J. ERICKSON.

MEASURED SERVICE TELEPHONE SYSTEM.

APPLICATION FILED DEC. 6, 1906.

1,243,721.

Patented Oct. 23, 1917.

3 SHEETS—SHEET 1.

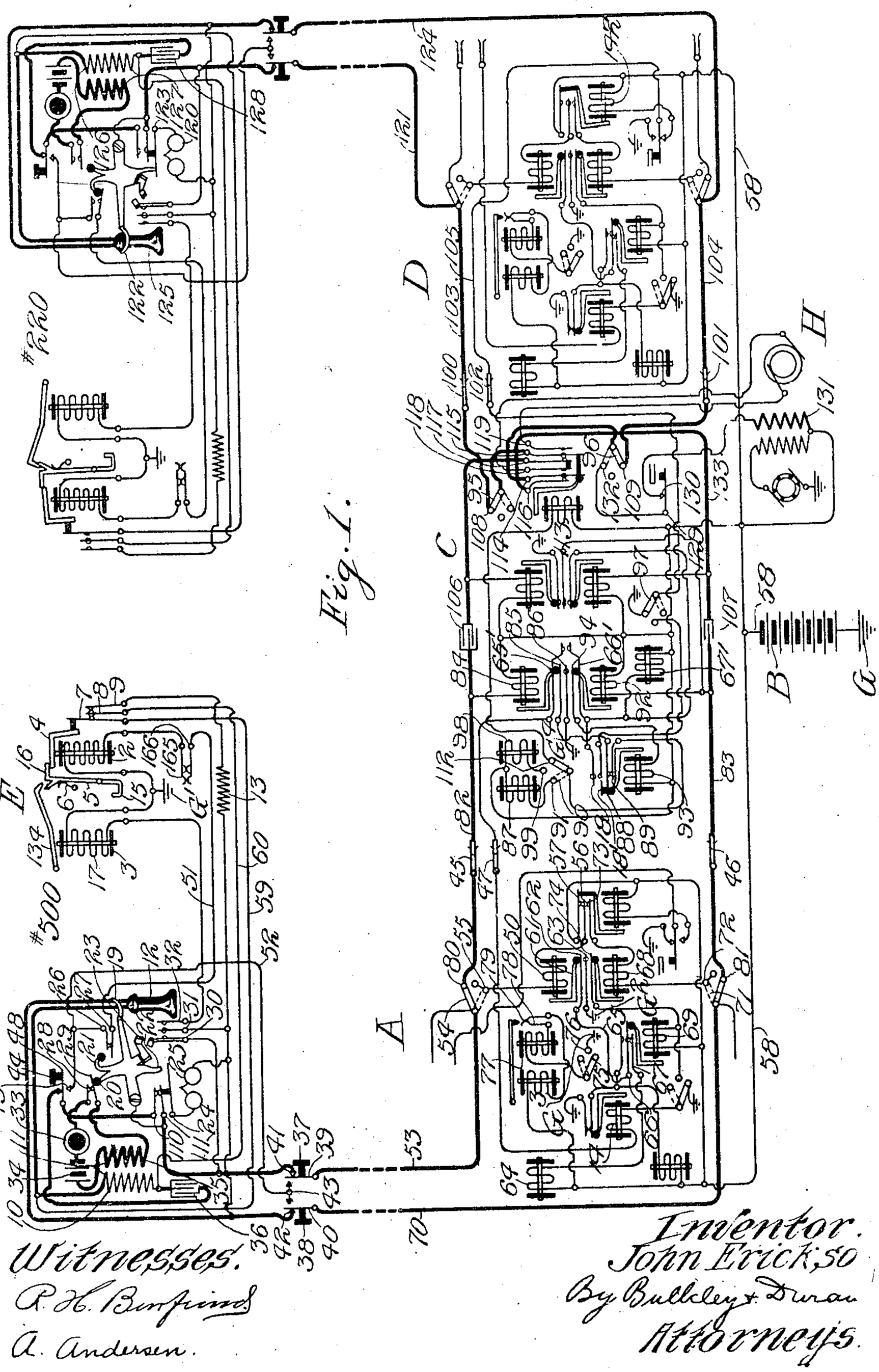

Fig. 1.

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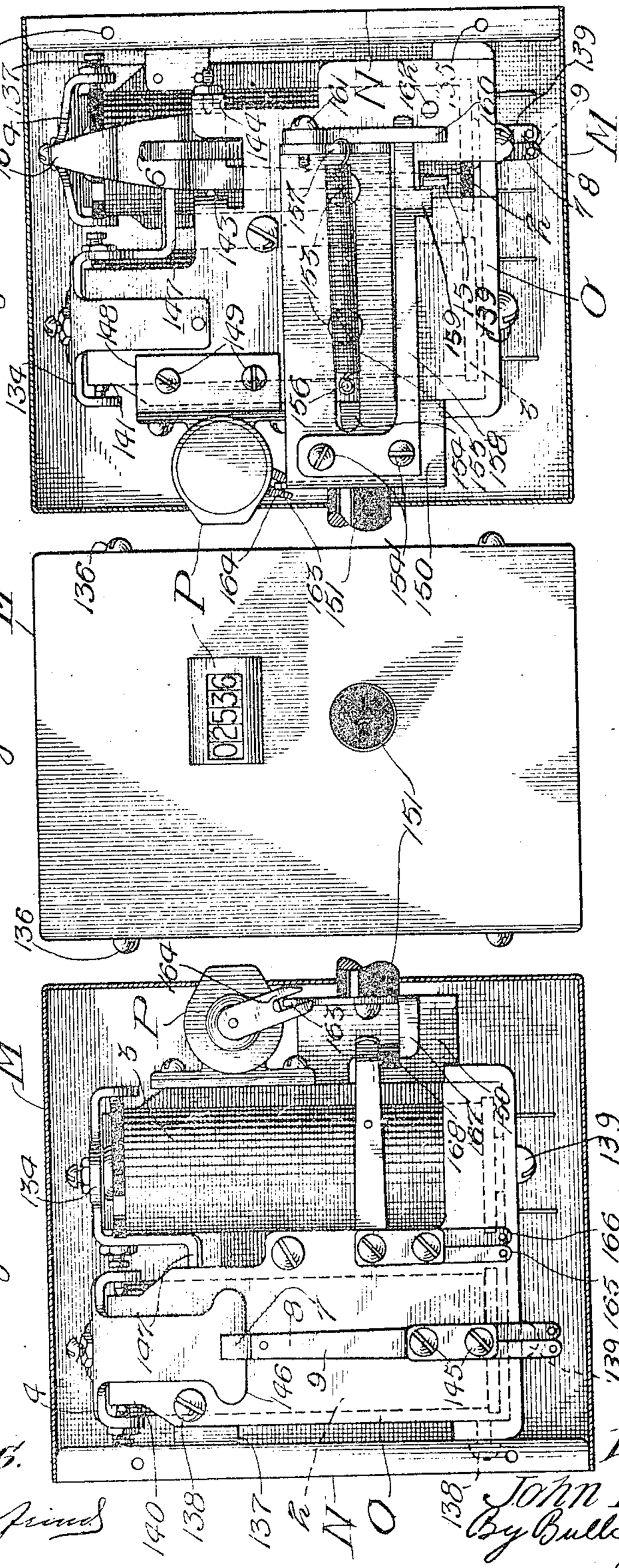
3 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

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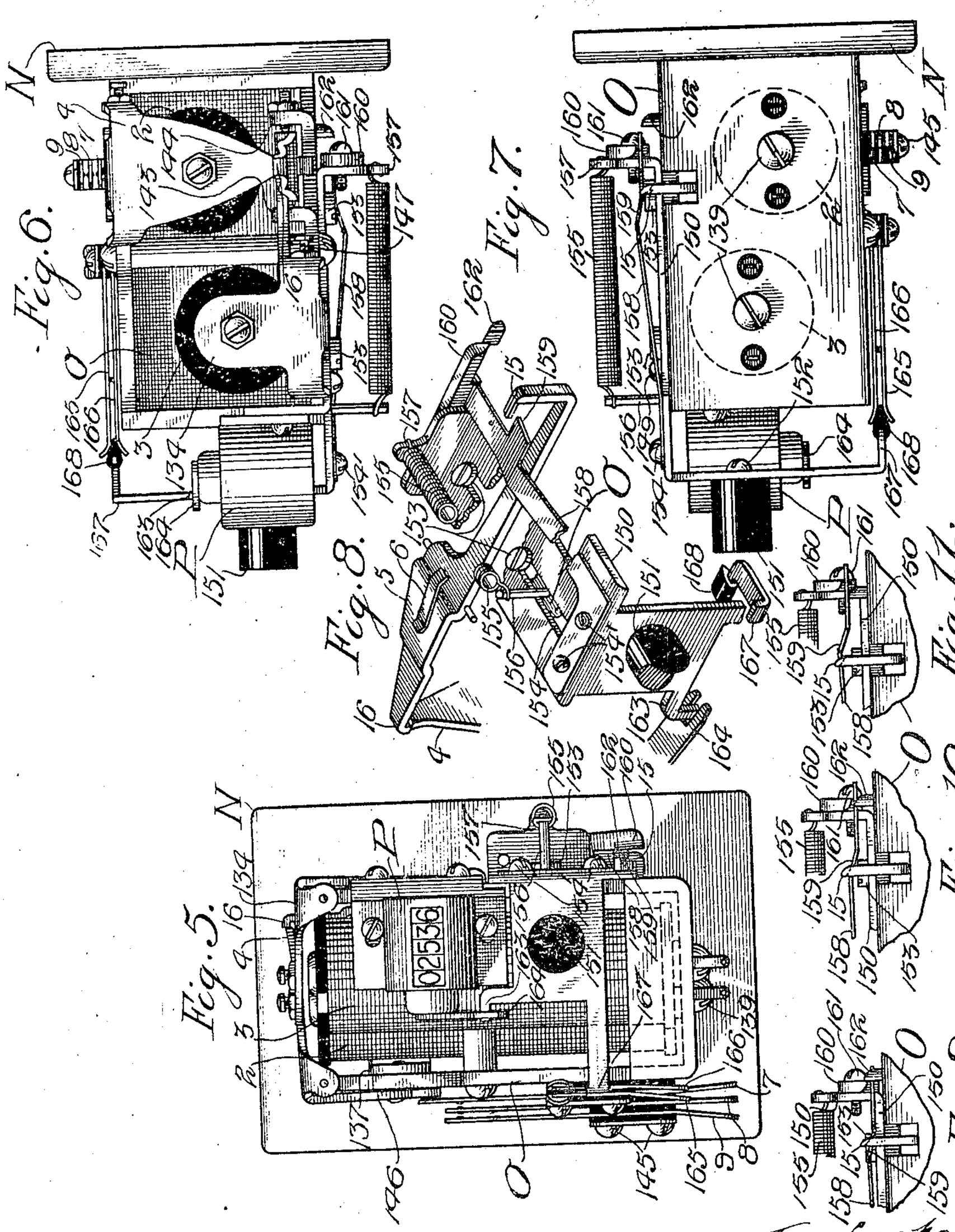

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UNITED STATES PATENT OFFICE.

JOHN ERICKSON, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AUTOMATIC ELECTRIC COMPANY, A CORPORATION OF ILLINOIS.

MEASURED-SERVICE TELEPHONE SYSTEM.

1,243,721. Specification of Letters Patent. Patented Oct. 23, 1917.

Application filed December 6, 1906. Serial No. 346,531.

To all whom it may concern:

Be it known that I, JOHN ERICKSON, 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 automatic telephone systems in general, but more particularly to toll systems, and is in the nature of an improvement on the toll system disclosed in my prior application Serial No. 343,042, filed November 12, 1906.

An object of my present invention is the provision of a metering or registering arrangement by which the toll-station telephone can be used without the necessity of depositing a coin, the call simply being registered and paid for afterward.

Another object is to provide an improved arrangement for enabling the calling subscriber to hear the called subscriber answer, without making it possible for the calling subscriber to use either his transmitter or receiver for talking with the called subscriber, except by making the proper payment for or registration of the successful call.

It is also an object of my invention to provide certain novel features and details and combinations tending to increase the general efficiency of a toll-station or measured service system.

To the foregoing and other useful ends, my invention consists in matters herein disclosed and claimed; and by the term "toll-station" I mean any telephone station which cannot be used for conversing with a called subscriber until after the calling subscriber has made either immediate payment for or registration of the successful call.

In the accompanying drawing, Figure 1 shows diagrammatically a calling substation and a called substation of any improved type connected through a central 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, granted March 13, 1906, to Keith, Erickson and Erickson. It will be noticed that the central battery B has its positive terminal preferably grounded. The operating relays of the central switches are normally connected to the non-grounded terminal of said battery, so that the subscriber, by grounding his line conductors, may operate the said switch, as is usually the custom in systems of the class in connection with which I have elected to illustrate my invention. In addition to the said first-selector there is shown at the central office a connector C of the general type described in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson. Another first-selector allotted to the called line is shown at D.

At the substation #500 the locking relay 2 and the releasing relay 3 of the call-register device E are shown. The armature 4 of the said locking relay is normally unlocked, as shown at substation #220, but when the relay 2 is energized said armature is attracted, as shown at the left in Fig. 1, and locked by the locking armature 5, which latter is pressed to the right by the spring 6. When the relay armature 4 is locked, the springs 7, 8 and 9 which it controls are forced together. The springs 7 and 8 when in contact short-circuit the secondary winding 10 of the induction-coil 11, and the closure of the springs 7, 8 and 9 shunts the receiver 12 through the resistance-coil. Being locked the armature 4 may be unlocked by pressing a plunger (not shown), which latter upon returning, by suitable means, presses the portion 15 of the locking armature or latch 5 to the right, driving the angled terminal 16 to the left, and permitting the armature 4 to resume its normal position, due to the tension of the spring 7. Said armature 4 may also be unlocked by the release magnet 3. The winding 17 is included in the subscriber's switch-release circuit, whereby the said release magnet 3 may be energized when the subscriber hangs up his receiver.

Fig. 2 is a left-hand view of the register, with a section of the cover cut away, showing the relative positions of the relays, armatures, etc.

Fig. 3 is a front view of the same, with the cover in place, showing the meter and plunger controlling the mechanism.

Fig. 4 is a right-hand view of the same, with a section of the cover cut away.

Fig. 5 is a front view of the meter, with the cover removed.

Fig. 6 is a plan view of the register.

Fig. 7 is a bottom view of the same.

Fig. 8 is a perspective of the locking latch and plunger mechanism.

Figs. 9, 10 and 11 show more clearly the locking latch 5 and the spring 158, which spring is the means whereby the armature 16 is unlocked when the subscriber registers.

The substations in the system may be of any suitable or approved type. The substation #500 (Fig. 1), for instance, is provided with the usual talking circuits and switch-hook controlling said circuits, and with calling and signaling devices. The switch-hook 19 is provided with a number of cam arms 20, 21, 22 and 23 for controlling local circuits. The cam arm 22 normally engages the ringer circuit spring 24, which circuit includes the ringer 25, said ringer being normally bridged across the subscriber's line. The cam arm 21 normally controls the ground springs 26 and 27 for putting the subscriber's calling device in connection with the ground terminal G of the battery B. When the switch-hook is up, the cam arm 20 also controls the local circuit springs 28 and 29. The release springs 30, 31 and 32 are controlled by the cam arm 23 for releasing the switching apparatus at the central office, as well as for energizing the release magnet 3 of the toll or measured service attachment. In the local circuit there are, of course, included the transmitter 33, the local battery 34 and primary winding 35 of the induction-coil 11. In the secondary circuit that comprises the receiver 12 and the secondary winding 10 there is included a condenser 36 for keeping the subscriber's line conductors normally open. The subscriber's calling device may be of any suitable type. I have represented said calling device as comprising a couple of push-buttons 37 and 38 and a couple of springs 39 and 40 that normally engage the contact points 41 and 42, respectively. Said springs 39 and 40 are adapted to be separated from their engaging contact points and thrust against a ground post 43. When the ground springs 26 and 27 close into contact, said ground post is connected with ground G′ through the winding of the coil 2. If the subscriber #500 wishes to make a call he proceeds as follows: If he desires to call the number 220 he removes his receiver from the switch-hook, and operates the vertical push-button 37 twice and the rotary push-button 38 once; again the first button is pressed twice and the second button once; for the last time the button 37 is pressed ten times and the button 38 once. By pressing the button 37 twice for the first digit of the desired number, the shaft (not shown) of the first-selector A is raised two steps and the switch-shaft wipers 45, 46 and 47 are raised to the second level of the line and private banks, respectively. The operation is as follows: When the spring 39 engages the ground post 43 an energizing circuit is established through the vertical line relay 50 of the first-selector A, and in series with the winding of the locking relay 2. The current in this circuit flows from ground G′ through the winding of said locking relay 2 to the conductor 51, and through the ground springs 27 and 26 to the conductor 52, through the ground post 43, spring 39 to the vertical line conductor 53, side switch wiper 54, contact point 55, vertical line relay 50, bridge-cut-off relay springs 56 and 57 to the battery lead 58, thence through battery B and to ground G. At the first impulse the locking magnet 2 is energized, together with the vertical line relay 50. Said locking magnet then attracts its armature 4 and permits the spring 6 to force the angled section 16 over the armature 4, thereby locking said magnet. It will be understood that the said angled section 16 normally rests against the left-hand rim of the armature 4, as shown at substation #220. As soon as the springs 7 and 8 are forced into contact, as previously stated, the secondary winding 10 of the induction-coil 11 is short-circuited or shunted. This short-circuit may be traced from the spring 7 to the conductor 59, thence to the secondary winding 10 and to the conductor 60, thence to the spring 8, which spring, as stated, is in engagement with the spring 7. Furthermore, the springs 8 and 9 being in contact, the coil 13 is shunted across the terminals of the receiver 12. This shunt may be traced from the spring 7 to the conductor 59 and to the receiver 12, thence from the other terminal of the said receiver to the coil 13 and the spring 9, thence through the spring 8 to the spring 7. Each time that the vertical line relay 50 is energized its armature 61 presses the line relay spring 62 onto the ground spring 63, as a result energizing the vertical magnet 64. The circuit through which the current for energizing said vertical magnet flows may be traced from ground G^2 through the springs 63 and 62 to the conductor 65, thence to the private springs 66 and 67, through the vertical magnet 64 to the battery lead 58, thence through battery B to ground G. Each time that the vertical magnet 64 is energized it operates to raise the shaft and shaft wipers one step. When a subscriber presses the spring 40 onto the ground post 43, the rotary line relay 68 of the first-selector A is energized. The said relay closes a circuit through the private magnet 69 as a result, and the latter then permits the side switch to pass from first to second position. The circuit that comprises the said rotary line relay 68 may be traced as follows: from ground G′ through the relay 2, conductor 51, springs 27 and 26, conductor 52 to the ground post 43, thence to the spring 40, rotary line con-

ductor 70, side switch wiper 71, contact point 72 to the rotary line relay 68, through the bridge-cut-off springs 73, 56 and 57 to the battery lead 58, thence through battery B to ground G. Having once been energized, the locking relay 2 at the registering device E is not further operated for the time being. The rotary line relay, however, upon attracting its armature presses the line relay spring 74 onto the ground spring 63 and closes an energizing circuit through the private magnet 69. The current for the said private magnet passes from ground G^2 through the springs 63 and 74 to the winding of the private magnet 69, thence to battery lead 58, and through battery B to ground G. The private magnet, upon energizing and deënergizing, allows the side switch wiper 75 to engage the contact point 76, thereby closing an energizing circuit through the rotary magnet 77. The current in this circuit passes from ground G^3 to the contact point 76, side switch wiper 75, through one winding of the magnet 77 to the interrupter springs 78 and 79, thence to the second winding of the rotary magnet, to the battery lead 58, thence through battery B and to ground G. When the rotary magnet 77 is energized, as described, the rotary armature operates to carry the shaft and shaft wipers in a circular direction. After the said magnet rotates the shaft one step, the side switch passes from second to third position, as is well known, providing there are no busy contacts to pass over. If the private wiper 47 meets a busy or grounded contact, the private magnet 69 is retained energized, and as a result the side switch is not permitted to pass to third position until the rotary magnet has carried the shaft and wiper over the last busy contact. If, as assumed, the shaft wipers are stopped on the first contact of the second level of the line bank, the subscriber's line conductors 53 and 70 will, when the side switch wipers 54 and 71 pass into engagement with the contact points 80 and 81, be extended to the connector C over the conductors 82 and 83. The second digit is called when the subscriber's line conductors have been extended to the connector C. The vertical button 37 is now pressed twice, carrying the spring 39 onto the ground post 43, and as a result energizing the vertical line relay 84 of the connector C. Current for energizing the said relay flows over the following path: from ground G′ to the relay 2, conductor 51, through the springs 27 and 26, conductor 52, through the ground post 43, spring 39, vertical line conductor 53, side switch wiper 54, contact point 80, shaft wiper 45, trunk conductor 82 to the vertical line relay 84, thence to battery lead 58, and through battery B to ground G. Each time that the vertical line relay is energized, the line relay springs 85 and 86 are pressed into contact, thereby closing an energizing circuit through the vertical magnet 87. This energizing circuit extends from ground G^4 through the springs 86 and 85, private magnet springs 88 and 89, side switch wiper 90, contact point 91, vertical magnet 87 to the battery lead 58, 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 a level in which are located the terminals of the line #220. When the rotary line conductor 70 is grounded, the rotary line relay 92 becomes energized through the following path: from ground G′ to the relay 2, conductor 51, through the springs 27 and 26, conductor 52, ground post 43, through the rotary line conductor 70, side switch wiper 71, contact point 81, shaft wiper 46, trunk conductor 83, through the winding of the rotary line relay 92 to the battery lead 58, thence through battery B and to ground G. The energizing of the said relay causes the energizing of the private magnet 93 over a circuit extending from ground G^4 through the springs 86 and 94, through the winding of the private magnet 93, thence to the battery lead 58, and through battery B to ground G. The energizing of the private magnet also releases the side switch and, therefore, moves the side switch wipers 95, 96, 97 and 90 to second position. The vertical line conductor 53 being grounded ten times for the last digit, the vertical line relay 84 becomes energized ten times over the same circuit previously traced; but when the springs 85 and 86 are placed into contact, the rotary magnet 98 instead of the vertical magnet 87 is energized, since the side switch wiper 90 is now in engagement with the contact point 99. The energizing circuit for the said rotary magnet is from ground G^4 through the springs 86 and 85 to the private magnet springs 88 and 89, side switch wiper 90, contact point 99, through the rotary magnet 98 to the battery lead 58, thence through battery B and to ground G. The rotary armature, being attracted ten times, rotates the shaft, carrying the shaft wipers 100, 101 and 102 into engagement with the tenth contact of the second level. The line wipers 100 and 101 are, therefore, placed in connection with the normal conductors 103 and 104, and the private wiper 102 in engagement with the private normal 105. The subscriber for the last time presses the rotary button 38 and grounds the rotary line conductor 70, thereby energizing the rotary line relay 92 over the circuit that has already been traced. The private magnet 93 is again energized once and the side switch is shifted into third position. As a result,

the subscriber's extended line conductors 82 and 83 are connected with the normal conductors 103 and 104, through the condensers 106 and 107, at the instant that the side switch wipers 95 and 96 engage with the contact points 108 and 109, respectively. The subscriber then presses his signaling button 44, thereby pressing the spring 48 onto the grounded contact point 49. An energizing circuit is established through the connector vertical line relay 84 from ground G′ through the coil 2, conductor 51, springs 27 and 26, contact point 49, spring 48, through the springs 110 and 111 to the vertical line conductor 53, thence to the trunk line conductor 82, to the vertical line relay 84, through the battery lead 58, thence through battery B to ground G. When the side switch passed to third position, the side switch wiper 90 passed into engagement with the contact point 112, and when the vertical line relay is energized and the springs 85 and 86 are pressed into contact, the ringer relay 113 is energized. The current for energizing the said relay flows from ground G^4 through the springs 86 and 85, private magnet springs 88 and 89, side switch wiper 90, contact point 112 to the ringer relay 113, thence to the battery lead 58, and through battery B to ground G. Said relay upon attracting its armature forces the springs 114 and 115 out of engagement with the springs 116 and 117 and into engagement with the springs 118 and 119. As a result the ringer generator H is bridged across the normal conductors 103 and 104, and the subscriber's bell 120 at the station #220 is then rung. The ringing current flows from the ringer generator H to the springs 119 and 115, to the side switch wiper 95, contact point 108, connector shaft wiper 100, normal conductor 103, line conductor 121, through the switch-hook 122, thence through the spring 123 to the ringer 120, through the rotary line conductor 124, rotary line normal conductor 104, connector shaft wiper 101, contact point 109 and side switch wiper 96, through the ringer relay springs 114 and 118, and back to the ringer generator H. The subscriber at the substation #220 upon hearing the signal removes his receiver 125 from the switch-hook 122, thereby disconnecting the bell 120 from across his line, and bridging instead his secondary talking circuit comprising the receiver 125 and the secondary winding 126 of the induction-coil 127 and the condenser 128. Since the meter apparatus at station #220 is in normal condition, the subscriber will find his telephone in condition for talking. Upon answering, he speaks into the transmitter and thereby induces a current in the secondary winding 126 which will pass to the line conductors 121 and 124. This current, by way of the heavy line conductor shown in Fig. 1, will reach the line conductors 53 and 70 of the calling substation. The current then passes from conductor 53 to the spring 39, contact point 41 to the springs 111 and 110, to the push-button spring 48, through the condenser 36, conductor 60, through the springs 8 and 7 to the conductor 59, thence through the receiver 12 to the contact point 42, through the spring 40 to the rotary line conductor 70. Although the coil 13 is shunted across the receiver 12 from the springs 8 and 9 to the contact point 42, it does not cut off all the current through the said receiver, so that the calling subscriber is able to hear the called subscriber when he answers; but he is absolutely unable to use his transmitter for talking, since said transmitter is short-circuited, as explained. The calling subscriber then presses a plunger or button, which latter operates to release the armature 4 from the locking latch or arm 5. The pressing of the plunger also causes the meter to register a call, as will be more fully explained. The springs 7, 8 and 9 at once separate, so that the subscriber's talking apparatus at the calling substation is restored and connected with the talking apparatus of the called substation. When the subscribers are through talking the calling subscriber restores his receiver 12 to his switch-hook, which latter upon descending causes the cam 23 to force the release springs 30, 31 and 32 into contact. As a result the vertical and rotary line conductors 53 and 70 are grounded simultaneously at ground G′. The circuit from the said ground to the vertical line conductor 53 passes through the winding 17 of the coil 3 to the release spring 32, thence through the springs 31 and 30 to the vertical line conductor 53, and from the release spring 31 the connection is established to the rotary line conductor 70. Both line conductors being grounded simultaneously, the switching apparatus is released in a well known manner—that is, when the line conductors become grounded simultaneously, the line relays 84 and 92 of the connector C are energized simultaneously, pressing the trunk-release springs 65′ and 66′ into contact. As a result an energizing circuit is established through the release magnet 67′ in series with the back-release relay 14 of the selector A. The connector shaft and side switch, as is well known, are restored, breaking the energizing circuit for the bridge-cut-off relay 142 of the first-selector D; and when the ground is removed from the line conductors all the magnets involved in the release are deënergized, after which there follows a full restoration of all the parts. Had the called subscriber been busy the connector C would not have established connection with the called line, but would have been released instead. The establishment of connection

would have been prevented by the grounded contact point which the private wiper 102 meets while the side switch wiper 97 is in second position. Therefore, the private magnet spring 18 of the connector is placed in connection with ground when the rotary line conductor 70 is grounded, and the private magnet 93 is energized, so that when the private springs 18 and 18′ close in contact, a release circuit is established through the release magnet 67′ by a flow of current from the private bank contact to the private wiper 102, thence to the side switch wiper 97 (in second position), to the private springs 18′ and 18 and to the release magnet 67′, thence to battery lead 58, and through battery B to ground G. As a result the connector switch-shaft and side switch are released and restored to normal position, and the connection with the connector bank contact is broken. Then when the signaling button 44 is pressed, as described, the vertical magnet 87 and not the ringer relay 113 is energized. As a result the switch-shaft is raised and the switch-shaft springs 129 and 130 are closed into contact, and the busy signaling current generated in the coil 131 is sent out over the line of the calling subscriber from the coil 131 through the springs 130 and 129 to the contact point 132, thence to the side switch wiper 96, ringer relay springs 114 and 116, conductor 133 to the rotary line condenser 107, first-selector rotary line wiper 46, contact point 81, side switch wiper 71, rotary line conductor 70, through the receiver 12 and coil 13 in multiple, as already described, to the vertical line conductor 53, thence to the side switch wiper 54, contact point 80, vertical line wiper 45, vertical trunk conductor 82 to the vertical line relay 84, thence to the battery lead 58 and to the coil 131. The calling subscriber upon hearing the busy signal, instead of pressing the plunger, as described, will hang up his receiver and establish a flow of current through the winding 17 of the coil 3, as already described, to the vertical and rotary line conductors 53 and 70, thence through the vertical and rotary line relays 84 and 92, over circuits that are already familiar, to the battery lead 58, and through battery B to ground G. Said magnet 3 upon being magnetized attracts its armature 134, which latter withdraws the latch 5 from the armature 4, permitting said armature to be restored, as already stated and for the object that has already been pointed out.

The meter or registering device, shown diagrammatically at E in Fig. 1, is constructed as follows: In general appearance the meter apparatus resembles a small box, the only parts exposed being the face of the meter and the button or plunger 151; and the operating mechanism is suitably inclosed in a case M, as clearly shown in Fig. 3. The instrument as a whole is adapted to be secured to any suitable support, since the mounting frame O is rigidly secured to the base N, and the mechanism operates successfully in any position. The said base N may be of any suitable material, with tap holes 135 for admitting the screws 136, which latter secure the case M to the base N. The bracket 137 of the said base is provided for retaining the frame O, upon which is mounted the circuit-controlling mechanism. The frame O is secured to the base N by the screws 138. The locking and releasing magnets 2 and 3 (Fig. 1) are set up within the said frame O and secured to the bottom of said frame by the screws 139 (Figs. 5 and 7). The armature 4 of the coil 2 is, as shown in Fig. 2, pivotally mounted upon the upright 140, and the armature 134 of the coil 3 is pivoted upon the section 141 (Fig. 4). There are two lugs 143 and 144 opposite the place allotted to the magnet 2, between which the latch 5 is pivotally mounted. The portion 15 of said latch is shown, in Figs. 4 and 7, projecting beyond the outer surface of the front wall of the frame O. Normally the armature 4 and latch 5 are in such positions with relation to each other that the end 16 rests upon the end of the armature 4 (Fig. 8); but there is a spring 6 which, if the armature 4 is attracted, carries the terminal 16 over the armature 4 and locks it in its attracted position. Near the base of the section 140 that supports the armature 4 there are fastened by the screws 145 the springs 7, 8 and 9, insulated from each other and from the frame O. This is clearly shown in Figs. 2 and 5. The said springs extend upwardly in front of the downwardly projecting angled section 146 of the armature 4. The spring 7 normally rests against the section 146 of the armature 4, and provides sufficient tension for retaining said armature in normal position. It will be seen that when the magnet 3 attracts its armature 134, after becoming energized, when the release springs 30, 31 and 32 come into contact, and when the subscriber restores his receiver for releasing the central office apparatus, the arm 147 then carries the locking arm or latch 5 out of engagement with the armature 4, and the said armature being unlocked returns to its normal position by reason of the tension of the spring 7, and permits the springs 7, 8 and 9 to disengage and restore the talking circuit of the substation. Were this last condition not the case, then when the subscriber released the switching apparatus the subscriber's talking circuit would be found locked in subsequently answering a call. The meter P (Fig. 4) is secured to the frame O by means of the bracket 148 and screws 149. The meter-operating mechanism, as clearly shown

in Figs. 7 and 8, consists of a sliding member 150 to which is secured the plunger push-button 151 by means of the screw 152. The piece 150 is adapted to be moved by the plunger 151 and is secured to the frame O by means of the screws 153 in the slot 154. The coil spring 155 is provided for restoring the piece 150 to its forward position after the plunger or button 151 has been pressed. One end of the said spring is retained upon the end of the post 156, which in turn is rigidly secured to the frame O. The other end is attached to the sliding member at the point 157, thus tending to at all times pull the piece 150 forward. The latch releasing spring 158, which is rigidly attached to the sliding member 150 by means of the screws 154′, is provided with the projecting cam 159, which latter, during the return motion of the sliding member 150, rides over the portion 15 of the latch 5 and unlocks the armature 4. The rear end of the spring 158 is in engagement with the arm 160, which latter is loosely mounted upon the screw 161 (Figs. 7 and 9), said screw being secured to the member 150. The relation of the spring projection 159 and the portion 15 may be more clearly understood upon referring to Figs. 9, 10 and 11. It will be obvious that the meter device should only be made to register after the locking relay 2 has been energized—that is, after the armature 4 has been caught by the locking member 16. Ordinarily—that is, before the subscriber sends an impulse to the line, and before he energizes the relay 2, if the plunger 151 is pressed the carriage 150 controlled thereby cannot perform its full stroke, in order to prevent the meter from registering should some one accidentally or improperly press the plunger 151 while the telephone is idle. The means by which the carriage 150 is prevented from performing a full stroke comprises a stop 162 (Fig. 8) and a latch 160, through a slot in which the spring 158 passes, as shown. If the locking arm 16 is in normal position—that is, if it is resting on end of the armature 4—the terminal 15 is so depressed that as the carriage advances, when the plunger 151 is pressed, the flange 159 of the spring 158 is depressed by the terminal 15, and as a result the latch 160 is lowered sufficiently to catch the stop 162, thus preventing the meter from registering. Of course, while the member 16 is over the armature 4 the portion 15 is high enough to admit the passage of the flange 159 of the spring 158 without lowering the latch 160 sufficiently to engage the stop 162. The operation is more clearly described as follows: In Fig. 9 the position of a section of the carriage mechanism is shown when the plunger has been pressed and while the angled terminal 16 of the locking latch 5 is resting on the end of the armature 4, as shown at substation #220 and in Fig. 8. Under these conditions, when the plunger 151 is pressed the carriage 150 is carried forward and the projecting section 159, which is oblique to the portion 15, on its forward stroke comes into contact with the portion 15; and as a result, since the portion 15 is now depressed, the spring 158 is pressed downwardly, whereby the arm 160 is also depressed, engaging in its forward movement the stop 162. That is, by the time the carriage 150 reaches the position shown in Fig. 9, the spring 158 is sufficiently depressed to carry the arm 160 into engagement with the stop or lug 162, thus preventing a further advance of the said carriage. The stroke thus imparted to said carriage 150 is not of sufficient length to permit the cam arm 163 (Fig. 8) to operate the meter, which latter the said arm 163 controls through the medium of the arm 164. When the plunger 151 is released the carriage 150 is restored to normal position by the retracting spring 155. In Fig. 10 the arm 160 is shown as having cleared the stop 162. In this instance the relay 2 is energized, as shown at E in Fig. 1, and the latch 5 is over the armature 4, so that the portion 15 is farther off than in the last instance; therefore, the spring 158 cannot be depressed as much as in Fig. 9, and consequently the latch 160 does not meet the stop 162 as the carriage advances, so that the carriage 150 can make a full stroke, as shown in Fig. 11. On the return of the carriage 150 the cam 159, having passed from beneath the portion 15, then passes above the same, and presses the portion 15 downwardly, which releases the armature 4 from the terminal 16. As shown in Fig. 11, when the spring 158 reaches the limit of its stroke, the cam 159 passes from beneath the member 15 and on the return motion the cam, being oblique, passes above the member 15. The armature resumes its normal position and the springs 7, 8 and 9 disengage, which restores the talking circuit, as previously described. The springs 165 and 166 are provided in order that only one call may be made for each operation of the meter. For example, and referring to Fig. 11, suppose when the sliding member 150 carries the spring cam 159 in contact with the portion 15 on the return stroke and releases the armature 4, that the plunger is held, thereby retaining the armature 4 in a released position. Under these conditions a second call could be made, and the relay 4 would not operate to close the springs 7, 8 and 9 in contact, which springs interfere with the talking circuit as explained; but to meet this emergency the springs 165 and 166 are provided, and when the plunger 151 is pressed, the arm 167 carries the bushing 168 between the springs 166 and 165, thereby breaking the contact thereof, which cuts off

the ground from the substation. This will be more clearly understood by referring to Fig. 1. When the springs 165 and 166 are disengaged the ground post 43 is without ground connection, and the operation of the calling buttons 37 and 38, as previously explained, will be without effect upon the central station apparatus, and it will be necessary for the plunger and sliding member 150 to complete the return stroke before the substation can be operated successfully.

The windings of the magnets 2 and 3 may be of any suitable resistance; but with a central battery of fifty volts good results are obtained when the magnets 2 and 3 are each wound to a resistance of thirty ohms. The resistance-coil 13 may be wound to a resistance of forty-five ohms.

Thus it will be seen that the calling subscriber cannot talk with the called subscriber until the call has been registered by the operation of the metering device. The toll-station apparatus is always reset for further use by the hanging up of the telephone.

Obviously, the use of the push-button 151 for signaling purposes is contingent on first using the calling mechanism, and use of the telephone is contingent on first using or properly operating both the calling mechanism and the call-registering device.

Selectors and connectors, such as illustrated, can be arranged or employed on a percentage basis, so that the switches will be less in number than the subscribers—that is, if first-selectors are employed as individual switches, then the connectors and intermediate selectors, if any, can be employed on a percentage basis; and if individual switches are interposed between the subscribers and the first-selectors, then the latter can also be arranged on a percentage basis; all in accordance with well-known practice, and so as to afford automatic trunking between subscribers' lines.

What I claim as my invention is:—

1. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a telephone, electromagnetically controlled means for rendering the telephone inoperative for talking, when the calling mechanism is used, by means of a shunt circuit about said telephone, and a call-meter having a push button for restoring the telephone to operative condition.

2. A toll-station apparatus for automatic telephone exchange systems having subscribers' telephones, calling devices and switches controlled by the latter, comprising electromagnetically controlled means for rendering a telephone inoperative for talking, when the associated calling device is used, by means of a shunt circuit about said telephone, a push-button, means operated by the push-button for restoring the telephone to operative condition, and registering mechanism operated by the push-button.

3. In a telephone exchange system, the combination of automatic switches, a calling mechanism for controlling said switches, a call-registering device the operation of which by the calling subscriber is contingent on first using the said mechanism, means for locking said meter when operated, and electromagnetic means for unlocking the same.

4. In a telephone exchange system, the combination of a lock-out magnet, an armature therefor, means for locking said armature, a push-button for restoring said locking means and armature by the back stroke of said button, a call-registering mechanism operated by said button, a calling mechanism for making the call-registering mechanism operative, a telephone, and devices by which use of the telephone is prevented until after the use of the calling mechanism and call-registering device.

5. In a telephone exchange system including subscribers' lines, the combination of switches, a calling mechanism for controlling said switches, a telephone, electromagnetically controlled means for rendering the telephone inoperative for talking by short-circuiting the same when the calling mechanism is used, and a call-meter having a push button for restoring the telephone to operative condition, said system including trunk lines and automatic switches for extending connection from a calling to a called line.

6. In a telephone exchange system including subscribers' lines, the combination of a lock-out magnet, an armature therefor, means for locking said armature, a push-button for restoring said locking means and armature by the back stroke of said button, a call-registering mechanism operated by said button, a calling mechanism for making the call-registering mechanism operative, a telephone, and devices by which use of the telephone is prevented until after the use of the calling mechanism and call-registering device, said system including trunk lines and automatic switches for extending connection from a calling to a called line, having one motion to select a group and another motion at right-angles to the first motion to find the called line in the predetermined group.

7. In a telephone exchange system including subscribers' lines, the combination of a lock-out magnet, an armature therefor, means for locking said armature, a push-button for restoring said locking means and armature by the back stroke of said button, a call-registering mechanism operated by said button, a calling mechanism for making the call-registering mechanism opera-

tive, a telephone, and devices by which use of the telephone is prevented until after the use of the calling mechanism and call-registering device, said system including trunk lines and automatic switches for extending connection from a calling to a called line, having one motion to select a group and another motion at right-angles to the first motion to automatically select an idle trunk in the predetermined group.

8. In combination with the call-effecting device of an automatic telephone, a register for the outgoing calls comprising a set of registering-disks, electromagnetically controlled mechanism controllably connected with the call-effecting device whereby the circuits of the telephone are affected upon the operation of the said call-effecting device, and means whereby the registry-disks are operated and the circuit-affecting mechanism released from said call-effecting device and the circuits restored.

9. In combination with the call-effecting device of an automatic telephone, a register for outgoing calls comprising registry-disks, means adapted to be operated by the call-effecting device, electromagnetically controlled mechanism intermediate of said means and the registry-disks whereby the receiver and transmitter circuits may be affected at a predetermined point, and means controllingly connected with the registry-disks and the circuit-affecting mechanism whereby the former are operated and the latter released from contact with the receiver and transmitter circuits.

10. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a telephone, electromagetically controlled means for placing a short-circuit about said telephone to thereby render it inoperative for talking when the calling mechanism is used, and a call meter for restoring the telephone to operative condition when the calling subscriber hangs up his receiver.

11. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a transmitter and a receiver, electromagnetically controlled means for placing shunt circuits about said transmitter and receiver when the calling mechanism is used, and a call meter for restoring the telephone to operative condition when the calling subscriber hangs up his receiver.

12. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a telephone, electromagnetically controlled means for rendering the telephone inoperative for talking when the calling mechanism is used, and a call meter having a push button for directly controlling means for restoring the telephone to operative condition.

13. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a telephone, a short-circuit about the telephone for rendering the telephone inoperative for talking when the calling mechanism is used, and a call meter having a push button for directly controlling means for restoring the telephone to operative condition, together with electromagnetic means for also controlling said last means.

14. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a telephone, a short-circuit about the telephone for rendering the telephone inoperative for talking when the calling mechanism is used, a relay for controlling said short-circuit, and a call meter having electromagnetically controlled means for directly controlling means for restoring the telephone to operative condition when the calling subscriber hangs up his receiver.

15. In a telephone exchange system, the combination of switches, a calling mechanism for controlling said switches, a call registering device, and electromagnetically controlled means for rendering said call registering device inoperative until after the first operation of said calling device.

16. In a substation telephone, a switch-hook, a conversation meter and a press-button therefor, a rotary circuit-changing automatic call-sending device, means locking said press-button except after operation of said call-sending device and while said switch-hook is elevated, and electromagnetic means for unlocking said button.

17. In a substation telephone, automatic impulse-governing means for sending a call, means for recording a call, locking means for said call recording means, and electromagnetically controlled means associated with said call sending means for unlocking said call recording means.

18. In a telephone system, a telephone, a calling mechanism for said telephone, electromagnetically controlled means for rendering said telephone inoperative for talking when said calling mechanism is used, by means of a shunt circuit about said telephone, and a call meter for restoring said telephone to operative condition when the subscriber hangs up his receiver.

19. In a telephone system, subscribers' telephones, calling devices and switches controlled thereby, register mechanism comprising electromagnetically controlled means for rendering a telephone inoperative for talking when the associated calling device is used, by means of a shunt circuit about said telephone, and electromagnetic means for restoring said telephone to operative condition when the subscriber hangs up his receiver.

20. In a telephone system, automatic switches, a calling mechanism for controlling said switches, a call registering device the operation of which by the calling subscriber is contingent upon first using said mechanism means for locking said device when operated, and electromagnetic means for unlocking said device when the calling subscriber hangs up his receiver.

21. In a telephone system, a lockout magnet, an armature therefor, means for locking said armature, a push button for restoring said locking means and said armature, a call registering mechanism operated by said button, a calling mechanism for making said call registering mechanism operative, a telephone, and additional electromagnetically controlled means for unlocking said armature, said last means controlled by said telephone.

Signed by me at Chicago, Cook county, Illinois, this 30th day of November, 1906.

JOHN ERICKSON.

Witnesses:

EDWARD D. FALES,

BERNARD D. WILLIS.