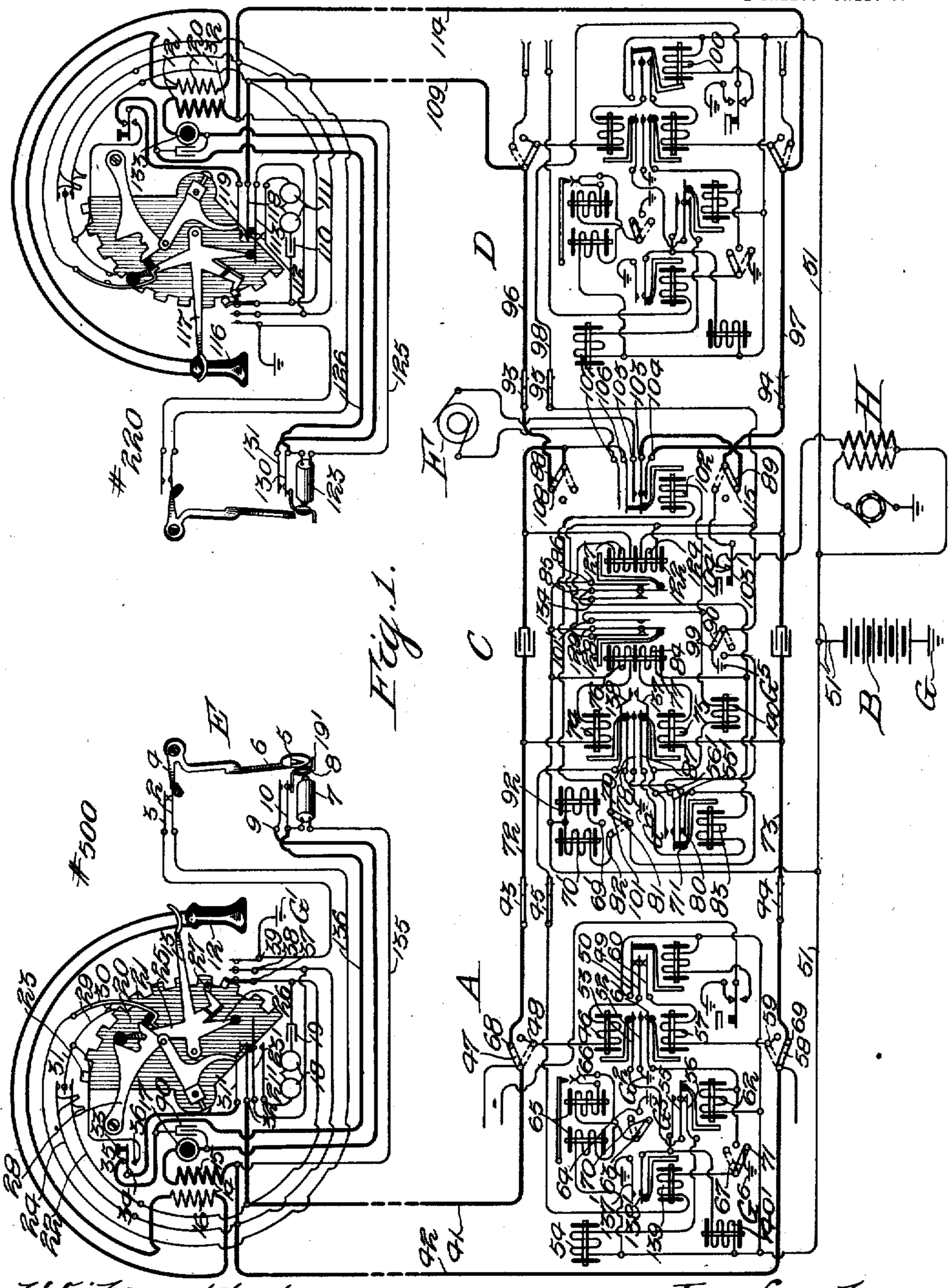
R. C. GIFFORD.

MEASURED SERVICE TELEPHONE SYSTEM.

APPLICATION FILED NOV. 14, 1906. RENEWED MAR. 1, 1918.

1,281,251. Patented Oct. 8, 1918.

2 SHEETS—SHEET 1.



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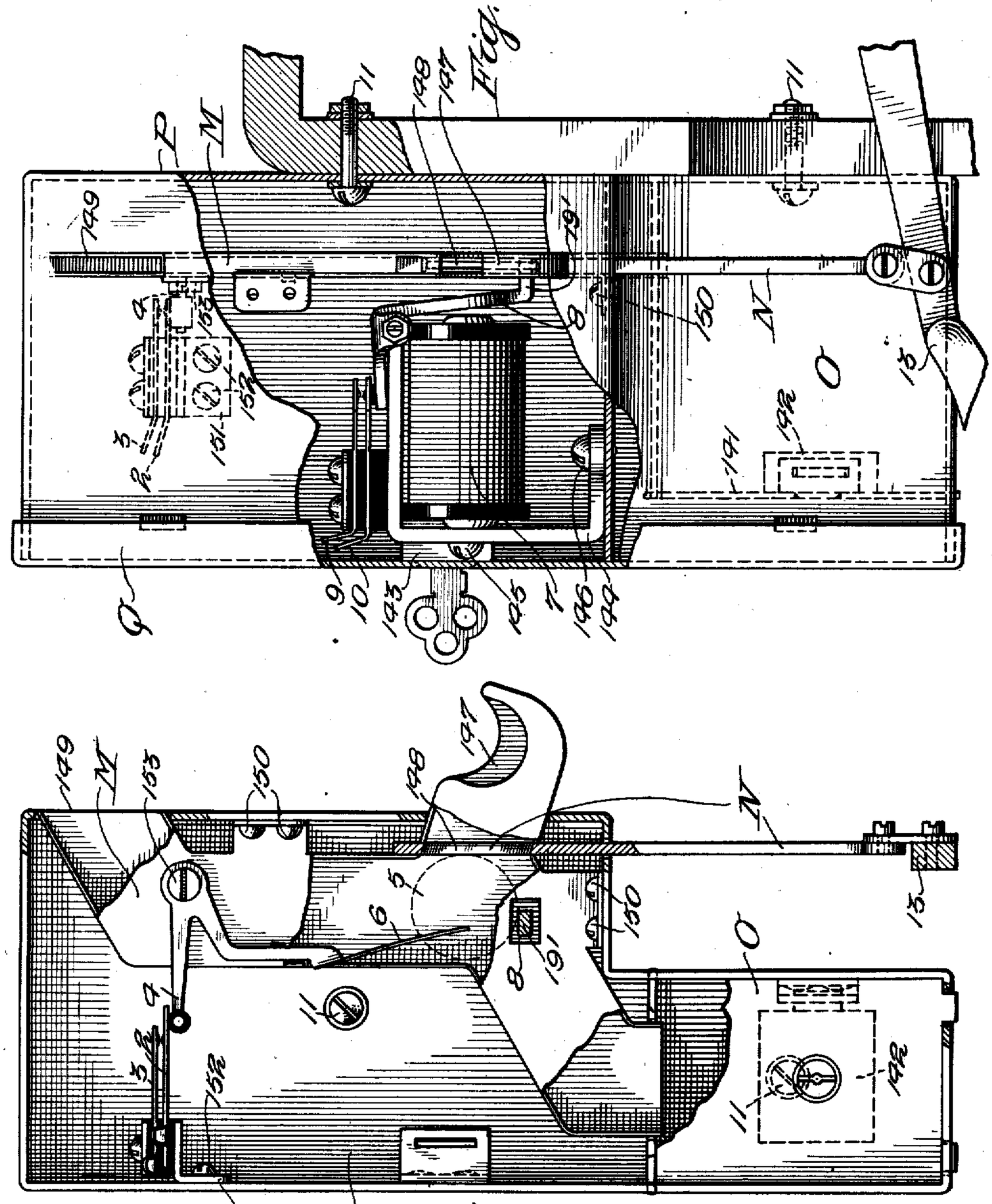

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UNITED STATES PATENT OFFICE.

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MEASURED-SERVICE TELEPHONE SYSTEM.

1,281,251. Specification of Letters Patent. Patented Oct. 8, 1918.

Application filed November 14, 1906, Serial No. 343,397. Renewed March 1, 1918. Serial No. 219,867.

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 contemplates improvements on automatic telephone exchange systems of the general character disclosed in application No. 343,042, filed Nov. 12, 1906, by J. Erickson; and in some respects my present invention is an improvement on the system disclosed in my prior application No. 343,396, filed Nov. 14, 1906.

Objects of my invention are to provide a highly efficient automatic common battery pay-station telephone exchange system; to provide means by which the pay-station of any calling subscriber is under the control of the called substation, so that toll is collected or assessed by the answering subscriber; and to provide certain novel features and details of construction and combinations tending to increase the general efficiency of a system of this particular character.

To the foregoing and other useful ends, my invention consists in matters herein disclosed and claimed; and by the term "pay-station" I mean one at which the telephone cannot be used without depositing a coin or paying toll in some other known or suitable way.

In the accompanying drawings, Figure 1 shows diagrammatically a called substation and a calling substation, of my improved type, connected through the medium of switches at a central office. 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, granted March 13, 1906 to Keith, Erickson and Erickson. It will be noted that the central battery B preferably has its positive terminal 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 switches, 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 any suitable connector C, for example of the general type described in United States Patent No. 815,176, granted March 13, 1906, to Keith, Erickson & Erickson, and of the common battery type described in application No. 294,663, filed January 4, 1906, by T. G. Martin. The first-selector D, similar to the selector A, is allotted to the called line. Substation #500 is shown temporarily connected with the substation #220, which latter is shown in normal condition. When the subscriber at substation #220 removes the receiver to answer, both the calling and called substations are then provided with battery current for talking purposes.

The coin-collecting device comprised in my invention may be considered as an attachment with suitable terminals which may be electrically connected with the circuits of the telephone proper, as diagrammatically shown at E. At the substation #500 the ground-controlling springs 2 and 3 are shown pressed into engagement by the arm 4. This operation takes place when the coin 5 comes into contact with the arm 6. The normal position of the said springs is shown at substation #220. A circuit-controlling relay 7 is shown at substation #500 with its armature 8 in normal position, said relay becoming energized when the called subscriber removes his receiver from the switch-hook. The latter thus closes a circuit at his telephone which supplies the called substation with talking battery current, and as a subsequent result the calling line is also supplied with talking battery current. The relay 7 upon energization attracts its armature 8, which closes in contact with springs 9 and 10, thereby completing the talking circuit at the substation #500.

Fig. 2 is a side view of the coin-collecting device, showing the coin-trough and the ground springs 2 and 3.

Fig. 3 is a front view of the same, showing the circuit-controlling relay 7 and the tip of its armature 8 obstructing the coin-trough or chute. The coin-collecting device is suitably secured to the telephone box by the bolts 11.

The pay-station attachment, as shown in the drawings, may be used in connection with a substation of any suitable or approved

type, for example, of the general type described in United States patent application No. 278,901, filed Sept. 18, 1905, by Keith, Erickson and Erickson. The substation #500 comprises, for instance, a receiver 12, switch-hook 13, induction-coil 14 which consists of the primary winding 15 and secondary winding 16, transmitter 17, ringer 18 and condenser 19. In addition to the above-mentioned parts there is provided an impulse wheel 20 which has the usual vertical impulse teeth 21 that are adapted to operate the vertical impulse spring 22. The impulse wheel also carries the rotary impulse tooth 23 which operates the rotary impulse spring 24. The said impulse wheel is, of course, rigidly secured to the dial shaft. The switch-hook has radiating from its body a number of cam arms 25, 26 and 27 and is pivotally secured to the keyboard, not shown. The cam arm 25 controls the so-called locking cam 28. When the coöperating ground springs 29 and 30 engage, the ground post 31 is then connected to the substation ground G', providing the ground-controlling springs 2 and 3 are in contact. When the switch-hook is down the cam arm 26 maintains the springs 21' and 23' in contact, thereby bridging the ringer 18 in series with the condenser 19 across the line. The springs 31' and 32 are then disengaged, and the primary circuit including the primary winding 15 and transmitter 17 is interrupted. The signaling device whereby a subscriber may signal another after connection has been established comprises a push-button 33 and a spring 34 which normally engages the contact point 35; but when the button 33 is pressed the spring 34 leaves the contact point 35 and engages the contact point 36 which is connected with the substation ground G'. Means whereby the subscriber may release the central station apparatus brought into service comprises three springs 37, 38 and 39, known as the release springs, and so controlled by the cam arm 27 that when the switch-hook descends the three release springs are brought into contact, thereby grounding both of the subscriber's line conductors simultaneously. Furthermore, the substation is provided with the condenser 40 so connected that the primary circuit is completed through the said condenser when the springs 9 and 10 are not in engagement. This is provided in order that the calling subscriber may hear the busy signal, even through the relay 7 has not operated and closed the primary circuit through the springs 9 and 10.

If the subscriber at substation #500, for example, wishes to call the subscriber at substation #220, he first removes the receiver 12 from the switch-hook 13 and then deposits a suitable coin in the slot, which coin comes to rest upon the tip 19' of the armature 8. When in this position said coin bears against the arm 6, which in turn imparts an upward motion to the arm 4, thereby closing in contact the springs 2 and 3, and thus placing the substation ground G' in connection with the ground spring 30 through the ground post 31. The calling subscriber suitably operates the dial for the first digit 2. On the return motion of the dial the vertical impulse spring 22 and the rotary impulse spring 24 come into contact with the ground post 31, in the order named, grounding the vertical and rotary line conductors 41 and 42, respectively, the former twice and the latter once. Likewise, when the second digit 2 and the last digit 0 are called, the line conductors are grounded correspondingly a proper number of times. After the first digit is called the first-selector shaft wipers 43, 44 and 45 are raised to the second level of the line and private banks, as follows: When the spring 22 engages the ground post 31 an energizing circuit is established through the vertical relay 46 of the first-selector A. The current in this circuit flows from ground G' through the springs 3 and 2, springs 30 and 29 to the ground post 31, thence to the vertical impulse spring 22, vertical line conductor 41, side switch wiper 47, contact point 48, vertical line relay 46, through the bridge-cut-off springs 49 and 50 to the battery lead 51, thence through battery B and to ground G. Each time the vertical line relay 46 is energized the springs 52 and 53 are pressed into engagement and an energizing circuit is established each time through the vertical magnet 54. The circuit through the said magnet extends from ground G^2 to the springs 52 and 53, private magnet springs 55 and 56, vertical magnet 54 to the battery lead 51, thence through battery B and to ground G. The vertical magnet being operated twice the first-selector switch-shaft wipers 43, 44 and 45 are carried opposite the first contact of the second bank level that comprises the contact points which constitute the terminals of the trunk lines leading to the connector C. Following the vertical impulses the rotary impulse spring 24 comes into contact with the ground post 31, thereby grounding the rotary line conductor 42 once and energizing the rotary line relay 57 of the first-selector once. The path of the energizing circuit may be traced as follows: From the substation ground G' through the springs 3 and 2 to the springs 30 and 29, to the ground post 31, rotary impulse spring 24, rotary line conductor 42, side switch wiper 58, contact point 59, rotary line relay 57, bridge-cut-off springs 60, 49 and 50 to the battery lead 51, thence through battery B and to ground G. The rotary line relay 57 upon energizing closes in contact the springs 61 and 52, thereby closing an energizing circuit through the private magnet

62 which extends from ground G² through the springs 52 and 61, private magnet 62 to the battery lead 51, thence through battery B and to ground G. The private magnet 62 being energized for a moment, the side switch of the first-selector A passes from first to second position, thereby permitting the side switch wiper 63 to engage the contact point 64, thus closing a circuit through the rotary magnet 65. The current-flow is from ground G³ to the contact point 64, side switch wiper 63, through the first coil of the rotary magnet to the interrupter springs 66, thence through the second coil of the rotary magnet to the battery lead 51, and through battery B to ground G. The rotary magnet is energized one step and the shaft wipers 43, 44 and 45 are carried into engagement with the bank contacts that constitute the terminals leading to the connector switch C, assuming that the trunk leading to the said connector leads off to the first set of contacts of the second level. But if the first trunk line is busy the first private bank contact is grounded in the well known maner, and an energizing circuit is established through the private magnet 62 when the private wiper 45 strikes the grounded private bank contact, thereby retaining the side switch in second position and thus maintaining the energizing circuit through the rotary magnet 65. The rotary magnet, by continuing to rotate the wipers, breaks the energizing circuit of the private magnet as soon as an idle line is found, and as soon as the private magnet is deënergized the side switch is tripped into third position; but if there are no busy contacts to be passed over, as assumed in the first instance, the rotary magnet 65, as is well known, trips the side switch to third position, with the result that the side switch wipers 47, 58, 63 and 67 engage the respective contact points 68, 69, 70 and 71, thus extending the subscriber's line conductors 41 and 42 to the connector C. Also, since the side switch wiper 67 engages the grounded contact point 71, a guarding potential is established at the private wiper 45 for protecting the seized trunk line from being molested by any other switch. The second digit is called after the subscriber has established connection with the connector C by way of the trunk conductors 72 and 73. The subscriber also rotates the dial for the second digit 2, thereby grounding the vertical and rotary line conductors 41 and 42, which causes the energization of the connector vertical and rotary line relays 74 and 75. The current for energizing the vertical relay 74 flows over the following path: From ground G′ through the springs 3 and 2 to the vertical impulse spring 22, vertical line conductor 41, side switch wiper 47, first-selector shaft wiper 43, conductor 72 to the vertical line relay 74, through the winding 76 of the differential relay 77 to the battery lead 51, and through battery B to ground G. Of course, the relay 77 becomes energized, since the winding 76 is in series with the winding 74; but the energization of the said differential relay at this time is without effect. Each time the vertical relay 74 is energized the line relay springs 78 and 79 are pressed into contact, thereby closing an energizing circuit through the vertical magnet 70′ over the following path: From ground G⁴ to the springs 79 and 78, private magnet springs 71′ and 80, side switch wiper 81, contact point 82, vertical magnet 70′ to the battery lead 51, thence through battery B and to ground G. The vertical magnet, thus energized, operates to raise the shaft and shaft wipers one step at a time until the said wipers are carried two steps to the bank level in which are located the terminals of the line #220. When the rotary line conductor 42 is grounded the rotary line relay 75 becomes energized through the following path: From ground G′ to the springs 3 and 2, ground post 31, rotary impulse spring 24, rotary line conductor 42, side switch wiper 58, shaft wiper 44, trunk conductor 73, rotary line relay 75, winding 84 of the differential relay 77, springs 85 and 86 to the battery lead 51, thence through battery B and to ground G. Since the winding 84 of the differential relay 77 is in series with the rotary line relay 75, the differential relay 77 becomes operative, but at this stage it is without effect. The energization of the rotary line relay 75 causes the energization of the private magnet 83 over a circuit extending from ground G⁴ through the springs 79 and 87 to the private magnet 83, springs 85 and 86 to the battery lead 51, thence through battery B to ground G; and the release of the side switch from first to second position, thus placing the wipers 88, 89, 90 and 91 in connection with their respective contact points in second position. The last digit being naught the subscriber operates the dial, as previously described, grounding the vertical line conductor 41 ten times and the rotary line conductor 42 once. The vertical and rotary line relays 74 and 75 are operated over previously traced circuits. However, when the line relay springs 78 and 79 engage, a circuit is closed through the rotary magnet 92 instead of through the vertical magnet 70′. The energizing circuit extends from ground G⁴ through the springs 79 and 78, private magnet springs 71′ and 80, side switch wiper 81, contact point 69′, rotary magnet 92 to the battery lead 51, thence through battery B and to ground G. Each time that the rotary magnet is energized it operates to rotate the shaft and shaft wipers 93, 94 and 95 one step at a time until the said wipers are carried into engagement with the normal conductors 96, 97 and

98, the first two of which lead to the line terminals of the desired subscriber. The energization of the rotary line relay 75, as previously stated, completes an energizing circuit through the private magnet 83, which now operates with one of two results—either the release of the side switch from second to third position, or the so-called busy release of the connector, which is brought about in the well-known manner. Suppose the former result to occur and the side switch to pass to third position, thus placing the side switch wipers 88, 89, 90 and 81 in contact with their respective contact points in 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, contact point 99 to the side switch wiper 90, switch shaft wiper 95, which engages the private contact of the called line. The said guarding potential also closes an energizing circuit through the bridge-cut-off relay 100 of the first-selector D, thereby removing the bridge formed by the vertical and rotary line relays of the said selector D. To signal the called subscriber the calling subscriber presses the signaling button 33, placing the spring 34 in contact with the substation ground, thereby energizing the vertical line relay 74. The path of the energizing circuit extends from ground G′ through the springs 3 and 2, springs 30 and 29, contact point 36, spring 34, springs 31′ and 32 to the vertical line conductor 41, through the relay 74, winding 76 of the differential relay 77 to the battery lead 51, 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 81 is in engagement with the contact point 101, thereby placing the vertical line relay 74 in control of the ringer relay 102 in the same manner in which the rotary magnet 92 came under the control of the vertical line relay when the side switch passed from first to second position. Therefore, when the vertical line relay 74 presses the springs 78 and 79 into contact the ringer relay 102 is energized by a flow of current from ground G^4 through the springs 79 and 78, private magnet springs 71′ and 80, side switch wiper 81, contact point 101, ringer relay 102, springs 101′ and 129 (bearing in mind that the differential relay 77 is energized) to the battery lead 51, thence through battery B and to ground G. The ringer relay upon energizing shifts the spring 103 from the spring 104 to the spring 105, and the spring 106 is shifted to engage with the spring 107. This results in bridging across the called subscriber's line the terminals of the ringer generator F. A signaling current is, therefore, sent from the generator F to the ringer relay springs 107 and 106, side switch wiper 88, contact point 108, shaft wiper 93, normal conductor 96, vertical line conductor 109, condenser 110, ringer 111, springs 112 and 113 to the rotary line conductor 114, rotary normal conductor 97, shaft wiper 94, contact point 115, side switch wiper 89, ringer relay springs 103 and 105 back to the generator F. As soon as the calling subscriber ceases to press the signaling button 33 the ringer relay 102 becomes deënergized and the springs 103 and 106 resume their normal position. The subscriber at substation #220, in response to the signal, removes the receiver 116 from the switch-hook 117, which allows the springs 118 and 119 to engage and the springs 112 and 113 to disengage, thereby removing the ringer 111 from across his line. The engagement of the springs 119 and 118 closes a series energizing circuit through both windings of the relay 122 at the connector C and the relay 123 at substation #220, extending from ground G^5 to the contact point 99, side switch wiper 90, winding 124 of the relay 122, through the ringer springs 104 and 103, side switch wiper 89, contact point 115, shaft wiper 94, rotary line conductor 114, conductor 125, through the relay 123, conductor 126 through the signaling device of the called substation, through the springs 119 and 118, vertical line conductor 109, shaft wiper 93, contact point 108, through the winding 127 of the relay 122, springs 128 and 129 to the battery lead 51, thence through battery B and to ground G. The energizing of the relay 123 causes its armature to close in contact the springs 130 and 131, whereby the primary talking circuit is completed from the rotary line conductor 114, through the primary winding 132 of the induction-coil 121, transmitter 133, springs 131 and 130, conductor 126, through the signal device and springs 119 and 118 to the vertical line conductor 109. The relay 122 upon energization operates to shift the spring 85 from the spring 86, which latter is connected to the battery lead 51, to the spring 134, which is in turn connected with ground. This reversal of the polarity of the spring 85 sets up an energizing circuit which supplies the calling subscriber with talking battery current and operates the relay 7 at substation #500. This circuit may be traced from ground G^5 to the contact point 99, side switch wiper 90, through the springs 134 and 85, winding 84 of the differential relay 77, rotary line relay 75, shaft wiper 44, side switch wiper 58, rotary line conductor 42, conductor 135, relay 7, conductor 136, contact point 35, spring 34, springs 31′ and 32 to the vertical line conductor 41, side switch wiper 47, vertical line relay 74, winding 76 of the differential relay 77 to battery lead 51, thence through battery

B and to ground G. The relay 7 upon energization attracts its armature 8, whereby the springs 9 and 10 engage, and the supporting tip 19′ is drawn from beneath the coin 5, thus permitting the latter to pass from engagement with the cam 6 and the springs 2 and 3 to again resume their normal position. The engagement of the springs 9 and 10 closes the primary circuit extending from the rotary line conductor 42 through the winding 15 of the induction-coil 14, transmitter 17 to the springs 9 and 10, conductor 136, through the signal device to the springs 31′ and 32 and to the vertical line conductor 41. The two substations are now connected and communication may be carried on over the circuit shown by the heavy lines in Fig. 1.

The release of the switching apparatus is brought about when the calling subscriber restores the receiver 12 to the switch-hook 13, thereby pressing into engagement for a moment the release springs 37, 38 and 39. The contact of the said release springs grounds the vertical and rotary line conductors 41 and 42 simultaneously from ground G′ to the release spring 39, thence through the springs 38 and 37 to the vertical and rotary line conductors. The grounding of the rotary line conductor 42 produces a short-circuit of the rotary relay 75 in series with the winding 84 of the differential relay 77 extending from ground G^5 to the contact point 99, side switch wiper 90, springs 134 and 85, winding 84 of the differential relay 77, rotary line relay 75 to the rotary line conductor 42, to the release springs 38 and 39 and to ground G′. Therefore, since the winding 76 of the differential relay 77 alone carries current, the said relay thereby becomes energized and attracts its armature which shifts the spring 129 from contact with the spring 128 to contact with the spring 101′. The disengagement of the springs 129 and 128 destroys the energizing circuit through the relay 122, and the spring 85 passes from engagement with the spring 134 into contact with the spring 86, which removes the said short-circuit of the rotary relay 75 and winding 84 and instead establishes an energizing circuit extending from the substation ground G′ through the release springs 39 and 38 to the rotary line conductor 42, side switch wiper 58, shaft wiper 44, relay 75, winding 84 of the differential relay 77, through the springs 85 and 86 to the battery lead 51, thence through battery B and to ground G. The rotary relay 75 now operates and the springs 137 and 138 come into contact, whereby an energizing circuit is established through the release relay 139 of the first-selector A in series with the release magnet 140 of the connector C. However, the current now in passing, as above stated, through the winding 84 aids the winding 76 in maintaining the springs 129 and 101′ in contact. The energizing circuit through the release relay 139 and release magnet 140 extends from ground G^6 to the contact point 71, side switch wiper 67, release relay 139, shaft wiper 45, springs 138 and 137, release magnet 140, springs 101′ and 129 to battery lead 51, and through battery B to ground G. When the connector release magnet 140 is thus supplied with current it energizes, and as a result the switch shaft and side switch are restored to normal position, thus breaking the connection between the connector switch-shaft wipers 93, 94 and 95 and the normal conductors 96, 97 and 98. The back-release relay 139 being in the same circuit with the release magnet energizes simultaneously with the latter and operates to close a circuit through the selector release magnet 140′ by pressing the back-release springs 137′ and 138′ together. The circuit through the said release magnet 140′ extends from ground through the springs 137′ and 138′ to the release magnet 140′, thence to the battery lead 51, and through battery B to ground G. When the ground to the line conductors 41 and 42 is interrupted all the magnets involved in the release are de-energized and all the switches are fully restored. It will be understood, of course, that when the connector switch C is released and the wipers 93 and 94 disengage from the normal conductors 96 and 97, the back-release relay 122 of the connector C is restored and the spring 85 returns into normal engagement with the non-grounded battery spring 86, thus cutting off talking battery current from the calling line. The substation relay 7 is, of course, deënergized and the armature 8 is restored to normal position by the tension of the spring 10. If the called line #220 is busy at the time that the calling subscriber #500 attempts to establish connection, the connector C is released by the last impulse to the rotary line conductor 42, as follows: The said impulse energizes the rotary line relay 75 of the connector C, which relay in turn energizes the private magnet 83, pressing the private springs 55′ and 56′ into contact after the private wiper 95 has been carried onto the grounded private bank contact. It is understood, of course, that whenever a line is busy the connector private bank contacts connected with the private normal 98, shown at the selector D, are all connected to ground. Therefore, since the connector side switch is in second position, when the private springs 55′ and 56′ are brought into contact an energizing circuit is established through the release magnet 140 from the said grounded private bank contact to the private wiper 95, thence to the side switch wiper 90, which is in second position, to the private magnet springs 55′ and 56′ to the release magnet 140, thence to

battery B and to ground G. The connector switch-shaft and side switch are thus released in the well-known manner, and connection is not established with the called line; and there is no liability of the back-bridge relay 122 energizing, thus making it impossible for the calling line to receive talking battery current, or for the substation relay 7 to energize. As a result the coin 5 is retained within the channel, as shown in Fig. 2, and when the subscriber receives the busy signal, and subsequently hangs up his receiver, the shutter N is removed from in front of the coin 5, which latter then rolls out into the cup 147. The busy signal is, of course, established when the subscriber presses his signaling button 33 after he has completed the calling operations, and, of course, after the connector is released, as described, in which case the connector side switch is in first position, as explained. As a result the vertical line conductor 41 is grounded when the signaling button spring 34 is carried onto the ground contact 36, whereby the vertical line relay 74 is energized. Therefore, the line relay springs 78 and 79 are brought into contact, and the vertical magnet 70′ is operated to raise the switch-shaft, whereby the off-normal springs 103′ and 104′ are brought into contact and a busy signaling current sent to the calling substation from the busy coil H through the springs 104′ and 103′ to the side switch wiper 89, ringer relay springs 103 and 104 to the calling subscriber's rotary line conductor 42, thence through the primary winding 15, transmitter 17, condenser 40 to the vertical line conductor 41, and through the vertical line relay 34 of the connector C and winding 76 of the differential relay 77 to the battery lead 51 and to the busy coil H. When the subscriber hangs up his receiver, after receiving the busy signal, he grounds the line conductors 41 and 42 simultaneously, energizing the line relays 74 and 75 of the connector C, as already explained, and producing the release of the switching apparatus as formerly.

The pay-station attachment used in connection with the substations, as described, consists essentially (Figs. 2 and 3) of the relay 7, ground closing springs 2 and 3 which are controlled by the arm 4, a coin-trough or chute M, shutter closing arm N suitably secured to the switch-hook, and a coin-receiving box O. The various parts are suitably mounted and contained within the case P. The coin-box O is provided with a cover 141 and a suitable lock 142 for securing the cover in place. Similarly, the case P is provided with a cover Q and a lock 143. The relay 7 is mounted upon the bracket 144 and firmly secured thereto by the screw 145, and the said bracket is in turn secured to the case P by means of the screw 146. Upon the said bracket are mounted the springs 9 and 10 insulated from each other and from the bracket. In Fig. 3 the relay 7 is shown in normal position. The tip 19′ of the armature 8 is shown extending into the coin-trough M. The object of this provision is to retain the coin in front of the return trough or throw-out 147, so that the coin may pass out of the coin-box providing the called party does not answer. Assume that the receiver has been removed, then the switch-hook in its upward course carries the shutter-closing arm N upwardly, thereby closing the passageway 148 from the coin-trough M to the return trough 147. Now when the coin 5 is deposited in the slot 149 it comes to rest in the position shown in dotted lines in Fig. 2. In this position the said coin rests upon the armature tip 19′ and against the shutter arm N. After the call is completed assume that the calling subscriber receives the busy signal, then in this instance the relay 7 does not energize and attract its armature, whereby the coin would pass to the coin-box O. But on the contrary the coin is retained in the said position until the receiver is restored, and the shutter-closing arm passes out of contact with the coin 5 and opens the passageway 148, thereby permitting the coin to pass to the trough 147 where it may be recovered by the calling subscriber. The coin-trough M is secured to the case P by means of the screws 150. The ground springs 2 and 3 whereby the substation is provided with ground are insulated from each other and from the bracket 151 to which they are secured, and the bracket is in turn mounted upon the case P by means of the screws 152. Secured to the trough M by means of the screw 153 is the arm 4 which operates to close the springs 2 and 3 in contact when a coin is dropped in the trough as described.

The winding of the relay 7 may be of any suitable resistance, but with a central battery of fifty volts good results have been obtained when the said relay is wound to a resistance of fifteen hundred ohms.

From the foregoing it will be seen that the operation of the subscriber's calling mechanism is contingent on first depositing a coin in the toll-box, and that the collection of said coin, as an equivalent operation, is contingent on the answering of the called subscriber. As shown, the deposit of a coin, or some equivalent operation, closes the connection to ground, and this makes the mechanism operative for calling. The use of the telephone for talking is, it will be seen, contingent on the answering of the called subscriber. Finally, the energizing of the pay-station relay 7 closes the line or charging circuit of the common battery transmitter 17. Before this the calling sub-

scriber's telephone equipment is operative for receiving but not for talking. In this way the called subscriber can be heard to answer, and the calling subscriber can also get the busy signal, which latter is, of course, of more importance.

The connectors C can be arranged on a percentage basis, so as to be less in number than the subscribers. This, with the selector and trunk lines, provide means for automatically trunking a calling line into connection with a called line. If necessary, second or third selectors can be employed between the first-selector and the connector, and like the latter arranged on a percentage basis. The first-selectors can, of course, be reduced to a percentage basis by any suitable or known arrangement.

What I claim as my invention is:—

1. A subscriber's transmitter, a line circuit for said transmitter, a normally open switch in said circuit, a coin collector, means controlled by the called subscriber for closing said switch and operating said coin collector, and a condenser in shunt or parallel with said switch.

2. In a telephone exchange system, a calling and a called subscriber's line, means having vertical and rotary motion for extending a talking connection from the calling line to the called line, a pay-station relay, and relay energizing means controlled by the called subscriber, said relay closing and maintaining closed during talking the talking connection.

3. In a telephone exchange system, a calling and a called subscriber's line, the combination of means having vertical and rotary motion for extending a talking connection from the calling line to the called line, a toll device, means including a relay controlled by the called subscriber for operating said device, a talking circuit closed and maintained closed during talking by said relay.

4. In a telephone exchange system, the combination of an automatic switch, a calling mechanism for controlling the vertical and rotary motion of said switch, a central source of talking current, a relay, a pay-station apparatus controlled by said relay by current supplied from said source, and a talking circuit closed by the operation of said relay, said relay maintaining said talking circuit closed during talking.

5. Means having vertical and rotary motion for extending connection from the calling line to the called line, a subscriber's transmitter, a line circuit for said transmitter, a normally open switch in said circuit, a coin collector, means controlled by the called subscriber for closing said switch, and operating said collector, and a condensed in shunt or parallel with said switch.

6. In a telephone system, means having vertical and rotary motion for extending connection from the calling line to the called line, and a calling subscriber's pay-station including a relay controlled by the called subscriber to complete a talking circuit over said connection at the calling substation, said relay remaining energized during talking.

7. In a subscriber's pay station equipment, a relay in a normally open circuit, contacts controlled by the switch hook for controlling one break in said circuit, means under the control of the called subscriber to energize said relay when said first break is closed, said pay station equipment controlled by said relay, progressively movable automatic switching mechanism for establishing a connection between two subscribers, a talking circuit, said relay closing and maintaining closed during talking said talking circuit substantially as described.

8. In a telephone system, a calling and a called subscriber's station, a talking circuit between said stations, a transmitter and a relay at the calling subscriber's station, an energizing circuit for said relay independent of said transmitter, a coin collector, and means by which the called subscriber controls said energizing circuit and operates said collector, said relay closing and maintaining closed during talking the talking circuit.

9. In a telephone system, a calling and a called subscriber's station, a talking circuit between said stations, a transmitter and a relay at the calling subscriber's station, an energizing circuit for said relay independent of said transmitter, a coin collector, and means whereby the response of the called subscriber closes said energizing circuit and operates said collector, said relay closing and maintaining closed during talking the talking circuit.

10. In a telephone system, a calling and a called subscriber's station, a normally open calling circuit and a primary circuit including a transmitter for said calling station, normally open contacts in said primary circuit; coin-controlled means for closing said normally open calling circuit, and means under the control of the called subscriber for closing said normally open contacts.

11. In a telephone exchange system, the combination of a coin collecting toll device and a calling subscriber's telephone station, circuits and a relay for operating said device controlled by a called subscriber's telephone station, and a talking circuit closed by said relay when the called subscriber answers, said delay maintaining said talking circuit closed during talking.

12. A subscriber's transmitter, a line circuit for said transmitter, a normally open switch in said circuit, a coin collector, circuits and a relay controlled by the called subscriber for closing said switch and for

operating said coin collector, and a condenser in shunt or parallel with said switch.

13. In a telephone exchange system, progressively movable switches having magnets for producing motion first in one direction and then in a different direction for extending connection from the calling line to the called line, a pay-station relay, and means controlled by the called subscriber for energizing said relay to close a talking circuit in said connection, said relay remaining energized during talking.

14. In a telephone exchange system, the combination of progressively movable switches having vertical and rotary motion for extending connection from the calling line to the called line, a toll device, circuits and a relay controlled by the called subscriber for operating said device, and a talking circuit closed and maintained closed during talking by said relay.

15. Progressively movable switches having magnets for producing motion first in one direction and then in a different direction for extending connection from the calling line to the called line, a subscriber's transmitter, a line circuit for said transmitter, a normally open switch in said circuit, a coin collector, circuits and a relay controlled by the called subscriber for closing said switch and for operating said collector, and a condenser in shunt or parallel with said switch.

16. In a telephone system, progressively movable switches having magnets for producing motion first in one direction and then in a different direction for extending a talking connection from the calling line to the called line, a relay, and a calling subscriber's pay-station device controlled by said relay to close a circuit at the calling substation, said circuit maintained closed during talking by said relay.

17. In a telephone system, the combination of progressively movable switches having magnets for producing motion first in one direction and then in a different direction for automatically trunking a calling line into talking connection with a called line, a relay, and a calling subscriber's pay-station device controlled by said relay to close a circuit at the calling substation, said circuit maintained closed during talking by said relay.

18. In a telephone system, a calling and a called subscriber's station, automatic progressively movable switches for establishing a talking connection between said stations, a transmitter and a relay at the calling subscriber's station, an energizing circuit for said relay independent of said transmitter, a coin collector, and a magnet by which the called subscriber controls said energizing circuit and operates said collector, said relay closing and maintaining closed during talking the talking circuit.

19. In a telephone system, a calling and a called subscriber's station, automatic progressively movable switches for establishing a talking connection between said stations, a transmitter and a relay at the calling subscriber's station, an energizing circuit for said relay independent of said transmitter, a coin collector, and a magnet controlled by the called subscriber to close said energizing circuit and operate said collector, said relay closing and maintaining closed during talking the talking circuit.

20. In a telephone system, a calling and a called subscriber's station, a normally open calling circuit and a primary circuit including a transmitter for said calling station, normally open contacts in said primary circuit, a coin-controlled switch for closing said normally open calling circuit, and a circuit and a relay under the control of the called subscriber for closing said normally open contacts.

21. In a telephone system, a telephone station, measured service means therefor comp ising equipment for controlling the operativeness of the telephone, a relay having ar armature, another telephone station, means comprising automatic progressively movable switching mechanism for connecting the two stations, means under control of said other station for energizing said relay for operating said measured service means and for maintaining said relay energized, whereby said measured service means is held operated to render the telephone operative for talking between said stations.

22. In a telephone system, a telephone station, measured service means therefor comprising a circuit controlling the operativeness of the telephone, a relay having an armature, another telephone station, means comprising automatic progressively movable switching mechanism for connecting said stations, means under control of the other station for energizing said relay for operating said measured service means and for maintaining said relay energized, whereby said circuit in the measured service means is held closed to render the telephone operative for talking between the said stations.

23. In a telephone exchange system, the combination of a pair of telephone stations, talking transmitters for said stations, an automatic progressively movable switch for establishing a connection between said stations, a calling mechanism for controlling said switch, a central source of current, said switch comprising means for supplying current from said source to said stations over the conductors of said connection for talking purposes, measured service equipment comprising a circuit for controlling the op-

erativeness of the transmitter of one of said telephone stations, a relay for controlling said equipment, said relay connectel to said connection and energized by the current supply for talking purposes to close the talking circuit in the said measured service equipment to enable subscribers to talk between said stations, the said relay being maintained energized during talking.

24. In a telephone system, a pair of telephone stations, means comprising an automatic progressively movable switch for connecting the two stations, a subscriber's pay station equipment including a circuit for one of said telephones, a calling mechanism for controlling said switch, the operation of said switch by said mechanism being contingent on the deposit of a coin, and a relay controlled from the other of said stations when the subscriber answers for closing said circuit at said pay station to render the first telephone operative for talking, said relay remaining energized during talking.

25. In a telephone exchange system, a calling and a called subscriber's station, automatic progressively movable switching mechanism for establishing a connection between the said stations, a pay station apparatus for the calling station, a relay for controlling said apparatus, a central source of current for talking purposes, means controlled by the called station for supplying current from said source to energize said relay to close a talking circuit in said connection, the said relay being maintained energized during talking.

26. In a telephone exchange system, the combination of calling and called subscribers' stations having lines that terminate in the exchange, automatic progressively movable switching mechanism for establishing a connection between a calling and a called station, a pay station apparatus for the calling station, equipment at said calling station for operating said switching mechanism, the operation of said switching mechanism by said equipment being dependent upon the deposit of a coin in said pay station apparatus, a relay at the calling station, said relay being energized by the called station to supply battery current to the talking equipment, said relay being maintained energized during talking.

27. In a telephone system, a calling and a called subscriber's station, equipment including talking transmitters at said station, automatic progressively movable switching mechanism for establishing a connection between said stations, an open metallic circuit for the transmitter of the calling station after the connection to a called station is established, a pay station apparatus and a relay for the calling station, means under the control of said called station for energizing said relay to close and maintain closed during talking the metallic circuit for said transmitter and for controlling said pay station apparatus.

28. A telephone exchange system comprising a telephone line extending from a substation to an exchange, means at the substation for receiving the deposited token, means including said token receiving means for initiating a call, relay mechanism for disposing of the deposited token, and means for actuating said mechanism to establish a talking circuit at the substation irrespective of the presence of the token in the token receiving means.

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

ROY C. GIFFORD.

Witnesses:
EDWARD D. FALES,
ARTHUR B. SPERRY.

Corrections in Letters Patent No. 1,281,251.

It is hereby certified that in Letters Patent No. 1,281,251, granted October 8, 1918, upon the application of Roy C. Gifford, of Chicago, Illinois, for an improvement in "Measured-Service Telephone Systems," errors appear in the printed specification requiring correction as follows: Page 2, line 57, for the word "through" read *though;* page 3, line 109, for the reference-numeral "91" read *81;* page 7, line 85, claim 7, strike out the words "substantially as described"; same page, line 124, claim 11, for the word "delay" read *relay;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 26th day of November, A. D., 1918.

[SEAL.]

R. F. WHITEHEAD,

Acting Commissioner of Patents.

Cl. 179—6.5.