J. ERICKSON.

MEASURED SERVICE TELEPHONE SYSTEM.

APPLICATION FILED MAR. 29, 1912.

1,217,426.

Patented Feb. 27, 1917.

5 SHEETS—SHEET 1.

FIG. 5.

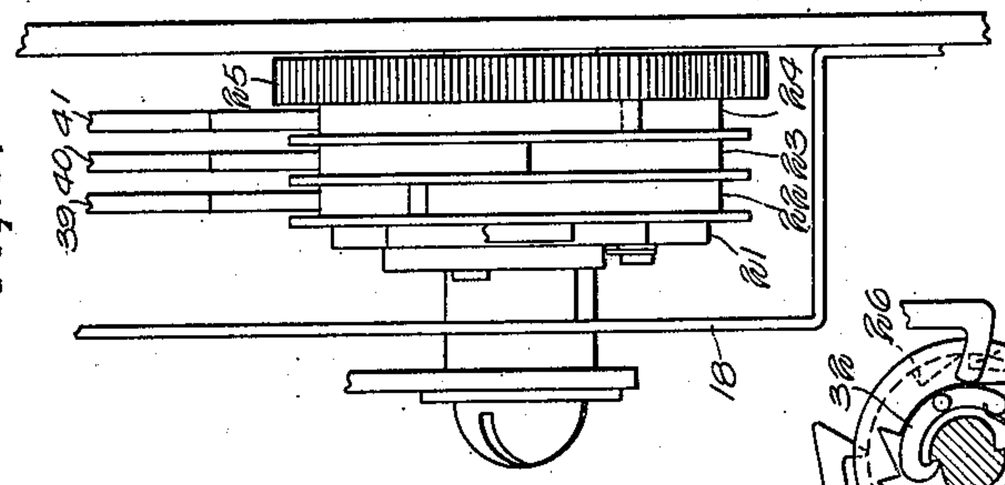


FIG. 4.

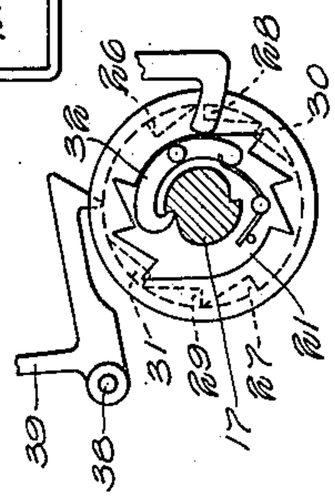


FIG. 3.

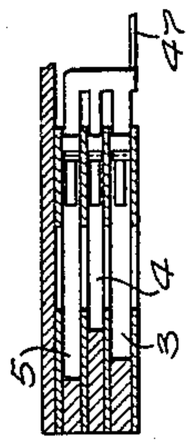
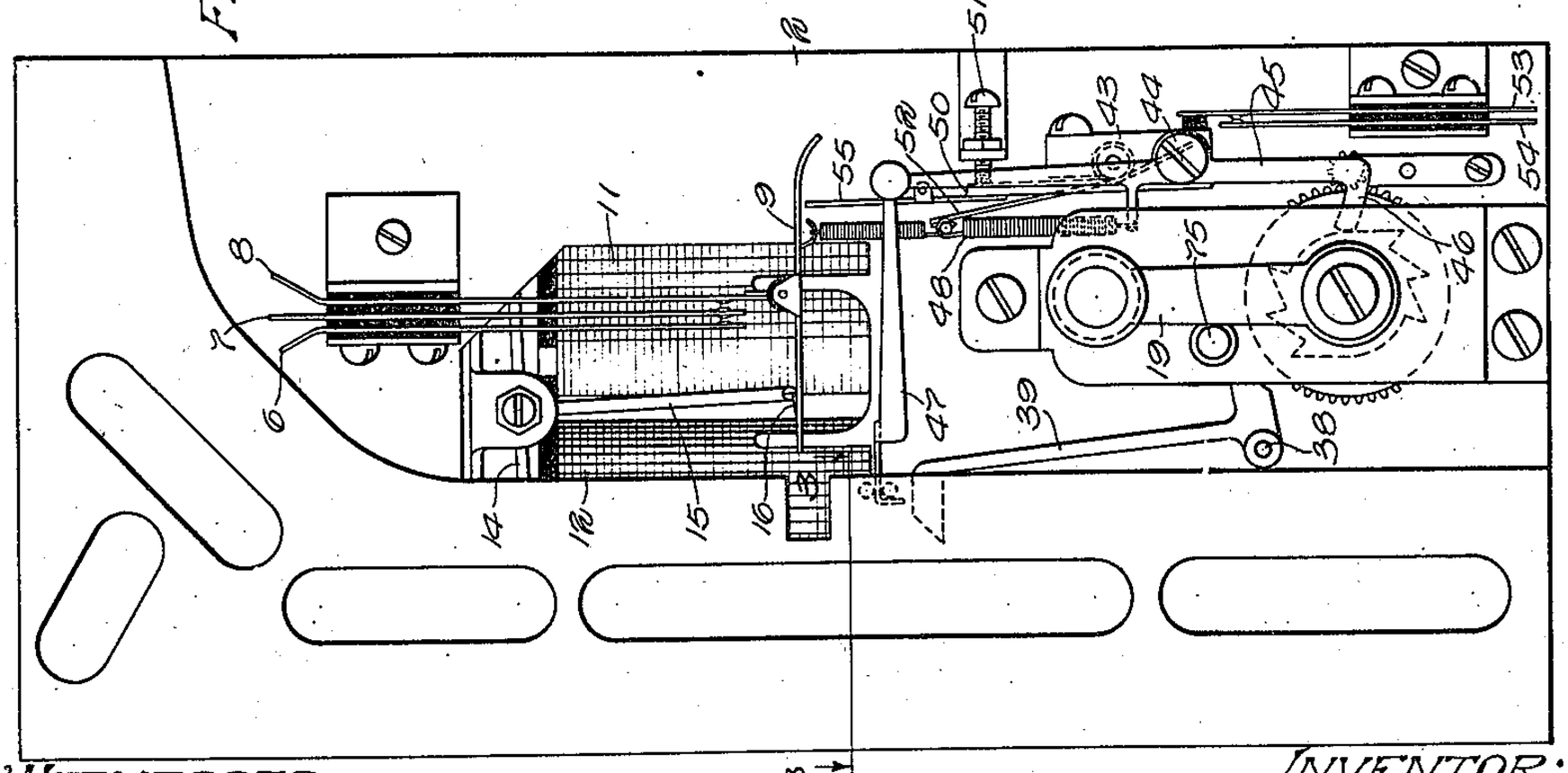


FIG. 2.

FIG. 1.



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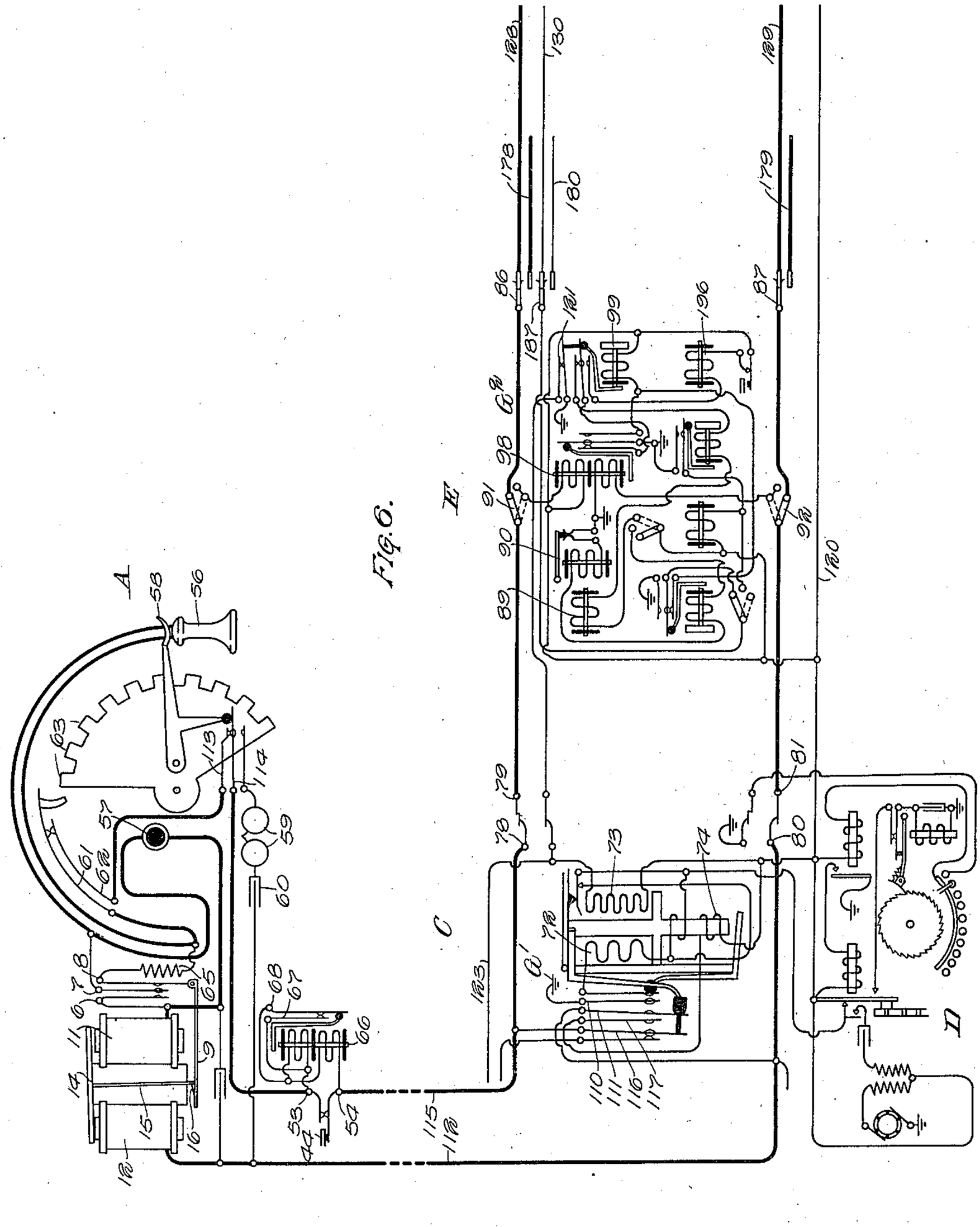
5 SHEETS—SHEET 2.

FIG. 6.



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5 SHEETS—SHEET 3.

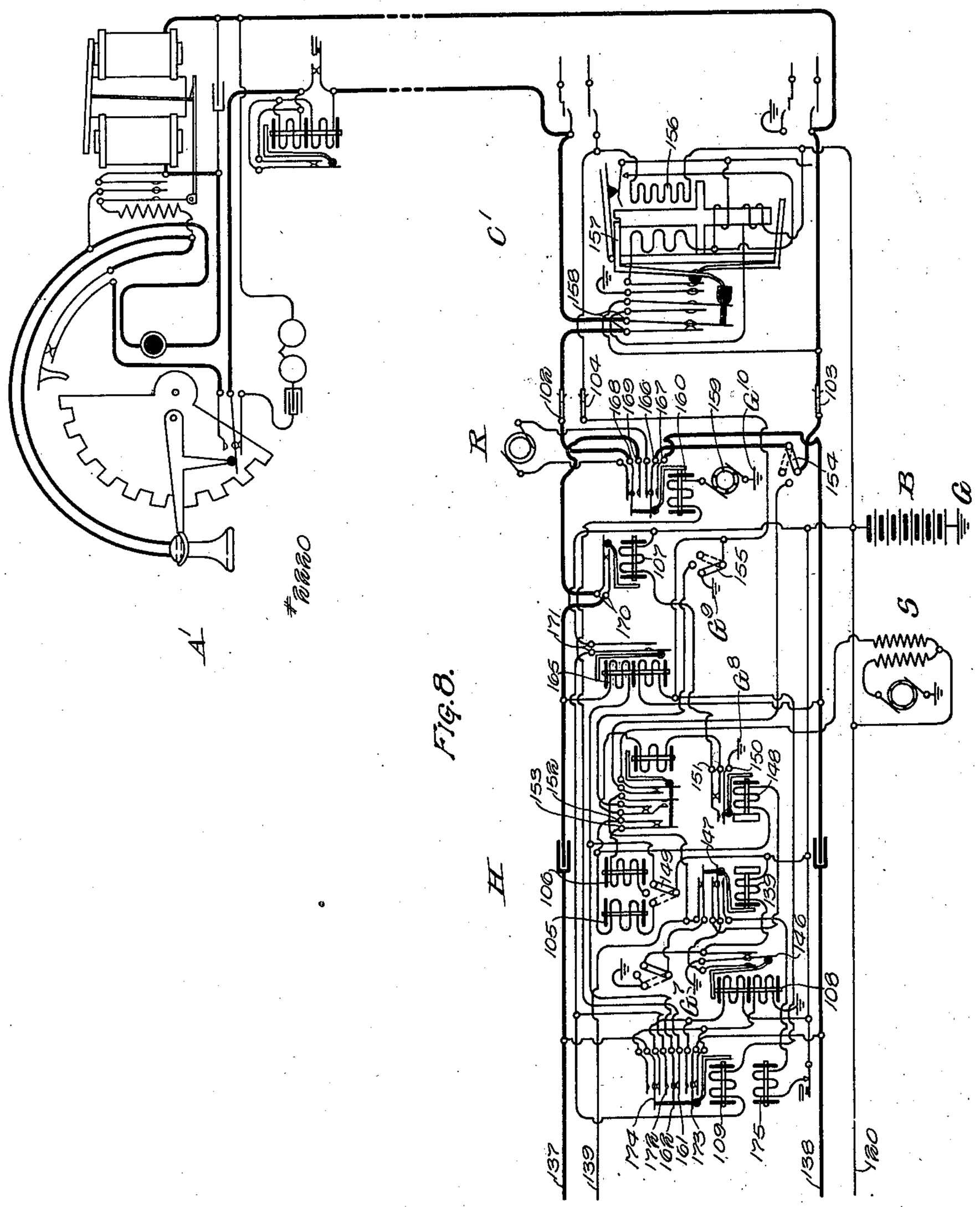

FIG. 8.

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5 SHEETS—SHEET 4.

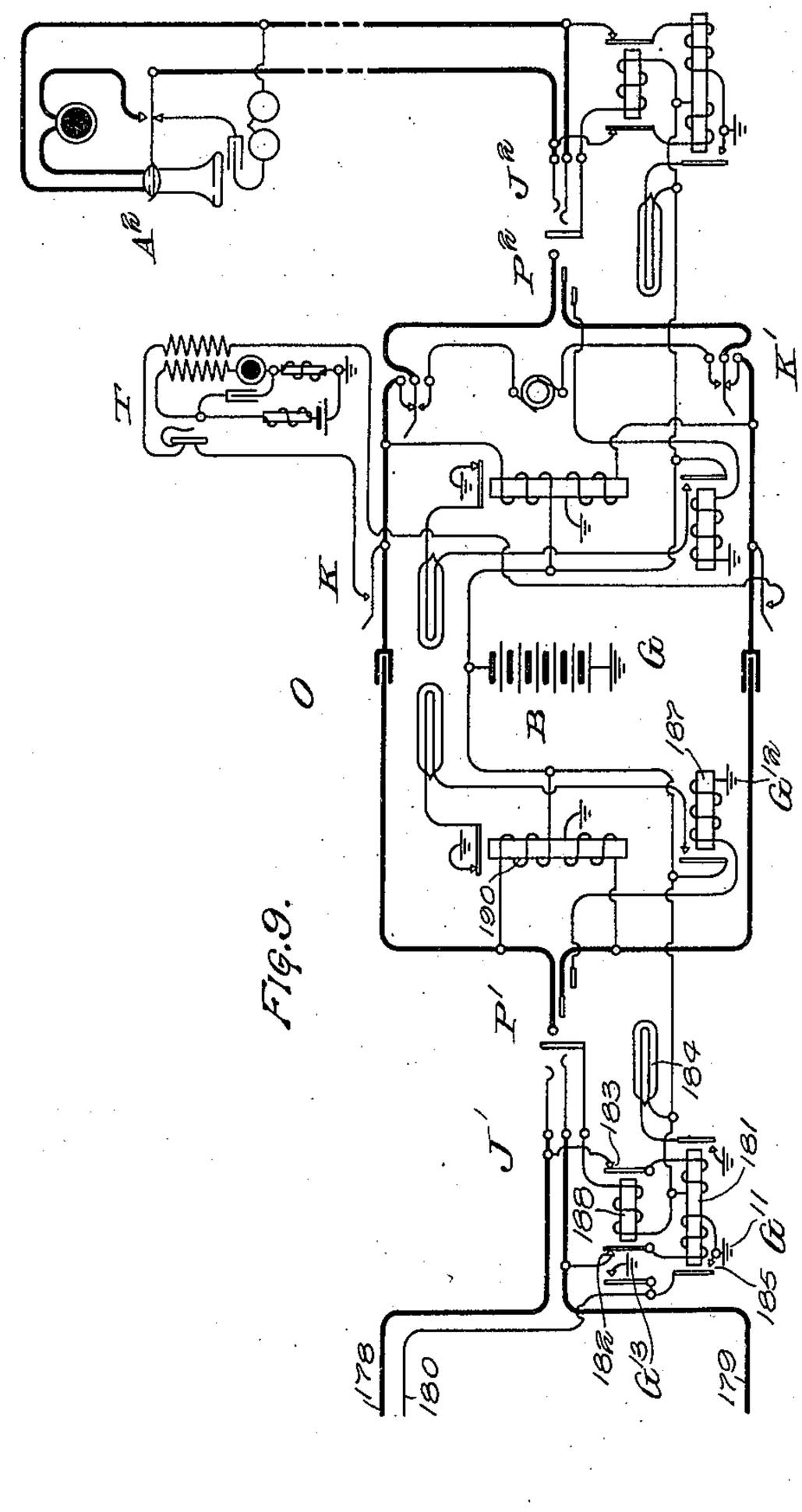

FIG. 9.

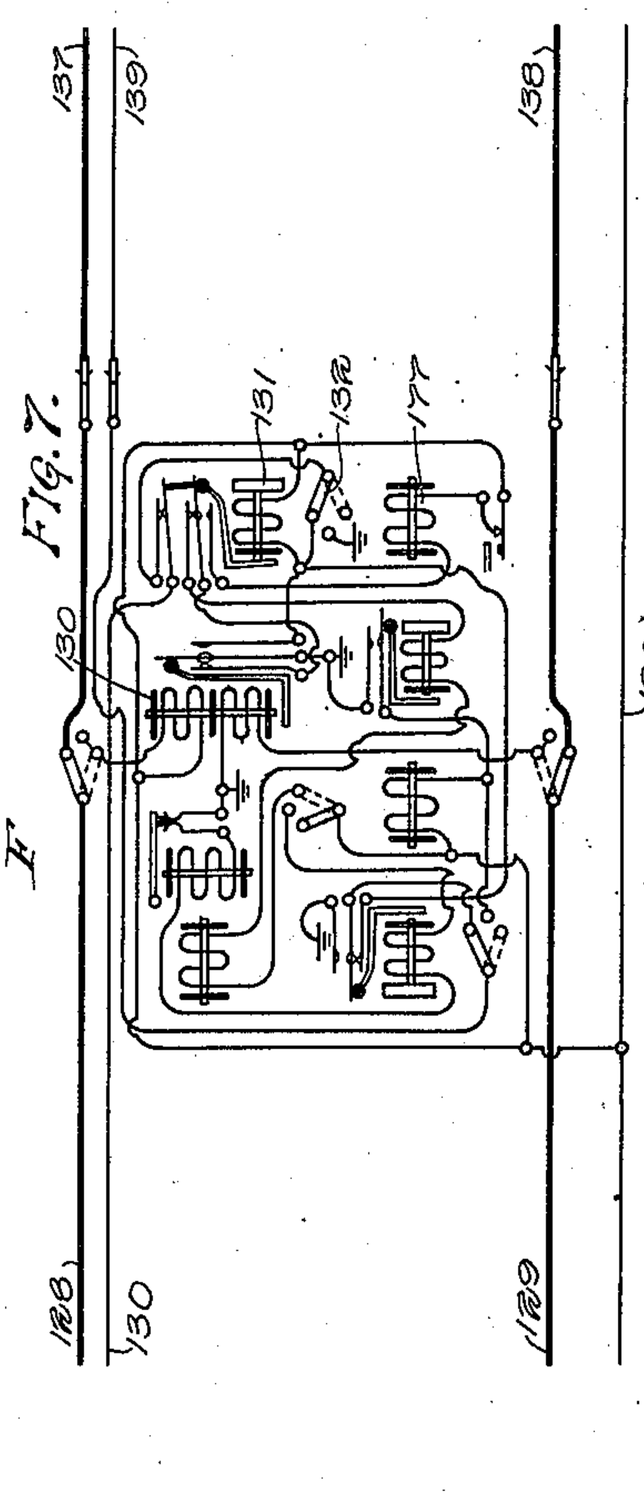

FIG. 7.

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5 SHEETS—SHEET 5.

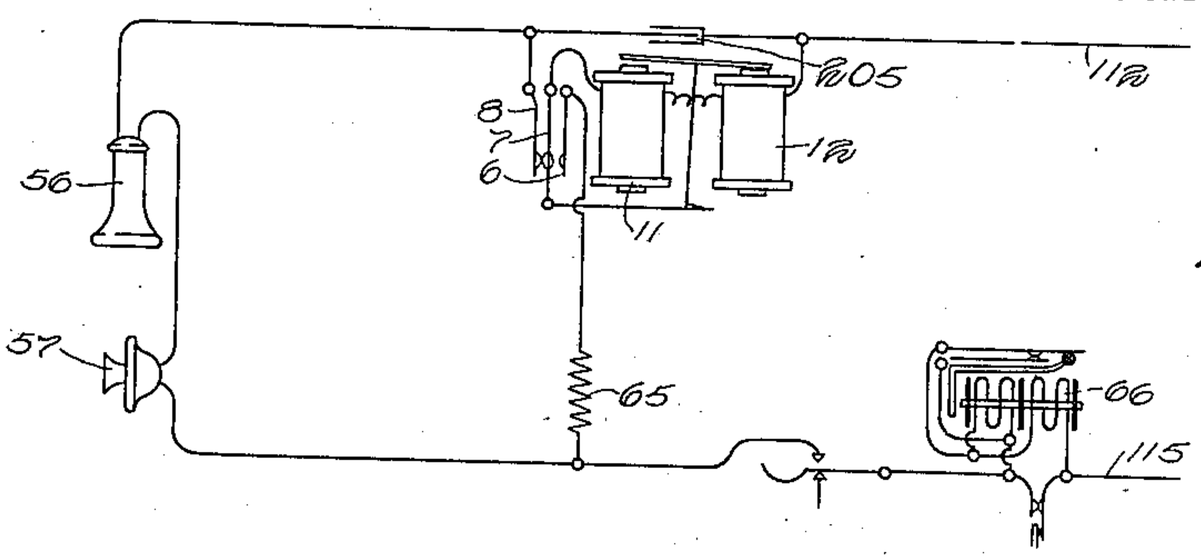


FIG. 10.

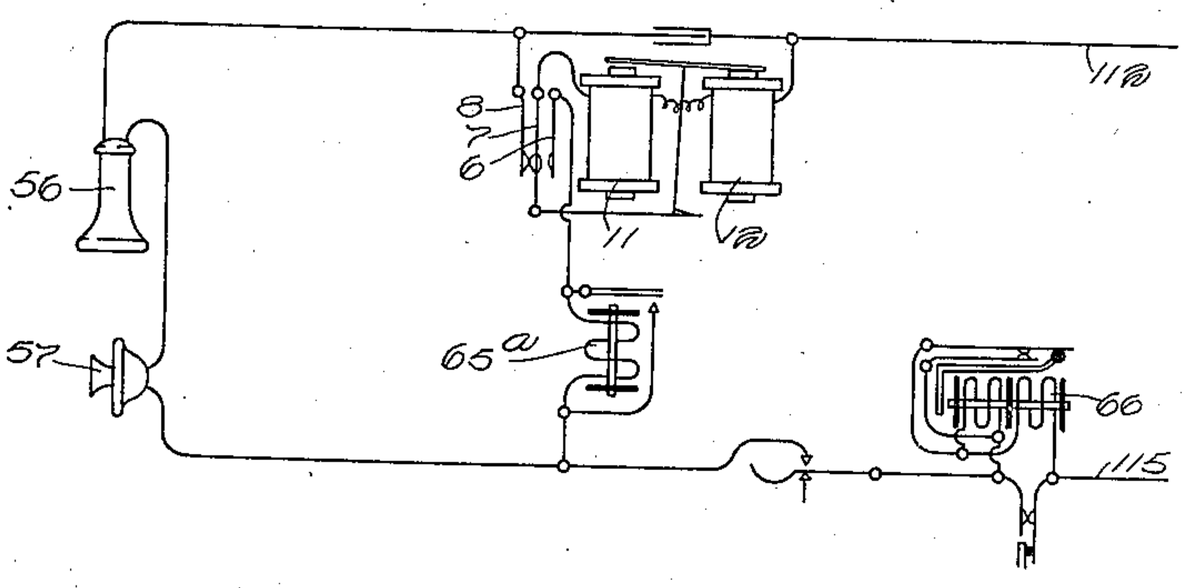


FIG. 11.

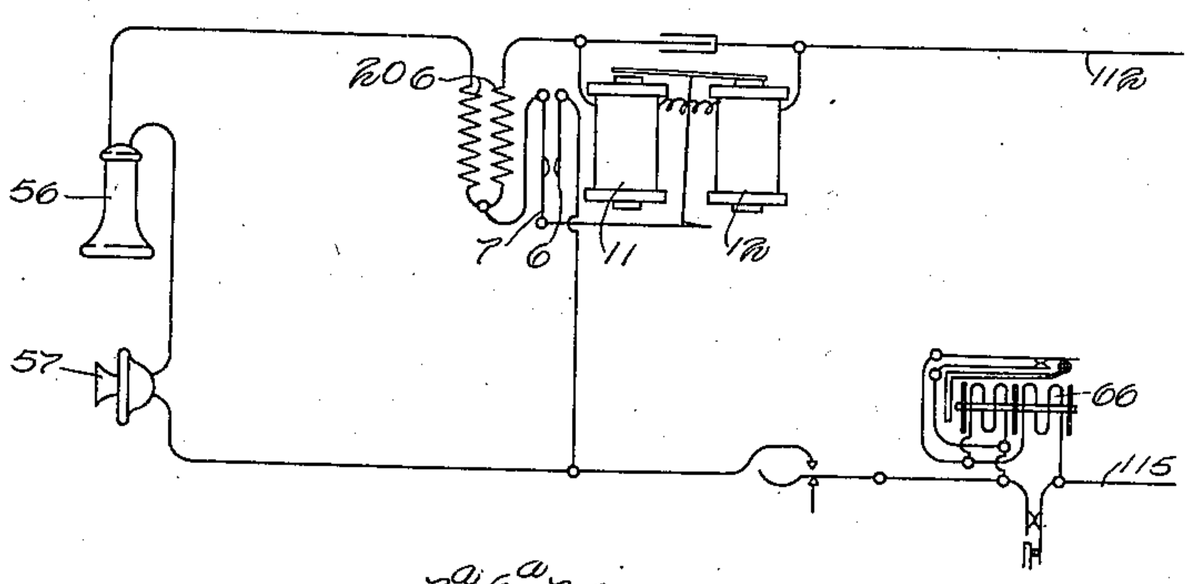


FIG. 12.

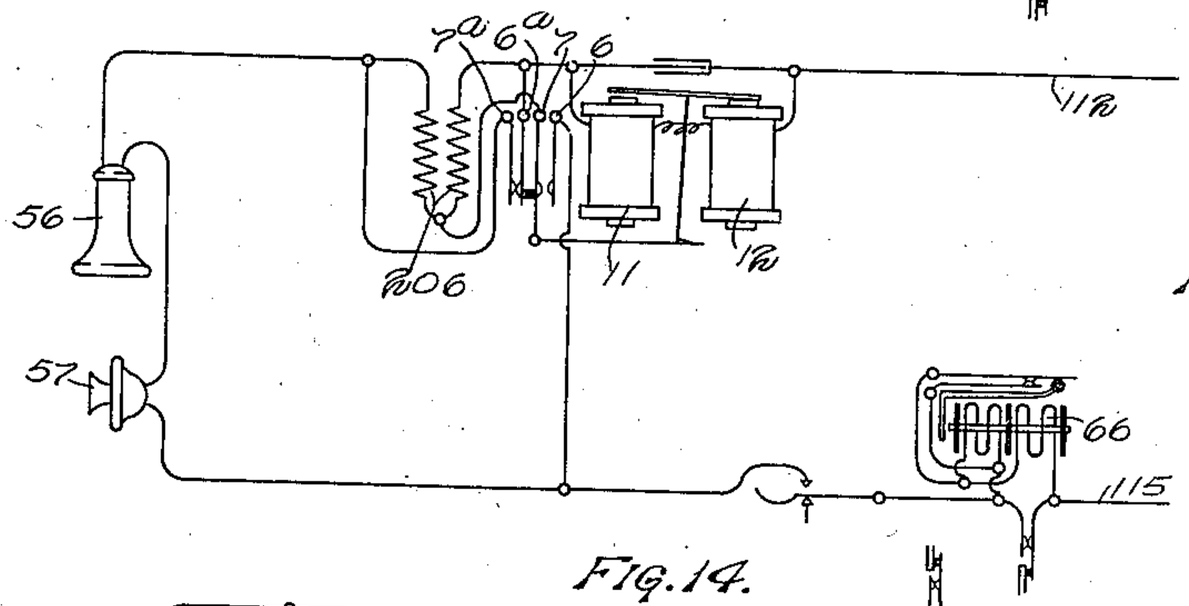
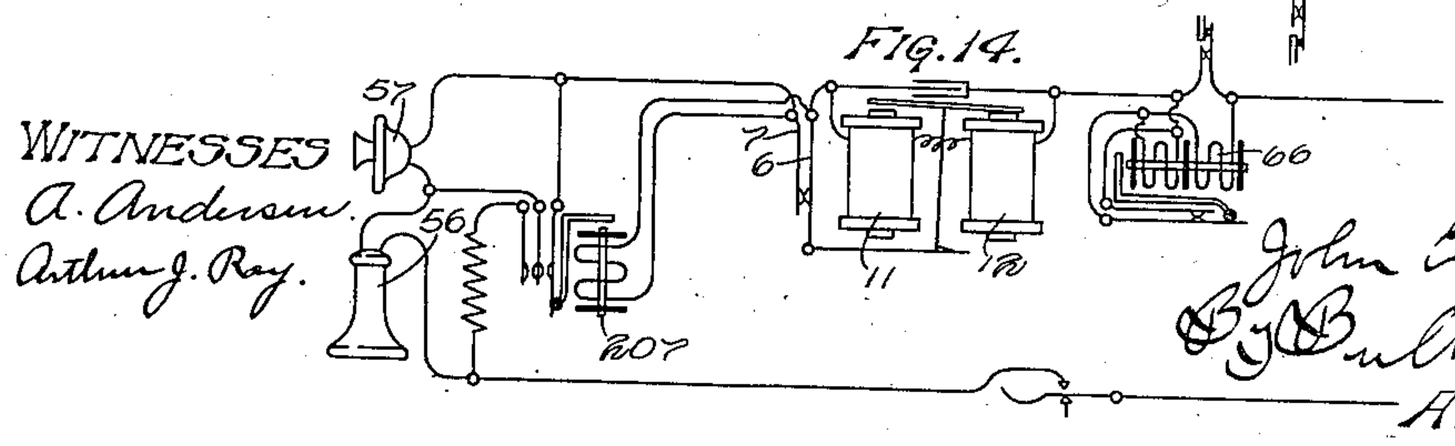


FIG. 13.

FIG. 14.



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MEASURED-SERVICE TELEPHONE SYSTEM.

1,217,426. Specification of Letters Patent. **Patented Feb. 27, 1917.**

Application filed March 29, 1912. Serial No. 687,102.

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 certain new and useful Improvements in Measured-Service Telephone Systems, of which the following is a specification.

My invention relates to a measured service telephone system, and more particularly to a coin-collecting device for automatic telephone systems, which coin-collecting device is particularly adapted for use at a public pay-station.

In automatic systems local calls are made automatically, while long distance calls are usually made semi-automatically—that is, through the intervention of an operator. It is therefore necessary that a coin-collecting device for use at a public pay-station in such a system be arranged to operate automatically to require the calling subscriber to deposit the coin before conversation can be carried on over a local connection. In the case of a long distance connection, however, the charges are not the same for all calls, and it is therefore not sufficient to simply require that the calling subscriber deposit a coin before he can talk, but there must be provided some means whereby the central office operator is notified of the denomination and number of coins deposited.

An object of my invention is, therefore, to devise a coin-collecting device in which these desired operations are accomplished, so that when a local automatic call is made a coin must be deposited before the talking circuit is rendered operative, while when a long distance connection is made through the medium of an operator a signal is transmitted to such operator to indicate the denomination of the coin deposited by the subscriber.

A further specific object of my invention is the provision of a buzzer which is operated over a line circuit which gives the signal to the operator on the depositing of a coin.

Other features of my invention are the general improvement of a coin-collecting device and its manner of operation and connection with the telephone system.

These and other objects of my invention will be more readily understood by reference to the accompanying drawings, in which I have illustrated one specific embodiment of my invention in connection with an automatic system of the two-wire type employing line switches, selectors and connectors, and in which provision is also made for extending a long distance call through the intervention of a manual cord circuit.

In said drawings Figure 1 is a front view and Fig. 2 a side elevation of my improved toll apparatus without its inclosing case.

Fig. 3 is a sectional view of the coin chute taken on the line 3—3 of Fig. 2.

Fig. 4 is a detail view showing more clearly the manner in which the cam wheels coöperate with the controlling levers.

Fig. 5 is an enlarged side view of the lower part of Fig. 1, with the springs 54 and 53 and the pinion 33 removed.

Figs. 6, 7 and 8 show a complete connection between a calling and a called subscriber in an automatic telephone system, illustrating one manner in which my invention may be employed.

Fig. 9 shows an operator's cord circuit and manual telephone.

Figs. 10 to 14, inclusive, show a number of different circuit arrangements which are suitable for use in connection with the coin-collecting device.

In Figs. 1 and 2 there is shown a base plate 2 to the front of which there are secured three coin chutes 3, 4 and 5 which lead down into any suitable coin box. Also secured to the front of the plate 2, but electrically insulated therefrom and from each other, there is a group of contact springs 6, 7 and 8. To the lower end of the spring 8 there is attached a swinging arm 9. Upon the back of the plate 2 there is mounted a polarized electromagnet comprising two coils 11 and 12, a permanent magnet 13 and a pivoted armature 14. To the armature 14 there is secured a downwardly projecting arm 15, the lower end of which arm is bent forward so as to extend across and just above the arm 9. Upon the upper side of the arm 9 there is a small lug 16. When the armature 14 is attracted downward toward the coil 12, the lower end of the arm 15 assumes a position behind the lug 16, as shown in Fig. 1. If the magnet now be energized in the opposite direction, so as to attract the armature downward toward the coil 11, the

arm 15 will engage the lug 16 and cause the arm 9 to be carried bodily to the left, thereby closing the contacts between the springs 6, 7 and 8. These springs will remain closed as long as the magnet remains energized in this direction, or until the left-hand end of the arm 9 is tipped downward so as to release the lug 16 from the arm 15.

Near the lower end of the base plate 2 there is a shaft 17 journaled in said base plate and in the mounting plate 18. To the forward end of the shaft 17 there is secured a handle or lever 19, while around the rear end of said shaft there is coiled a driving spring 20. Loosely mounted upon the shaft 17 between the plates 2 and 18, but rigidly secured to each other, there are four cam wheels 21, 22, 23 and 24 and a gear wheel 25. (See the enlarged Fig. 5). Each of the cam wheels 22, 23 and 24 is provided with two notches diametrically opposite each other. The notches of adjacent wheels are radially displaced from each other by approximately the length of a notch, as shown in Fig. 4, in which 26 and 27 are the notches in the wheel 22; 28 and 29 are the notches in the wheel 23; and 30 and 31 are the notches in the wheel 24. Upon the periphery of the cam wheel 21 there are six teeth divided into two groups of three each and located diametrically opposite each other. Upon the face of the wheel 21 there is a pawl 32 adapted to coöperate with two ratchet teeth in the shaft 17 in such a manner that as the handle 19 is rotated in a clockwise direction it may rotate within the cam wheels without moving them. The rotation of the shaft in this direction, therefore, simply serves to store up tension in the spring 20. When, however, the shaft 17 is rotated in a counter-clockwise direction by the spring 20, the teeth in the shaft engage the pawl 32 and force the cam wheels to rotate with it. The gear wheel 25 meshes with a pinion 33 which is firmly secured to a worm wheel 34 which meshes with a worm on a shaft 35 to which are secured two weighted governor springs 36. When the shaft 35 rotates, the ends of the springs 36 fly out and rub on the inside of a stationary cup 37, thereby providing a braking action to govern the speed of operation of the device.

Loosely mounted upon the pin 38 (Fig. 1) there are three bell crank levers 39, 40 and 41. The horizontal arms of these levers are pawl-shaped and rest upon the upper side of the cam wheels 22, 23 and 24, respectively, as shown in Figs. 4 and 5. The vertical arms of the levers 39, 40 and 41 are provided with horizontal projections which extend into the coin chutes 3, 4 and 5, respectively. (See Figs. 1 and 3). When the horizontal arms of these levers are resting upon the periphery of their respective cam wheels, the upper ends of said levers project far enough into the respective coin chutes to catch and hold a deposited coin of the denomination which that particular chute is designed to receive. When, however, a notch in one of the cam wheels is rotated under the end of its lever it drops into said notch and permits the upper end of the lever to be withdrawn from the chute far enough to permit the free passage of the coin.

Just above and to the right of the cam wheels there is a short thick block-like lever 43 rotatably mounted upon the base plate 2. Loosely mounted upon the block 43 by means of the screw 44 there is a lever 45, the lower end of which lever is provided with a projection 46 which projects into the path of the teeth on the cam wheel 21. To the upper end of the lever 45 there is loosely secured an arm 47 provided at its end with three fingers which project into the respective coin chutes 3, 4 and 5. The spring 48 normally holds the lower end of the lever 45 against the wheel 21. The lever 43 is normally held in the position shown in Fig. 1, with the projection 50 resting against the stop screw 51 by the spring 52. Likewise pivoted to the base plate 2 there is an arm 55 the lower end of which projects into the path of the projection 50, while the upper end is adapted to engage the downwardly-extending end portion of the arm 9 when the upper end of this lever is swung to the right. As the cam wheel 21 revolves, the teeth thereon force the lever 45 outward. The spring 52 is stronger than the spring 48, so that if there is no coin in any of the chutes to prevent the arm 47 from moving to the left when the lower end of the lever 45 is forced outward, said lever simply oscillates about the pivot screw 44 and the block 43 remains stationary. If, however, there is a coin in any one of the chutes when the lower end of the lever 45 is forced outward, the arm 47 cannot move to the left and consequently the lever vibrates about the right-hand end of the arm 47 as an axis and the screw 44 is forced to the right, causing the block 43 to turn upon its pivot against the tension of the spring 52. When the block 43 is thus turned it separates the contact springs 53 and 54 and rotates the lever 55 about its pivot point, causing the upper end of said lever to swing to the right so as to engage the down-turned end of the arm 9 and tip it up so as to release the lug 16 from the arm 15.

The manner of coöperation between the cam wheels, levers, etc., is as follows: If the lever 19 is rotated in a clockwise direction through half a revolution and then allowed to be returned to its normal position by the spring 20, the coöperation of the ratchet teeth in the shaft 17 and the pawl 32 causes

the cam wheels 21, 22, 23 and 24 to rotate with said shaft during its return movement. During this return of the cam wheels the following operations occur in regular order: First the lever 45 is momentarily forced outward by a tooth on the wheel 21, then the end of the lever 39 drops into a notch in the wheel 22, thereby momentarily opening the chute 3, then the lever 45 is again forced out by the next tooth on the wheel 21, after which the end of the lever 40 drops into a notch in the wheel 23 to open the chute 4, then the lever 45 is once more operated by the third tooth in the wheel 21 and, finally, the lever 41 is operated to open the chute 5. As has been explained, the operation of the lever 45 when there is a coin in any one of the coin chutes causes the block 43 to operate and open the springs 53 and 54, while the operation of the lever 45 when there is no coin in any of the chutes is without effect on the block 43. It will thus be seen that if a coin is deposited in the slot 3 and the lever 19 is operated, as above described, the springs 53 and 54 will be separated once, then the coin will be released and the two following operations of the lever 45 will be ineffective to operate said springs. Likewise, if a coin is deposited in the slot 4, the springs will be separated twice, and a coin in the slot 5 will cause three separations of said springs during the return of the lever 19.

The entire mechanism of the coin-collecting device, with the exception of the lever 19 and the stop pin 75, may be inclosed in a suitable case or box. The automatic telephone system represented in Figs. 6, 7 and 8 is the well-known type of system employing subscribers' individual or line switches, first selectors, second selectors and connectors, the connection shown being established between a calling substation A and a called substation A′ through the medium of a line switch C, a first selector E, a second selector F and a connector H. As shown herein, the substation A comprises the usual receiver 56, transmitter 57, switch hook 58, ringer 59 and condenser 60. Being an automatic substation it is also provided with an automatic calling device. This calling device may be of the type shown in British patent to S. G. S. Dicker No. 29,654 of 1910. In Fig. 6, however, the calling device is represented diagrammatically by a pair of impulse springs 61 and 62 and a toothed impulse wheel 63 which is controlled by the subscriber through the medium of a dial (not shown) provided with finger holes. The mechanism is so arranged that as the dial and impulse wheel are rotated forward by the subscriber, the impulse springs are not operated; but as the dial returns to normal position, said springs are separated momentarily a number of times corresponding to the digit called. The substation A is also provided with a coin-collecting device of the character hereinbefore described. The coin-collecting device is represented only diagrammatically in Fig. 6, the parts being numbered the same as in Figs. 1 and 2. The coils 11 and 12 are connected in one side of the line in series with the telephone. The springs 6, 7 and 8 are so arranged that when their contacts are closed, the transmitter 57 is short-circuited and the receiver 56 is shunted by the resistance 65. The springs 53 and 54 of the calling device form a short-circuit around the coil 66 of a buzzer which is included serially in one side of the line. The coil of the buzzer comprises two windings connected differentially, one of said windings, however, being short-circuited through the springs 67 and 68 when said coil is deënergized.

The line switch C and the master switch D are of the general type of line and master switches disclosed in British patent to R. W. James No. 26,301 of 1906, but of the particular form shown in British patent to T. G. Martin No. 1,419 of 1910.

The selector E is of the general type of selector switch shown in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson, the circuits being modified, however, as shown in British Patent No. 1,419 of 1910, referred to above, in order to operate in a system in which the central office apparatus is controlled by the calling subscriber over the two sides of the line in series.

The selector F is similar to the selector E, with the addition of the side switch wiper 132.

As the structure and operation of the line and master switches and the selectors are in general well known in the art, and are fully described in the publications hereinabove referred to, it is not thought necessary to describe the same in detail herein.

The connector H is of the general type of connector switches disclosed in United States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, but, like the selectors, is modified to operate in a two-wire system. Like the selectors, the connector is provided with a shaft (not shown) carrying the wipers 102, 103 and 104 and controlled by the vertical and rotary magnets 105 and 106, respectively. The usual side switch is controlled by the private magnet 107 in the usual manner. The line relay 108 is connected with the line through the springs of a reversing relay 109. At R there is shown a ringing current generator and at S a busy signaling machine is represented.

The substation A′ and the line switch C′ are identical with the substation A and the line switch C shown in Fig. 6. The oper-

ator's cord O and the manual substation A^2 (Fig. 9) may be of any suitable or approved type of manual apparatus. In the drawings a number of batteries B having one terminal grounded at G are represented. There need, however, be but one such battery, or, preferably, but one battery in each exchange, if there are more than one exchange.

Having given a general description of the apparatus, it will now be explained in detail how the subscriber at substation A may obtain connection with either an automatic line or a manual line, and how the coin-collecting device may be operated to collect the proper toll for the different kinds of calls. It will first be explained how the substation A is connected with the automatic substation A'. When the receiver at the calling substation A is removed from the switch hook preparatory to making a call, the talking circuit is bridged across the line, whereby a circuit is closed from ground G' through the springs 110 and 111, line 112, coils 12 and 11, transmitter 57, receiver 56, springs 61 and 62, hook switch springs 113 and 114, springs 53 and 54, line 115, springs 116 and 117 and the line winding 74 of the switch C to the battery lead 120, thence to the battery B and to ground G. The current through the coils 12 and 11 of the coin-collecting device is at this time in the proper direction to attract the armature toward the coil 12 to carry the arm 15 behind the lug 16 on the arm 9. The winding 74 of the switch C, upon energizing, closes the circuit of the operating winding 72, which causes said switch to operate to extend the line connection through the bank springs 78 and 79 and 80 and 81 to a first selector E, whereupon its line relay 98 becomes energized by reason of the closed bridge across the line at the substation. The relay 98, upon energizing, closes the circuit of the relay 99. The closure of the springs 121 of the relay 99 completes a circuit for the holding winding 73 of the line switch C and extends a guarding potential from the ground G^2 back through the switch C and over the conductor 123 to the connector private bank contacts of the calling line. When the calling subscriber operates his calling device for the first digit of the number of the called substation, which will be assumed to be 2220, the circuit of the selector line relay 98 is broken twice momentarily by the separation of the impulse springs 61 and 62 at the substation. The relay 99, and other relays similarly represented throughout the drawings, are slow acting—that is, slow to deënergize, so that they remain energized during the momentary interruptions of their circuits. Each time the line relay 98 is deënergized in response to the impulses from the substation, a circuit is closed through the vertical magnet 89. Since the digit called is 2, the vertical magnet 89 receives two impulses over this circuit and operates to raise the switch shaft and wipers two steps, after which the side switch passes to second position. The rotary magnet 90 then operates in the usual manner to rotate the wipers onto an idle trunk line, after which the side switch passes to third position, whereby the line connection is extended through the side switch wipers 91 and 92 and shaft wipers 86 and 87 to the conductors 128 and 129 leading to the second selector F. The line relay 130 of the selector F thereupon becomes energized in the same manner in which the relay 98 of the selector E was energized when connection was first extended to it.

When the substation calling device is operated for the second digit 2 of the called number, the second selector F operates in the same manner as explained for the selector E in connection with the first digit, to extend the connection over the trunk conductors 137 and 138 to an idle connector H. The line relay 108 of the connector thereupon becomes energized over the line circuit and closes an energizing circuit through the relay 139.

When the substation calling device is operated for the third digit 2, the line relay 108 of the connector is deënergized twice momentarily. Since the relay 139 is slow acting, the deënergizations of the relay 108 transmit two impulses over the circuit extending from ground G^7 through the spring 146 and its back contact, spring 147 and its front contact, relay 148, vertical magnet 105 and the side switch wiper 149 to the battery lead 120. Since the digit called is 2, the vertical magnet 105 receives two impulses over this circuit and operates to raise the wipers of the switch two steps to a position opposite the second level of bank contacts. The relay 148, which is included in the circuit of the vertical magnet, is energized by the first impulse and, being slow acting, remains energized until after the last impulse is delivered. In its energized position the relay 148 completes a circuit extending from ground G^8 through the private magnet 107 to the battery lead 120. The private magnet 107, upon deënergizing when its circuit is broken by the relay 148 after the last impulse is delivered to the vertical magnet, permits the side switch to pass from first to second position. The calling subscriber now operates his calling device for the last digit O, thereby causing the line relay 108 to deënergize ten times, each time closing a circuit extending from ground G^7 through the spring 146 and its back contact, spring 147 and its front contact, relay 148, springs 152 and 153, rotary magnet 106 and the side switch wiper 149 (in second position) to the battery lead 120. The rotary magnet operates in response to the ten impulses deliv-

ered over this circuit to rotate the wipers 102, 103 and 104 ten steps onto the contacts of the desired line No. 2220. The relay 148 operates in response to the impulses for this digit in the same manner as for the preceding digit to cause the private magnet to trip the side switch from second to third position after the last impulse has been delivered to the rotary magnet. The deënergization of the private magnet and the engagement of the side switch wiper 154 with its third-position contact point finally complete the connection through the wipers 102 and 103 with the called line. The side switch wiper 155, when in third position, completes an energizing circuit for the cut-off winding 156 of the switch C′ and extends a guarding potential to the connector private bank contacts of the called line.

The winding 156, upon energizing, attracts the armature 157, which operates to disconnect the switch C′ from the called line and to close the contact 158 in the talking circuit. The engagement of the side switch wiper 149 of the connector with its third-position contact point completes a circuit extending from ground G^{10} through the interrupter 159, ringing relay 160, springs 161 and 162 and the side switch wiper 149 to the battery lead 120. The ringing relay 160, upon energizing, operates to disconnect the calling line from the called line and to signal the called subscriber. Since the circuit of the ringing relay 150 includes the interrupter 159, said relay is energized only intermittently so as not to ring the called subscriber continuously. It will be seen that the current which flows through the windings 12 and 11 of the coin-collecting device at the calling substation in series with the windings of the line relay 108 of the connector after the connection is extended thereto is in the same direction as the original current which flows through said windings in series with the line relay of the switch C when the receiver is first removed from the switch hook. Therefore, during the entire operation of setting up the connection the armature 14 remains attracted toward the coil 12. When the calling subscriber removes his receiver in response to the call, or as soon thereafter as the ringing relay 160 deënergizes, if it happens to be energized at the time, the called substantion is provided with talking current over a circuit extending from ground G^9 at the connector through the side switch wiper 155, lower winding of the relay 165, ringing relay springs 167 and 166, side switch wiper 154, shaft wiper 103, thence to and through the substation A′ and back over the other side of the line through the shaft wiper 102, springs 168 and 169, springs 170, upper winding of the relay 165 and the side switch wiper 149 to the battery lead 120. The relay 165 is energized by this talking current and closes a circuit extending from ground G^9 through the side switch wiper 155, relay 109 and the springs 171 to the battery lead 120. The relay 109, upon energizing, opens the circuit of the ringing relay 160 and closes a locking circuit for itself to battery by way of the springs 172 and 162 and the side switch wiper 149. The shifting of the springs 173 and 174 upon the energization of the relay 109 transposes the connections between the windings of the relay 108 and the trunk conductors 137 and 138, thereby reversing the direction of current flowing in the calling line. This reversal of the current in the calling line causes the armature 14 of the coin-collecting device to be attracted downward toward the coil 11, and, since the arm 15 is behind the lug 16, this operation of the armature 14 closes the contact between the springs 6, 7 and 8, thereby short-circuiting the transmitter 57 and shunting the receiver 56 by the resistance 65. This short-circuiting of the receiver and transmitter renders the calling substantion inoperative for talking, but the calling subscriber can hear the called subscriber answer owing to the fact that the receiver is not completely short-circuited, but is only shunted by the resistance 65. In order to converse with the called substation the calling subscriber must cause the springs 6, 7 and 8 to be separated, and this can be done only by depositing a coin in the coin-collecting device. The charge for automatic calls is preferably that corresponding to the coin of the smallest denomination for which any of the coin chutes are intended. As has been explained, when a coin is deposited in any of the chutes and the lever 19 is pulled down and permitted to return to normal position, the springs 54 and 53 are opened at least once and the lever 55 raises the end of the lever 9 momentarily one or more times. The separation of the springs 54 and 53 at this time is without any particular function. The tipping up of the lever 9, however, releases said lever from the arm 15 and permits the springs 6, 7 and 8 to return to their normal disengaged positions, whereby the calling substation is rendered operative and the calling and called subscribers may carry on an uninterrupted conversation over the calling circuit represented by the heavy lines in Figs. 6, 7 and 8.

Upon the completion of the conversation the entire connection is automatically released by the hanging up of the receiver at the calling substation. During the time the conversation is being carried on the circuits of the release magnets of the switches H, F and E are held open by the relays 139, 131 and 99, which are energized over a circuit extending from ground G^7 at the connector through the spring 146 of the line relay 108

and its front contact and thence through the relays 139, 131 and 99 in multiple to the battery lead 120. The hanging up of the receiver at the substation A permanently breaks the circuit of the connector line relay 108. The relay 108, upon deënergizing, opens the holding circuits of the release relays 139, 131 and 99 of the switches H, F and E, respectively. These relays, upon deënergizing, close the circuits of their respective release magnets 175, 177 and 196, which, upon energizing, immediately restore the shafts and side switches of their respective switches to normal position. The switch shafts, upon reaching their lowest positions, separate their respective off-normal springs to permit the release magnets to deënergize. The deënergization of the relay 99 of the selector E also opens the holding circuit of the holding winding 73 of the line switch C and permits its plunger to be restored to normal position, thereby leaving all of the apparatus employed in the connection in its normal position.

It having been explained how the subscriber at substation A may obtain connection with an automatic substation, and how the coin-collecting device requires the calling subscriber to deposit a coin before he can carry on a conversation, it will now be explained how the subscriber at an automatic substation A may obtain connection with a manual substation A^2 through the medium of an operator's cord circuit O, and how the operator may require the calling subscriber to deposit coins of different denominations for calls for which different rates are charged, and how, through the medium of the coin-collecting device, the operator is notified whether or not the calling subscriber has deposited the proper coin or coins. In the system shown herein it is assumed that to a certain level of the banks of the first selectors E there are connected trunk lines which terminate in jacks J′ (Fig. 9) on a manual switchboard. When the calling subscriber wishes to call the manual subscriber A^2 he removes his receiver and operates his calling device for the digit corresponding to the first selector bank level to which the manual trunk lines are connected. The first selector E operates in the manner already described to connect the calling line with the trunk conductors 178 and 179 leading to the jack J′. A circuit is thereupon closed from ground G^{11} through the left-hand winding of the relay 181, contact 182, trunk conductor 179, thence to and through the substation A and back over the other side of the line through the trunk conductor 178, contact 183 and the right-hand winding of the relay 181 to the battery lead. The relay 181, upon energizing, closes the circuit of the line lamp 184 and completes a holding circuit for the release relay 99 of the selector E. The circuit of the relay 99 extends from ground G^{11} through the contact 185, conductor 180, private wiper 187 and thence to and through the relay 99. The operator, upon seeing the signal of the lamp 184, inserts the plug P′ into the jack J′, whereupon the line is connected with the cord O and a circuit is closed from ground G^{12} through the relay 187, sleeve conductors of the plug P′ and the jack J′ and cut-off relay 188 to the battery B. The relay 188, upon energizing, cuts off the line relay 181 and connects the ground G^{13} with the release relay 99 of the selector E to maintain said relay energized after ground G^{11} is cut off by the deënergization of the line relay 181. After the line relay 181 is disconnected from the line, the calling substation is provided with talking current through the supervisory relay 190 of the cord circuit. The operator now operates the key K to connect her talking set T with the cord to inquire of the calling subscriber the station desired. The operator completes the connection with the line called for by inserting the plug P^2 into the jack J^2 and operating the ringing key K′ to signal the called subscriber in the usual manner. After the called subscriber has answered, the operator again operates the key K to connect her talking set with the line and requests the calling subscriber to deposit a coin of the proper denomination in the coin-collecting device. As has been explained, if a coin is deposited in the slot 3 (Fig. 3) and the lever 19 is pulled down, the springs 53 and 54 will be separated once. If a coin is deposited in the slot 4, the said springs will be opened twice, and if the coin is deposited in the slot 5, the springs will be separated three times. Referring to Fig. 6, it will be seen that when the springs 53 and 54 are separated, the short-circuit is removed from the buzzer coil 66, and since one winding of the coil is normally short-circuited through the springs 67 and 68, said coil will be energized; but as soon as the springs 67 and 68 are separated by the attraction of the armature of the coil, the short-circuit is removed from the upper winding and, since the coil is differentially wound, the current in the upper coil equalizes the current in the lower coil and the armature drops back to again permit the springs 67 and 68 to close. It will therefore be seen that as long as the springs 53 and 54 are open, the coil 66 will operate as a buzzer, but during its operation it does not open the line circuit so as to interfere with the energization of any relays which are energized over the line. The operations of the buzzer produce a buzzing sound in the operator's receiver. Therefore, if the operator hears one buzz after requesting the calling subscriber to deposit the coin, she knows the coin has been

deposited in the slot 3, or two buzzes indicate that the coin has been deposited in the slot 4, while three buzzes indicate that the coin has been deposited in the slot 5. The operator is therefore enabled to ascertain whether or not the calling subscriber has deposited the coin which he has been requested to deposit. After the conversation is completed the operator is given the usual disconnect signal by the hanging up of the receiver at the calling and called substations, and she thereupon removes the plugs P′ and P^2 in the usual manner. The removal of the plug P′ from the jack J′ permits the cut-off relay 188 to deënergize, which disconnects ground G^{13} from the release relay 99 of the selector E, which deënergizes and causes the automatic part of the connection to be released in a manner which has already been described.

As shown in Fig. 6, the circuit arrangement is such that when the springs 6, 7 and 8 are brought into contact by the operation of the polarized magnet of the coin-collecting device, the transmitter is completely short-circuited, but the receiver is simply shunted by the resistance 65. This arrangement is very simple, but is not entirely without objection owing to the fact that it does not entirely preclude the possibility of the calling subscriber talking through his receiver. In Figs. 10, 11, 12 and 13 there are shown a number of arrangements by which this objection may be removed. The receiver shown herein is assumed to be of the series type—that is, a receiver without a permanent magnet and which is dependent for its energization upon current received over the line from the central office battery. Such a receiver, when not energized by direct current, is susceptible to a certain extent to alternating voice currents and will operate as a receiver, but will not act as a transmitter to transmit voice-currents in response to words spoken into it. This fact is made use of in the arrangements shown in Figs. 10, 11, 12 and 13, in which the circuit connections are such that when the current is reversed in the calling line by the response of the called subscriber, the receiver of the calling line is placed in such relation to the line that it may receive voice-currents, but cannot receive any battery current from the line. The calling telephone is thereby rendered entirely inoperative for talking, but is left operative for hearing the called subscriber. The same reference numerals, as far as possible, have been used in Figs. 10, 11, 12 and 13 as are used in Fig. 6.

In Fig. 10 the normal circuit through the substation extends from the line 112 through the coils 12 and 11, springs 7 and 8, receiver 56 and transmitter 57 to the line 115. When the current in the line is reversed upon the response of the called subscriber, the spring 7 is shifted out of contact with the spring 8 and into engagement with the spring 6, whereby the circuit for direct current through the receiver and transmitter is broken and the coils 12 and 11 are bridged across the lines through the resistance 65. Although the circuit through the receiver is broken so far as direct current is concerned, it still remains intact for voice currents which flow through the condenser 205.

In Fig. 11 the arrangement is the same as in Fig. 10 except that the resistance 65 is replaced by a short-circuiting buzzer 65^a. This buzzer begins to operate as soon as it is bridged across the line through the coils 11 and 12 and notifies the calling subscriber that the called subscriber has removed his receiver without the necessity of waiting for a verbal response. In addition to the buzz caused directly by the vibrations of the armature of the buzzer, fluctuations of current are also set up through the receiver, which produce a buzzing sound therein.

In Fig. 12 the two windings of an induction coil are connected serially in the line. When the polarized magnet of the coin-collecting device is operated to close the contact between the springs 6 and 7, all direct current is shunted from the receiver and transmitter and they are included in a local circuit which is inductively connected with the line circuit through the two windings of the induction coil.

The arrangement in Fig. 13 is the same as that in Fig. 12 with the addition of two springs 6^a and 7^a which normally short-circuit the induction coil 206.

It is sometimes desirable to have the springs which render the calling telephone inoperative when the called subscriber answers situated in the telephone itself instead of in the coin-collecting box. This may be done, as shown in Fig. 14, by placing the telephone-shunting springs which correspond to the springs 6, 7 and 8 in Fig. 6 under the control of an auxiliary relay 207. This relay is inserted in the line circuit, but is normally short-circuited by the springs 6 and 7. When the called subscriber answers, the magnet in the coin-collecting box operates to separate the springs 6 and 7 to remove the short-circuit from the relay 207. The relay 207, upon energizing, operates to shunt the telephone. Although, as shown, the relay 207 shunts the telephone in the same manner in which this is done by the springs 6, 7 and 8 in Fig. 6, any of the arrangements shown in Figs. 10, 11, 12 and 13 might be used in connection with the relay 207.

It will thus be seen that I have devised a very efficient pay-station device in which the calling telephone is rendered inoperative until after a coin has been deposited in the coin-collecting device, and in which a signal

is transmitted over the line circuit to the central operator when such is employed in extending a connection to indicate to such operator the character and denomination of the coin deposited.

While I have illustrated one particular embodiment of my invention, it is to be understood that I do not wish to be limited to the exact construction shown and described.

What I claim as my invention is:—

1. In a telephone system, a subscriber's line, a coin-collecting device on said line, a signal, a circuit including said line for operating said signal to indicate the denomination of a coin deposited in said device, and common battery means for supplying talking current to the line.

2. In a telephone system, a subscriber's line extending to the central office, a coin-collecting device on said line, a buzzer, a circuit including said line for operating said buzzer to indicate the denomination of a coin deposited in said device, and means for establishing a talking circuit over said line.

3. In a telephone system, a plurality of subscribers' lines, means including an operator's cord circuit for extending a connection between two of said lines, a coin-collecting device on one of said subscribers' lines, a signal, means for operating said signal over a line circuit in order to indicate to the operator the denomination of the coin deposited in said coin-collecting device, and common battery means for supplying talking current to the line.

4. In a telephone system, a subscriber's line, means including an operator's cord circuit for extending a connection from said subscriber's line to a second subscriber's line, a coin-collecting device on said first-mentioned line, a signal for indicating to the operator the denomination of the coin deposited in said coin-collecting device, a line circuit for controlling the operation of said signal and common battery means for supplying talking current to the line.

5. In a telephone system, a coin-collecting device having a plurality of coin chutes, a plurality of levers for closing said coin chutes, a pair of contact springs, means for operating said contact springs a certain number of times when a coin is deposited in one of the chutes, and for then opening the chutes to allow the coin to be collected, and a signal controlled by the operation of said contact springs.

6. In a telephone system, a subscriber's line, a coin-collecting device on said line, a plurality of coin chutes for said coin-collecting device, a plurality of levers, one for each coin chute, for closing the corresponding chute, a pair of contact springs, means for operating said contact springs a certain number of times when a coin it deposited in one of said chutes, means for then opening the chutes to allow the coin to be collected, and means controlled by said contact springs for transmitting a signal over said subscriber's line.

7. In a telephone system, a subscriber's line, a coin-collecting device on said line, a plurality of coin chutes for said coin-collecting device, a plurality of levers, one for each coin chute, for closing the corresponding chute, a pair of contact springs, means for operating said contact springs a certain number of times when a coin is deposited in one of said chutes, the operation of said contact springs being varied in accordance with the chute in which the coin is deposited, means for then opening the chutes to allow the coin to be collected, and means controlled by said contact springs for transmitting a signal over said subscriber's line.

8. In a telephone system, a subscriber's line, a coin-collecting device on said line having a plurality of coin chutes, a plurality of levers for closing said chutes, a pair of contact springs, a plurality of cam wheels and levers associated therewith for operating said contact springs a certain number of times when a coin is deposited in one of the chutes, and to then open the chutes to allow the coin to be collected, and a signal transmitted over the line circuit controlled by the operation of said contact springs.

9. In a telephone system, a plurality of subscribers' lines, semi-automatic and automatic means for establishing a connection between two of said lines, a coin-collecting device, means for automatically requiring a coin to be deposited before conversation can be carried on over an automatic connection, and means for notifying an operator of the denomination of the coin deposited in a semi-automatic connection.

10. In a telephone system, a plurality of subscribers' lines, automatic switches for establishing automatic connection between one of said subscribers' lines and a second line, a coin-collecting device on one of said lines, means for rendering said connection inoperative for talking purposes until after a coin has been deposited in said coin-collecting device, an operator's cord circuit, means including said operator's cord for establishing a connection between said first-mentioned line and a third line, a signal for indicating to the operator the denomination of the coin deposited in said coin-collecting device, and a circuit including a subscriber's line for operating said signal.

11. In a telephone system, a plurality of subscribers' lines, automatic switches for extending a connection between two of said lines, a coin-collecting device on the calling line, means operative upon the response of the called subscriber for rendering the talk-

ing circuit inoperative, and a lever for said coin-collecting device adapted to be rotated by the calling subscriber after a coin has been deposited to restore the talking circuit to operative condition.

12. In a telephone system, a plurality of subscribers' lines, automatic switches for extending a connection between two of said lines, a coin-collecting device on the calling line, means operative upon the response of the called subscriber for rendering the talking circuit inoperative, and a lever for said coin-collecting device adapted to be operated by the calling subscriber after a coin has been deposited to restore the talking circuit to operative condition.

13. In a telephone system, a subscriber's line, a coin-collecting device on said line, a plurality of coin chutes, and a differentially-wound buzzer adapted to transmit a signal over said line to indicate the chute in which a coin is deposited.

14. In a telephone system, a subscriber's line, a coin-collecting device on said line having a plurality of coin chutes, a plurality of coin wheels, one corresponding to each chute, means for operating said wheels, a pair of contact springs controlled by said coin wheels and adapted to be operated one or more times, dependent upon the chute in which a coin is deposited, and a signal controlled by said contact springs.

15. In a telephone system, a subscriber's line, a coin-collecting device on said line having a plurality of coin chutes, a differentially-wound buzzer, and means for operating said buzzer one or more times when a coin is deposited in one of said chutes to indicate the chute employed.

16. In a telephone system, a subscriber's line, a coin-collecting device, a signal, a pair of normally closed contact springs for short-circuiting said signal, and means for separating said springs to operate said signal when a coin is deposited in said coin-collecting device to indicate the value of the coin.

17. In a telephone system, a plurality of subscribers' lines, automatic selecting switches and an operator's cord circuit for extending a connection between two of said lines, a coin-controlled device on one of said subscribers' lines, and a signal for indicating to the operator the denomination of a coin deposited in said device.

18. In a telephone system, a plurality of subscribers' lines, automatic selecting switches and an operator's cord circuit for extending a connection between two of said lines, a coin-controlled device on one of said lines, a buzzer, and a circuit for operating said buzzer so as to indicate to the operator the denomination of the coin deposited in said coin-controlled device.

19. In a telephone system, a plurality of subscribers' lines, automatic selecting switches and a cord circuit for extending a connection between two of said lines, a coin-collecting device on one of said lines having a plurality of coin chutes, and a differentially-wound buzzer adapted to transmit a signal over said line to indicate the chute in which a coin is deposited.

20. In a telephone system, a plurality of subscribers' lines, means including an automatic switch and an operator's cord circuit for extending a connection between two of said lines, a coin-controlled device on said lines having a plurality of coin chutes, a differentially-wound buzzer, and means for operating said buzzer one or more times when a coin is deposited in one of said chutes to indicate the chute employed.

21. In a telephone system, a plurality of subscribers' lines, semi-automatic and automatic means for establishing a connection between two of said lines, a coin-collecting device, means for automatically requiring a coin to be deposited before conversation can be carried on over an automatic connection, and means for notifying an operator of the denomination of the coin deposited in a semi-automatic connection and for collecting said toll.

22. In a telephone system, a plurality of subscribers' lines, automatic switches for establishing automatic connection between one of said subscribers' lines and a second line, a coin-collecting device on one of said lines, means for rendering said connection inoperative for talking purposes until after a coin has been deposited in said coin-collecting device, an operator's cord circuit, means including said operator's cord for establishing a connection between said first-mentioned line and a third line, a signal for indicating to the operator the denomination of the coin deposited in said coin-collecting device, and a circuit including a subscriber's line for operating said signal and for collecting said toll.

23. In a telephone system, a plurality of subscribers' lines, automatic progressively movable switches for extending a connection between two of said lines, a coin-collecting device on the calling line, means operative upon the response of the called subscriber for rendering the talking circuit inoperative, and a lever for said coin-collecting device adapted to be rotated by the calling subscriber after a coin has been deposited to restore the talking circuit to operative condition and for collecting said toll.

24. In a telephone system, a plurality of subscribers' lines, automatic progressively movable switches for extending a connection between two of said lines, a coin-collecting device on the calling line, means operative upon the response of the called sub-

scriber for rendering the talking circuit inoperative, and a lever for said coin-collecting device adapted to be operated by the calling subscriber after a coin has been deposited to restore the talking circuit to operative condition and for collecting said toll.

Signed by me at Chicago, Cook county, Illinois, this 25th day of March, 1912.

JOHN ERICKSON.

Witnesses:
ARTHUR J. RAY,
ALBERT ANDERSEN.