 90 the operation thereof when he hangs up his telephone, and subscriber-controlled automatic means for connecting one line with another.

8. In a telephone exchange system, the
 95 combination of automatic means for connecting one line with another, responsive to a call, and a service meter conjointly controlled first by the called and then by the calling subscribers to register the successful
 100 calls.

9. The combination of telephone lines, automatic switches less in number than said lines, but in which said lines have multiple
 105 terminals, automatic means by which a calling subscriber trunks to an idle switch, a call-registering device, means by which the called subscriber operates the call-registering device one step when he answers, and
 110 means by which the calling subscriber operates the said device another step when he releases the switch and trunking means.

10. In an automatic telephone exchange system, the combination of means for auto-
 115 matically trunking one line into connection with another, a common battery, means for admitting the battery current to the called line during conversation, means for excluding the battery current from the calling line during conversation, and a call-registering
 120 device responsive to the flow of current in the called line.

11. A telephone connector having pro-
 125 vision for retaining both sides of the calling line in connection with one pole of a battery during conversation, and for bridging said battery across the called line, and a call-registering device responsive to the flow of current in the called line.

12. A service meter having a local magnet
 130

circuit, a selector or individual switch having off-normal springs for closing said circuit at one point, and a switch for enabling the called subscriber to close said circuit at another point, said circuit including a portion of the talking circuit.

13. A service meter, a battery for operating the meter one step when the called subscriber answers, and another battery for operating the meter another step when the calling subscriber hangs up his telephone.

14. A telephone system comprising a calling subscriber's telephone line, a called subscriber's telephone line, a centralized source of current, means for excluding the current from the calling line during conversation, means for maintaining the current on the called line during conversation, and register means responsive to the flow of current in the called line.

15. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a selector and a connector switch, off normal springs in said selector controlling said circuit at one point, and a relay in said connector controlling the circuit at a second point.

16. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a selector and a connector switch, off normal springs in said selector controlling said circuit at one point, and a relay in said connector in bridge of the talking circuit to control said circuit at a second point.

17. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a selector and a connector switch, off normal springs in said selector controlling said circuit at one point, and a relay in said connector in bridge of the talking circuit to control said circuit at a second point, said relay being energized upon the response of the called subscriber.

18. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a relay under the control of the called subscriber adapted to close said circuit to energize said meter magnet to partially operate said meter, and contacts controlled by such energization to then place said meter magnet under the control of the calling subscriber, whereby said meter may be completely operated.

19. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a relay controlling said circuit to energize said meter magnet, means for energizing said relay upon the response of the called subscriber, contacts controlled by the energization of said meter magnet to then place said magnet under the control of the calling subscriber, and means to then energize said magnet when the calling subscriber hangs up.

20. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a double-wound relay bridged across the talking circuit for controlling said energizing circuit, and contacts controlled by such energization to then place said meter magnet under the control of the calling subscriber.

21. In a telephone system, a service meter, a magnet for operating said meter, a circuit for energizing said magnet, a double-wound relay bridged across the talking circuit for controlling said energizing circuit, means for energizing said relay upon the response of the called subscriber, contacts controlled by the energization of said meter magnet to then place said magnet under the control of the calling subscriber, and means to then energize said magnet when the calling subscriber hangs up.

22. In a telephone system divided into groups, the combination of means for automatically trunking one line into connection with another, and call-registering devices for measuring the service, located at the exchange or central office, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

23. In a telephone system divided into groups, the combination of means for automatically trunking one line into connection with another, and call-registering devices located at the exchange or central station, controlled by the called subscribers, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

24. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates said device in answering, and means by which the calling subscriber then completes the operation thereof, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

25. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates said device in answering, and means by which the calling subscriber then completes the operation thereof when he hangs up his telephone, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

26. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates

ates said device in answering, means by which the calling subscriber then completes the operation thereof, and automatic means for trunking one line into connection with another, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

27. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates said device in answering, means by which the calling subscriber then completes the operation thereof when he hangs up his telephone, and automatic means for trunking one line into connection with another, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

28. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates said device in answering, means by which the calling subscriber then completes the operation thereof, and subscriber-controlled automatic means for connecting one line with another, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

29. In a telephone system divided into groups, a call-registering device, means by which the called subscriber partially actuates said device in answering, means by which the calling subscriber then completes the operation thereof when he hangs up his telephone, and subscriber-controlled automatic means for connecting one line with another, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

30. In a telephone system divided into groups, the combination of telephone lines, automatic switches less in number than said lines, but in which said lines have multiple terminals, automatic means by which a calling subscriber trunks to an idle switch, a call-registering device, means by which the called subscriber operates the call-registering device one step when he answers, and means by which the calling subscriber operates the said device another step when he releases the switch and trunking means, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

31. In a telephone system divided into

groups, a service meter having a magnet circuit, a selector or individual switch having off-normal springs for closing said circuit at one point, and a switch for enabling the calling subscriber to automatically close said circuit at another point, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

32. In a telephone system divided into groups, a service meter, a battery for operating the meter one step when the called subscriber answers, and another battery for operating the meter another step when the calling subscriber hangs up his telephone, said system being operative by vertical motion of certain elements thereof to select groups and by rotary motion of the same elements to connect with the called line in any selected group.

33. A call-registering device, means by which the called subscriber in answering prepares an operating circuit for said device, and means by which the calling subscriber then closes the said circuit to operate the said device.

34. A call-registering device, means by which the called subscriber in answering prepares an operating circuit for said device, means by which the calling subscriber then closes the said circuit to operate the said device, and subscriber-controlled automatic means for connecting one line to another.

35. A call-registering device, means by which the called subscriber in answering prepares the said device to be operated, means by which the calling subscriber then automatically operates the said device, and subscriber-controlled automatic means for connecting one line to another.

36. A call-registering device, means by which the called subscriber in answering prepares an operating circuit for said device, and means by which the calling subscriber then closes the said circuit to operate the said device when he hangs up his telephone.

37. A call-registering device, means by which the called subscriber in answering prepares the said device to be operated, and means by which the calling subscriber then automatically operates the said device when he hangs up his telephone.

38. In a telephone exchange system, a calling and a called subscriber's line, automatic means for connecting said lines, and a service meter rendered operative by the response of the called subscriber and actuated by the calling subscriber to register the call.

39. In a telephone system, the combination with a plurality of calling and called lines, of selector and connector switches

adapted to automatically interconnect said
lines, conversation recorders, preparatory
circuits extending through said switches for
controlling the preliminary action of said
5 recorders, said preparatory circuits being
controlled by said called lines, and supple-
mentary circuits for controlling the final
action of said recorders to effect registra-

tion, said supplementary circuits being con-
trolled by said calling lines.

Signed by me at Chicago, Cook county,
Illinois, this 9th day of November, 1906.

ROY C. GIFFORD.

Witnesses:

EDWARD D. FALES,
ARTHUR B. SPERRY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."