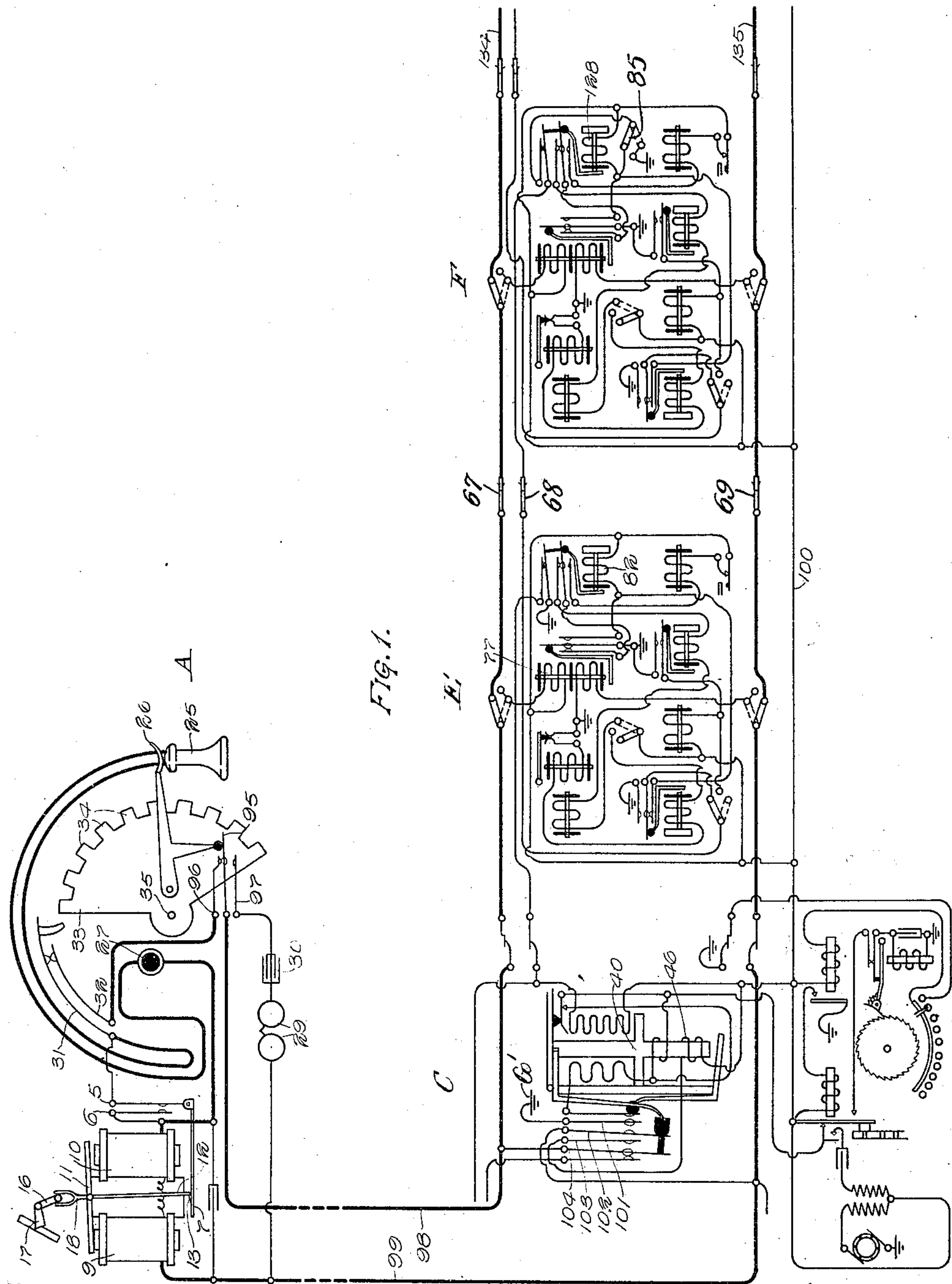


1,244,816.

B. D. WILLIS.
MEASURED SERVICE TELEPHONE SYSTEM.
APPLICATION FILED NOV. 22, 1911.

Patented Oct. 30, 1917.
3 SHEETS—SHEET 1.



WITNESSES

A. Andersen.

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INVENTOR:

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3 SHEETS—SHEET 2.

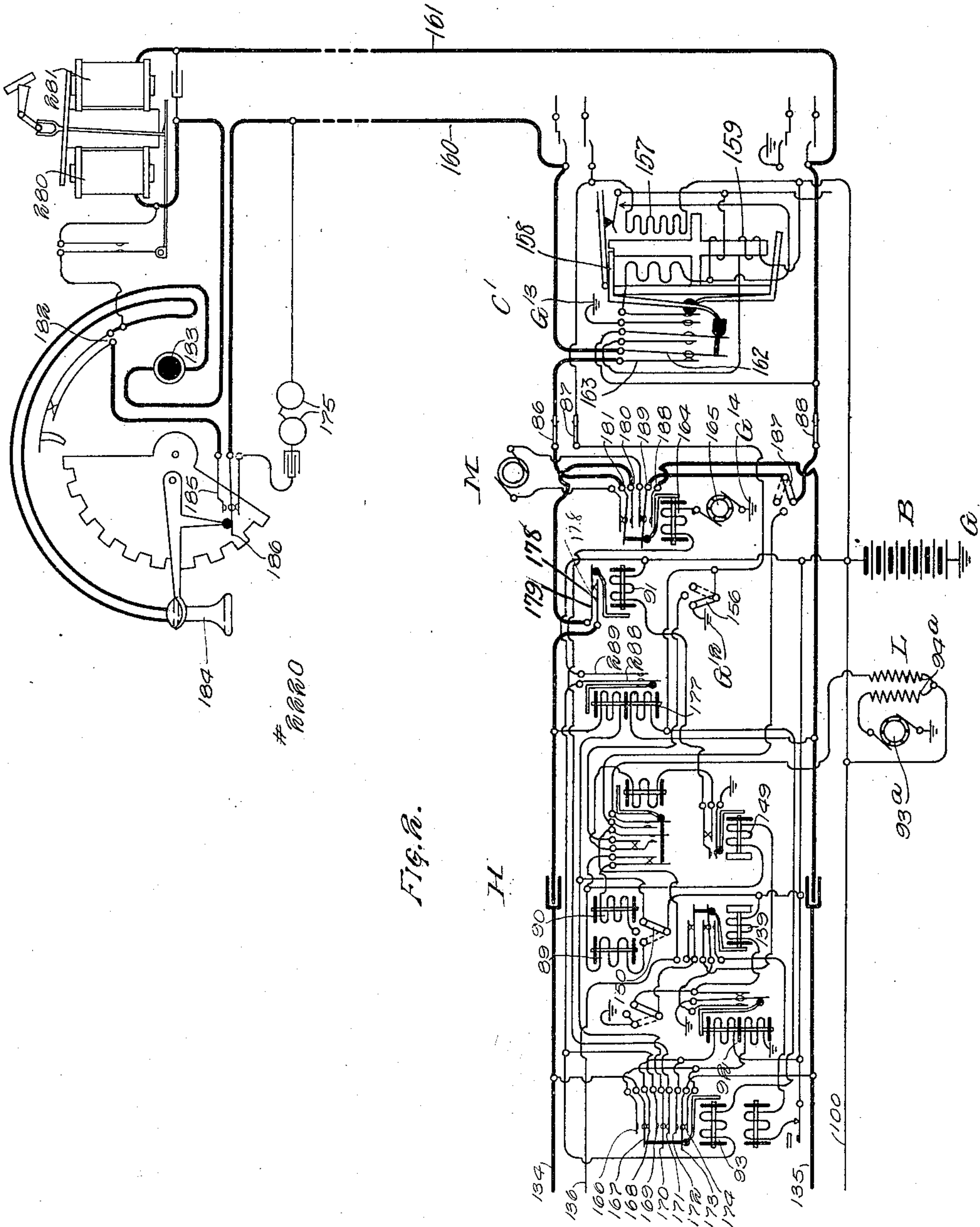


Fig. 2.

WITNESSES
A. Andersen.
A. J. Ray.

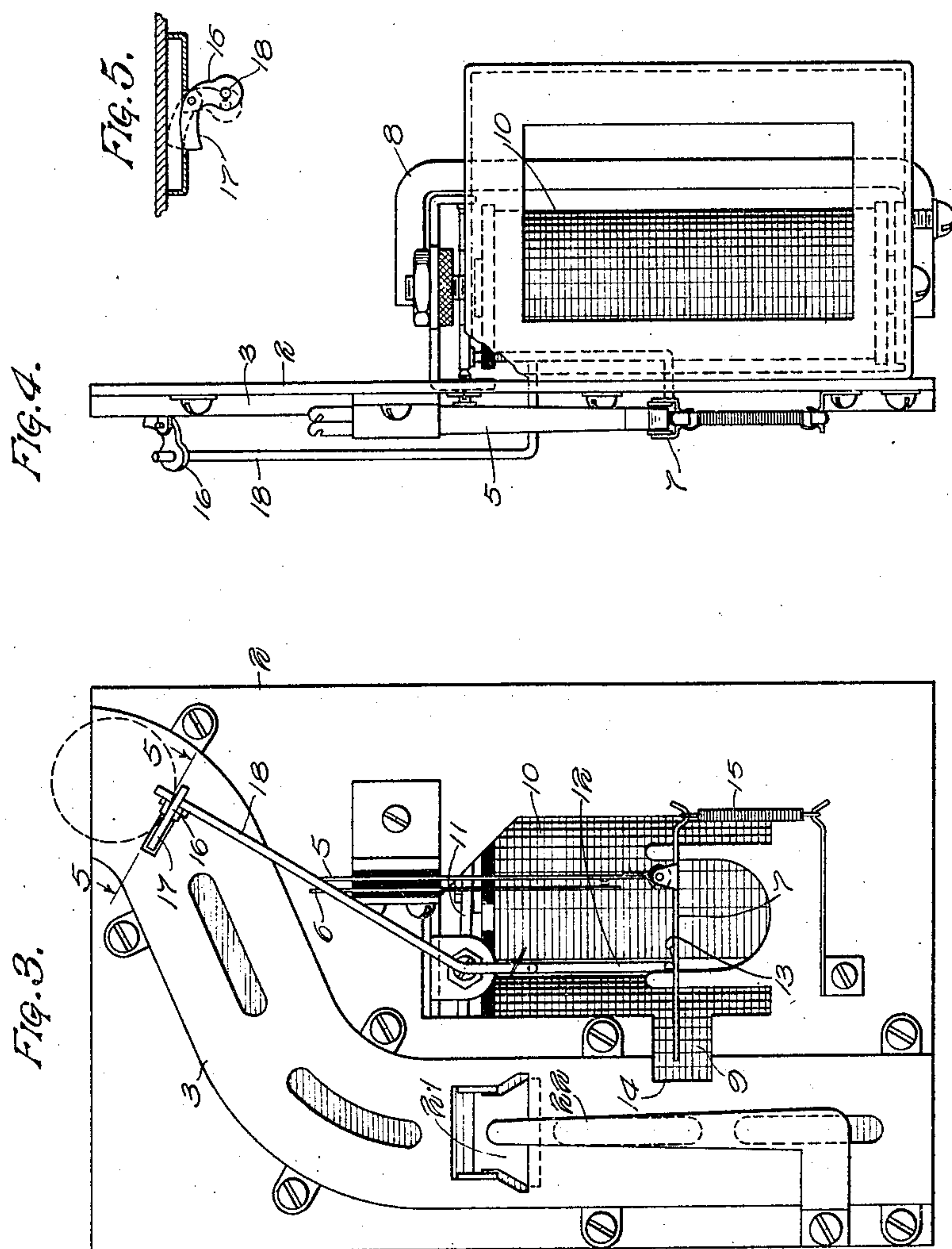
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3 SHEETS—SHEET 3.



WITNESSES
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MEASURED-SERVICE TELEPHONE SYSTEM.

1,244,816.

Specification of Letters Patent.

Patented Oct. 30, 1917.

Application filed November 22, 1911. Serial No. 661,764.

To all whom it may concern:

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

My invention relates to an improved measured service telephone system, and relates more particularly to an improved coin-collecting device and the method of operating the same in connection with an automatic telephone system.

It relates to a telephone system in which a connection is automatically established between a calling and a called subscriber by means of suitable automatic switches, and in which it is necessary for the calling subscriber to deposit a coin in the coin-collecting device before he can carry on a conversation with the called subscriber.

Heretofore, in systems of this general type, it has been customary to provide means whereby when the called subscriber answered he could be heard by the calling subscriber, but the calling subscriber could not converse with the called subscriber until after he had deposited a coin in the coin-collecting device. In such systems, when the calling subscriber heard the called subscriber answer, it was a signal for him to deposit a coin, which coin operated to render his telephone operative for conversational purposes. Such systems, however, have been found objectionable owing to the fact that a certain amount of time elapsed between the answering of the called subscriber and the time when the coin deposited by the calling subscriber rendered the system operative, so that the calling subscriber could talk to the called subscriber. During this interval of time the called subscriber was unable to hear the calling subscriber, and it has, therefore, been found that oftentimes the called subscriber would hang up his receiver before the calling subscriber had deposited a coin, thinking that he had been called by mistake. In order to obviate this difficulty I have provided a system in which the coin can be partially inserted within the coin-collecting device prior to the response of the called subscriber. The response of the called subscriber renders the calling subscriber's receiver and transmitter inoperative, but at the same time the coin

is released and allowed to pass into the coin-collecting device, at which time the coin operates to again render the calling transmitter and receiver operative for conversational purposes. In this manner there is no appreciable delay between the response of the called subscriber and the time when the coin renders the calling subscriber's telephone operative. If, however, no coin is deposited, the response of the called subscriber having rendered the calling subscriber's transmitter and receiver inoperative, it is impossible for a conversation to be carried on. In my improved system the coin can be partially deposited any time prior to the response of the called subscriber, but it is not necessary to deposit this coin before the calling device is operated to operate the automatic switches, as this calling device controls the switches entirely independently of the coin-controlled mechanism.

I have chosen to illustrate my invention in connection with an automatic system of the well-known type comprising line switches, which are individual to the calling subscriber's line, first and second selectors and connectors.

In the accompanying drawings Figures 1 and 2 represent a complete connection between a calling substation A (Fig. 1) and a called substation A' (Fig. 2) in a system embodying the principles of my invention. In Fig. 1 there is represented an automatic substation A to the line conductors of which there is allotted at the central office an individual or line switch C. At D there is shown a master switch for controlling a group of line switches C. The line switches of this group have common access to a number of trunk lines which lead to first selector switches E. A number of first selectors have common access to a number of second selectors F, which in turn have access to connector switches H (Fig. 2), by means of which connection may be completed with subscribers' lines.

Fig. 3 is a front view of my improved substation coin-collecting device.

Fig. 4 is a side elevation of the apparatus shown in Fig. 3.

Fig. 5 is a partial sectional view of the coin chute taken on the line 5—5 of Fig. 3.

I will first describe the construction and method of operation of the coin-collecting device. In Figs. 3 and 4, 2 represents a face

plate to the front surface of which there is attached a coin chute 3. Also upon the front of the plate 2, but insulated therefrom and from each other, there is mounted a pair of contact springs 5 and 6. The lower end of the spring 5 carries a swinging arm 7. Back of the plate 2 there is mounted a polarized electromagnet comprising a permanent magnet 8 and two coils 9 and 10. The armature 11 of the electromagnet is provided with a downwardly projecting arm 12. The lower end of the arm 12 is bent forward above the arm 7. When the armature 11 is attracted downward to the left, the lower end of the arm 12 is brought behind the lug 13 on the arm 7. If, now, the armature 11 be tipped downward to the right, the end of the arm 12 engages the small lug 13 and carries said arm 7 to the left. When the arm 7 is thus moved to the left, its left end projects into an opening 14 in the side of the coin chute, while the spring 5 is forced into engagement with the spring 6. If a coin be dropped down the chute while the arm 7 is in this position, the coin will strike the end of said arm 7, carrying the lug 13 out of engagement with the arm 12, whereby the springs 5 and 6 are permitted to separate. The spring 15 serves to hold the arm 7 in engagement with the arm 12 until the coin is deposited. After the arm 7 has been released it cannot be drawn over again until the electromagnet has been energized in the reverse direction to bring the arm 12 behind the lug 13 again.

Upon the front of the coin chute and near the top thereof there is pivotally mounted a small flat lever 16. The inner end 17 of this lever is adapted to swing through an opening in the front of the chute and form an obstruction therein to prevent a coin passing down. The end 18 of the lever is provided with an opening through which passes the end of a rod 18, the lower end of which rod is secured to the armature 11 of the electromagnet. The lever 16 is thus controlled by the electromagnet in such a manner that the coin chute is obstructed either when the armature of the magnet is in its neutral position or when it is attracted downward to the left. When the armature 11 is attracted downward to the right, the end 17 of the lever 16 passes entirely outside the coin chute, leaving it unobstructed. If a coin is placed in the chute when it is obstructed by the lever 16, the coin assumes the position shown by dotted lines in Fig. 3, with a portion thereof extending above the top of the chute, whereby it may be grasped and removed if desired.

Mounted in the front wall of the coin chute there is a gate 21, the lower end of which is forced against the back wall of the chute by the spring 22. When a coin passes down the chute it forces the gate out

and passes on with but little obstruction. If, however, a wire or anything of a similar nature should be inserted in the chute for the purpose of fraudulently operating the arm 7, the gate 22 acts as a clutch and seizes the wire when an attempt is made to withdraw it.

The automatic substations may be of any suitable or approved type. Those with which I have chosen to illustrate my invention, and as illustrated at A in Fig. 1, comprise the usual receiver 25, switch hook 26, transmitter 27, ringer 29 and condenser 30. In addition, the substation A is provided with the impulse springs 31 and 32 and an impulse wheel 33. The impulse wheel 33 carries upon its periphery the impulse teeth 34 and is secured to a shaft 35 to which there is also attached a dial (not shown) provided with finger holes, through the medium of which holes the impulse wheel may be rotated. As the impulse wheel is returned to normal position by a spring (not shown) after it has been rotated for any digit, each of the teeth 34 which passes the end of the spring 31 forces said spring out of engagement with the spring 32. The number of times these springs are separated depends upon the digit called. Connected to the line of the substation A there is also shown one of my improved coin-collecting devices. The coin-collecting device is represented only diagrammatically in Fig. 1 and the parts are designated by the same reference numerals as in Figs. 3 and 4.

The line switch C, which is individual to the line of substation A, and the master switch D are modified forms of the general type of line switch and master switch disclosed in British patent to R. W. James, No. 26,301 of 1906, being of the particular type, however, shown in British patent to T. G. Martin, No. 1419 of 1910.

The selector E is of the general type of selectors disclosed in United States Letters Patent No. 815,321, granted March 13, 1906, to Keith, Erickson and Erickson, being modified, however, as shown in the British Patent No. 1419 of 1910, above referred to, so as to operate in a two-wire system, *i. e.*, a system in which the central office apparatus is controlled from the calling substation 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 85.

As the specific structure of these line switches and first and second selectors forms no part of my present invention, it is not thought necessary to describe the same more in detail, as the construction and operation of the same are well known in the art.

The connector H is of the general type of connector switch disclosed in United

States Letters Patent No. 815,176, granted March 13, 1906, to Keith, Erickson and Erickson, but, like the selectors, is modified in order to operate in a two-wire system.

5 Like the selectors, the connector is provided with a shaft (not shown) carrying the wipers 86, 87 and 88, and is controlled by the vertical magnet 89 and the rotary magnet 90. The usual side switch is controlled

10 by the private magnet 91 in the usual manner. The line relay 92 is connected with the line conductors through the springs of a reversing relay 93. The connector is provided with a so-called back-bridge relay 177

15 through which the called substation is provided with talking battery current, and with a ringer relay through the medium of which ringing current may be applied to the called line after connection is completed therewith.

20 The substation A' and the line switch C' are similar to the substation A and the line switch C, respectively. At M there is shown a ringing current generator and at L a busy signaling machine comprising a circuit interrupter 93^a and an induction coil 94^a. For

25 operating the central office apparatus and for furnishing talking current, there is provided a battery B having one pole, preferably the positive, grounded at G.

30 Having given a general description of the apparatus, I will now explain the operations by which one subscriber establishes connection with another in a system embodying the principles of my invention. It will be explained how the substation A may obtain

35 connection with the substation A', the number of which is assumed to be 2220. When the calling subscriber removes his receiver preparatory to making a call, the switch hook rises, permitting the spring 95 to pass out of engagement with the spring 97 and

40 into contact with the spring 96, whereby the circuit of the ringer 29 and the condenser 30 is broken and a bridge consisting of the substation transmitter, the receiver and the

45 windings of the coin-collecting device is closed across the line conductors 98 and 99. The closure of this bridge across the line completes an energizing circuit through the line winding 46 of the switch C. This circuit extends from ground G' through the

50 springs 101 and 102, line 99, coils 9 and 10 of the coin-collecting device, transmitter 27, receiver 25, impulse springs 31 and 32, springs 96 and 95, line 98, springs 104 and 103 of the line switch C and the winding

55 46 of the magnet 40 to the battery lead 100. The current through the coils of the coin-collecting device at this time flows in such a direction as to attract the armature toward the coil 9, as shown in Fig. 1, thereby bringing the end of the arm 12 into engagement with the lug 13 on the arm 7. The energization of the winding 46 serves to operate the

60 line switch in the usual and well-known

manner to select an idle trunk extending to the first selector E.

The calling subscriber now operates his calling dial in the usual manner for the first digit 2 of the desired number. As the im-

70 pulse wheel 33 returns to normal position after being rotated for this digit, the impulse springs 31 and 32 are separated twice momentarily. Each time the springs 31 and 32 are separated, the energizing circuit of

75 the line relay 77 of the selector E is broken, allowing said relay to be momentarily de-energized. This operation of the line relay 77 operates to raise the switch wipers 67, 68 and 69 to a position opposite the second

80 level. These wipers are then rotated automatically to select the first idle trunk in this second level, which trunk leads to one of the second selectors F. Connection is thus extended to the second selector. The calling

85 subscriber now operates his calling device for the second digit 2. The second selector F operates in response to the impulses for this digit in the same manner as the selector E, and extends connection to an idle con-

90 nector H over the trunk lines 134 and 135.

The calling subscriber now operates his dial for the third digit 2, momentarily separating the impulse springs 31 and 32 in the same manner as described for the first digit.

95 Each time the impulse springs are separated for the third digit, the energizing circuit for the connector line relay 92 is broken momentarily. This operation of the line relay operates the connector in the well-known

100 manner to raise it up to the second level. The connector is then in position to receive impulses for the last digit 0. The operation of the substation calling device for this digit

105 breaks the energizing circuit of the relay 92 ten times. The rotary magnet 90 then receives ten impulses and operates to rotate the wipers ten steps onto the contacts of the line No. 2220. The private magnet relay 149 is

110 energized by the first impulse to the rotary magnet and again closes the circuit of the private magnet 91. The circuit of the relay 149 is not opened long enough to permit it to deenergize until after the last impulse

115 has been delivered to the rotary magnet. The relay 149 then deenergizes and breaks the circuit of the private magnet 91 which, if the called line is not already busy, in turn deenergizes and permits the side switch to

120 pass to third position, whereby connection is completed between the calling and called lines. The side switch wiper 156 (in third position) extends the guarding potential from ground G¹² through the private wiper

125 87 to the connector private bank contacts of the called line, and also provides an energizing circuit for the cut-off winding 157 of the line switch C'. The winding 157, upon energizing, attracts the armature 158, which operates to disconnect the line winding 159

130

and ground G^{13} from the called line, and to extend the line conductor 160 through the springs 162 and 163 to the connector bank contact which is engaged by the wiper 86.

5 When the side switch wiper 150 of the connector reaches third position, the energizing circuit is established for the ringer relay 164. This circuit extends from ground G^{14} through the interrupter 165, relay 164,

10 springs 171 and 170 and the side switch wiper 150 to the battery lead 100. Since this circuit includes the interrupter 165, the relay 164 is energized only intermittently. Each time the relay 164 is energized it op-

15 erates to disconnect the calling line from the called line and to bridge the generator M across the called line to ring the bell 175. When the called subscriber removes his receiver, or as soon thereafter as the relay 164

20 deenergizes, if it happens to be energized at the time, the called substation is provided with talking battery current from the central office. The circuit over which this talking current flows extends from ground G^{12}

25 to the side switch wiper 156, lower winding of the relay 177, ringer relay springs 188 and 189, side switch wiper 187, shaft wiper 88, line 161, coils 281 and 280 of the coin-collecting device, transmitter 183, receiver

30 184, impulse springs 182, hook switch springs 185 and 186, line 160, springs 162 and 163, shaft wiper 86, ringer relay springs 181 and 180, private magnet springs 179 and 178, upper winding of the back-bridge relay 177

35 and the side switch wiper 150 to the battery lead 100. The current through the coils 281 and 280 of the coin-collecting device at the substation A' is in such direction at this time as to attract the armature toward the coil

40 281. When the connector back-bridge relay 177 is energized by the talking current it operates to close the circuit through the relay 93. This circuit extends from ground G^{12} through the side switch wiper 156, relay 93

45 and springs 288 and 289 to the battery lead 100. The relay 93, upon energizing, operates to break the circuit of the ringer relay 164 at the springs 171 and 170, and to complete a locking circuit for itself through the

50 springs 170 and 169 and the side switch wiper 150. This locking circuit is independent of the springs 288 and 289 of the back-bridge relay 177. Consequently, the relay 93 will not deenergize and close the

55 circuit of the ringer relay 164 again in case the called subscriber should hang up his receiver and break the circuit of the back-bridge relay 177 before the calling subscriber has hung up his receiver. When the

60 relay 93 is energized it also operates to shift the springs 167 and 173 out of engagement with the springs 168 and 174 and into contact with the springs 166 and 172, respectively. By this operation the connections

65 between the windings of the relay 92 and

the trunk conductors 134 and 135 are interchanged. By this shifting of the connections of the relay 92 the current in the calling line is reversed. This reversal of the current causes the polarized relay of the 70 coin-collecting device at the substation A to attract its armature in the opposite direction—that is, toward the coil 10.

Some time before completing the call, preferably before beginning to operate the 75 calling device, the calling subscriber inserts a coin in the chute of the calling device. The coin is arrested by the lever 16 and remains in the position indicated by the dotted circle in Fig. 3 until the called 80 subscriber answers. It has been explained that when the called subscriber answers, the armature 11 of the coin-collecting device is attracted over toward the coil 10. When the armature is thus attracted, the arm 12 85 carries the arm 7 over so as to close the contact between the springs 5 and 6 and to cause the end of said arm 7 to project into the coin chute. At the same time the arm 18 moves the lever 16 so as to remove the 90 obstruction from the coin and allow it to pass on down the chute. When the coin reaches the arm 7 it releases it from the arm 12 and permits the springs 5 and 6 to separate. When the springs 5 and 6 are 95 brought into contact, the transmitter and receiver at the substation are short-circuited and rendered inoperative. Thus it will be seen that unless the calling subscriber de-

100 posits a coin to cause these springs to be separated, he will be unable to converse with the called subscriber. It will also be seen that through the medium of the lever 16 the calling subscriber is enabled to de-

105 posit the coin before the called subscriber answers, and said coin will be held in readiness to pass on down the chute and restore the calling telephone to operative condition immediately upon the removal of the re-

110 ceiver at the calling substation. If no response is received from the called line, the obstruction will, of course, not be removed from the coin, and the calling subscriber can simply remove it from the chute and is, therefore, not required to pay for a call 115 which is not answered.

After the conversation is completed, the release of the central office apparatus is initiated by the hanging up of the receiver at the calling substation. When the receiver 120 25 is restored to the switch hook 26, the springs 95 and 96 are separated, thereby breaking the energizing circuit through the connector line relay 92. The relay 92, upon deenergizing, breaks the holding circuits of 125 the release relays 139, 128 and 82 of the switches H, F and E, respectively, whereby they are released in the well-known manner.

The foregoing is an explanation of the manner in which connection is obtained 130

with an idle line. It will, of course, be understood that there is a guarding ground potential on the connector private bank contacts of a busy line. Thus if the wipers of the connector H are rotated onto the contacts of the busy line, a busy signal is transmitted back to the calling subscriber from the busy signaling machine L in a manner well understood in the art. The switches are then released in this position by the hanging up of the receiver at the calling substation in practically the same manner as when an idle line is called. It will be seen that when a busy line is called, the current in the calling line is not reversed. Therefore, the armature of the coin-collecting device at the substation A is not attracted toward the coil 10 to close the springs 5 and 6, but remains in the position shown in Fig. 1 until at some subsequent time an idle line is called from the substation A and the call is answered.

From the foregoing it will be seen that the calling subscriber's telephone is rendered inoperative upon the response of the called subscriber, but that if a coin has been deposited, said telephone will be again immediately rendered operative by said coin. Thus it is evident that no conversation can be carried on until after the calling subscriber has deposited a coin in the coin-collecting device. It will also be seen, however, that means are provided whereby the coin may be deposited in the device any time before the called subscriber answers, but the coin remains in a position from which it may be readily recovered by the depositor. Upon the response of the called subscriber the coin is immediately allowed to pass on down the chute and perform its function of rendering the calling telephone operative. Thus there is no delay between the time when the called subscriber answers and the time when the calling subscriber is able to talk, as there often is in cases where the calling subscriber does not deposit the coin until after he is notified in some manner that the called subscriber has answered.

A further advantage of my improved system is as follows: In telephone systems giving so-called measured service it is very often desired that no charge shall be levied for calling certain lines, such as lines which terminate at the central office over which operators or exchange attendants are called, etc. In the system shown herein it is very easy to provide for free service when certain lines are called. This may be done by making the lines which are to be called free of charge accessible from special connector switches. These special connectors may be similar in all respects to the connector H, with the exception that the line relay 92 should be connected with the trunk conductors 134 and 135 direct instead of through the springs of

the relay 93. In these special connectors the relay corresponding to the relay 93 would have no springs corresponding to the springs 166, 167, 168, 172, 173 and 174. Since the line relay of these connectors is permanently connected with the line conductors, the current in the calling line is not reversed upon the removal of the receiver at the called substation which has been called through one of these special connectors. Since the current in the calling line is not reversed, the calling telephone is not made inoperative and consequently it is not necessary for the calling subscriber to deposit a coin before he can talk. It is evident that if the subscriber does deposit a coin before making a free call, the coin will not pass beyond the control of the calling subscriber and may be readily recovered.

What I claim as my invention is:—

1. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, means operated upon the response of the called subscriber for rendering the transmitter and receiver on the calling line inoperative, and means under the control of the calling subscriber for thereafter rendering said transmitter and receiver operative.

2. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, means operated upon the response of the called subscriber for rendering the transmitter and receiver on the calling line inoperative, and coin-controlled means under the control of the calling subscriber for thereafter rendering said transmitter and receiver operative.

3. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, means operated upon the response of the called subscriber for short-circuiting the transmitter and receiver on the calling line to render the same inoperative, and means under the control of the calling subscriber for thereafter breaking said short-circuit to again render said transmitter and receiver operative.

4. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, means operated upon the response of the called subscriber for short-circuiting the transmitter and receiver on the calling line to render the same inoperative, and coin-controlled means under the control of the calling subscriber for thereafter breaking said short-circuit to again render said transmitter and receiver operative.

5. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for establishing a connection between said lines, a coin-collecting device and an impulse-transmitting device at the calling station, means for operating said impulse-transmitting device independently of said coin-collecting device for operating said switches, means for rendering the transmitter and receiver at the calling station inoperative upon the response of the called subscriber, and means controlled by said coin-collecting device for again rendering said transmitter and receiver operative.

6. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device and to render said talking equipment inoperative for talking.

7. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein and to render said talking equipment inoperative for talking.

8. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending the connection between said lines, means operated upon the response of the called subscriber for reversing the current upon the calling subscriber's line to render the transmitter and receiver thereon inoperative, and subscriber-controlled means for thereafter rendering said transmitter and receiver again operative.

9. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending the connection between said lines, means operated upon the response of the called subscriber for reversing the current upon the calling subscriber's line to render the transmitter and receiver thereon inoperative, and coin-controlled means for thereafter rendering said transmitter and receiver again operative.

10. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between

said lines, a coin-collecting device on the calling line including a coin chute, a stop normally preventing a coin from passing down said chute, a magnet for controlling said stop, and means for reversing the current through said magnet upon the response of the called subscriber to remove said stop to permit the coin to pass down said chute and be collected and to render said talking equipment inoperative for talking.

11. In a measured service telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a coin-collecting device on said calling line including a coin chute, a stop normally preventing a coin from passing down said chute, an arm carrying said stop, an electromagnet for operating said arm, means operated upon the response of the called subscriber for reversing the current through said magnet to operate said arm to remove said stop and thus permit the coin to pass down said chute, means operated by said arm for short-circuiting the transmitter and receiver on the calling line, and means operated by the coin passing down said chute for breaking said short-circuit to again render said transmitter and receiver operative.

12. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated upon the response of the called subscriber for rendering the transmitter and receiver on the calling line inoperative, and means under the control of the calling subscriber for thereafter rendering said transmitter and receiver operative.

13. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated upon the response of the called subscriber for rendering the transmitter and receiver on the calling line inoperative, and coin-controlled means under the control of the calling subscriber for thereafter rendering said transmitter and receiver operative.

14. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated

upon the response of the called subscriber for short-circuiting the transmitter and receiver on the calling line to render the same inoperative, and means under the control of the calling subscriber for thereafter breaking said short-circuit to again render said transmitter and receiver operative.

15. In a measured service telephone system, a calling and a called subscriber's line, means including automatic trunk-selecting switches for extending a connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated upon the response of the called subscriber for short-circuiting the transmitter and receiver on the calling line to render the same inoperative, and coin-controlled means under the control of the calling subscriber for thereafter breaking said short-circuit to again render said transmitter and receiver operative.

16. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, a coin-collecting device on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein.

17. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending the connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated upon the response of the called subscriber for reversing the current upon the calling subscriber's line to render the transmitter and receiver thereon inoperative, and subscriber-controlled means for thereafter rendering said transmitter and receiver again operative.

18. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending the connection between said lines, an impulse transmitter for transmitting impulses over two sides of the calling line in series for controlling the operation of said switches, means operated upon the response of the called subscriber for reversing the current upon the calling subscriber's line to render the transmitter and receiver thereon inoperative, and coin-controlled means for thereafter rendering said transmitter and receiver again operative.

19. In a measured service telephone sys-

tem, a calling and a called subscriber's line, means including automatic switches for establishing a connection between said lines, a coin-collecting device and an impulse-transmitting device at the calling station, means for operating said impulse-transmitting device independently of said coin-collecting device for transmitting impulses over two sides of the calling line in series for operating said switches, means for rendering the transmitter and receiver at the calling station inoperative upon the response of the called subscriber, and means controlled by said coin-collecting device for again rendering said transmitter and receiver operative.

20. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for establishing a connection between said lines, a coin-collecting device and an impulse-transmitting device at the calling station, means for operating said impulse-transmitting device independently of said coin-collecting device for transmitting impulses over two sides of the calling line in series for operating said switches, means for partially inserting a coin in said device prior to the response of the called subscriber, and means for collecting said coin when the called subscriber responds.

21. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including an automatic switch for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device and to render said talking equipment inoperative for talking.

22. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein and to render said talking equipment inoperative for talking.

23. In a telephone system, a calling and a called subscriber's line, means for establishing a connection between said lines, a coin-collecting device on the calling line, means for partially inserting a coin in said device before the called subscriber answers, and means controlled by the response of the called subscriber for first rendering the telephone of the calling subscriber inoperative and for then rendering it again operative if

the calling subscriber has partially inserted the coin in the coin-collecting device.

24. In a telephone system, a calling and a called subscriber's line, means including an automatic switch for establishing a connection between said lines, a coin-collecting device on the calling line, means for partially inserting a coin in said device before the called subscriber answers, and means controlled by the response of the called subscriber for first rendering the telephone of the calling subscriber inoperative and for then rendering it again operative if the calling subscriber has partially inserted the coin in the coin-collecting device.

25. In a measured service telephone system, a calling and called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line operative in one direction by the operating current, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said device in the other direction to collect a coin deposited therein and to render said talking equipment inoperative for talking.

26. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line operative in one direction by the operating current, means under the control of the called subscriber for operating said device in the other direction to render the transmitter and receiver of the calling line inoperative, and means under the control of the calling subscriber for thereafter rendering said transmitter and receiver operative.

27. In a telephone system, automatic progressively movable apparatus for extending a talking connection from a calling line to a called line, an impulse sender and talking equipment for the calling line, a central battery for operating and talking purposes, said automatic switches provided with means responsive to impulses from said battery and controlled by said impulse sender over the two sides of the talking circuit in series, and a toll device having a magnet responsive to the talking current to prevent the subscriber from making a call without charge by changing the circuits of the talking equipment of said calling line to render the same inoperative for transmitting and receiving purposes.

28. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said

magnet controlled by current in one direction, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device, and to thereafter render said equipment operative for talking.

29. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line, said device controlled by current in one direction, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein, and to thereafter render said equipment operative for talking.

30. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line including a coin chute, a stop normally preventing a coin from passing down said chute, a magnet for controlling said stop, said magnet controlled by current in one direction and means for reversing the current through said magnet upon the response of the called subscriber to remove said stop to permit the coin to pass down said chute and be collected and to thereafter render said equipment operative for talking.

31. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including an automatic switch for extending a connection between said lines, a coin collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled by current in one direction, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device and to thereafter render said equipment operative for talking.

32. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line controlled by current in one direction, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein and to thereafter render said equipment operative for talking.

33. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between

said lines, a coin-collecting device on the calling line operative in one direction by the operating current, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said device in the other direction to collect a coin deposited therein and to thereafter render said equipment operative for talking.

34. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled by current in one direction, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device, said magnet also for rendering said talking equipment inoperative when energized by said reversal of current and for rendering said equipment operative when the coin is collected.

35. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line, said device controlled by current in one direction, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein said magnet also for rendering said talking equipment inoperative when energized by said reversal of current and for rendering said equipment operative when the coin is collected.

36. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line including a coin chute, a stop normally preventing a coin from passing down said chute, a magnet for controlling said stop, said magnet controlled by current in one direction, and means for reversing the current through said magnet upon the response of the called subscriber to remove said stop to permit the coin to pass down said chute and be collected, said magnet also for rendering said talking equipment inoperative when energized by said reversal of current and for rendering said equipment operative when the coin is collected.

37. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including an automatic switch for extending a connection between said lines, a

coin-collecting device on said calling line, a magnet for controlling the operation of said coin collecting device, said magnet controlled by current in one direction, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device, said magnet also for rendering said talking equipment inoperative when energized by said reversal of current and for rendering said equipment operative when the coin is collected.

38. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line controlled by current in one direction, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein, said means also for rendering said talking equipment inoperative when operated by said reversal of current and for rendering said equipment operative when the coin is collected.

39. In a measured service telephone system, a calling and called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line operative in one direction by the operating current, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said device in the other direction to collect a coin deposited therein, said means also for rendering said talking equipment inoperative when operated by said reversal of current and for rendering said equipment operative when the coin is collected.

40. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled over two sides of the talking circuit in series by current in one direction to affect the talking equipment on the calling line, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device and to restore said equipment.

41. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line, said magnet controlled over the two sides of

the talking circuit in series by current in one direction to affect the talking equipment on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein and to restore said equipment.

42. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line including a coin chute, a stop normally preventing a coin from passing down said chute, a magnet for controlling said stop, said magnet controlled over two sides of the talking circuit in series by current in one direction to affect the talking equipment on the calling line, and means for reversing the current through said magnet upon the response of the called subscriber to remove said stop to permit the coin to pass down the chute and be collected and to restore said equipment.

43. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means including an automatic switch for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled over two sides of the talking circuit in series by current in one direction to affect the talking equipment on the calling line, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device and to restore said equipment.

44. In a measured service telephone system, a calling and a called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line, said magnet controlled over two sides of the talking circuit in series by current in one direction to affect the talking equipment on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein and to restore said equipment.

45. In a measured service telephone system, a calling and called subscriber's line, talking equipment for each of said lines, means for extending a connection between said lines, a coin-collecting device on the calling line operative in one direction by the operating current to affect the talking equipment on the calling line, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said device in the other

direction to collect a coin deposited therein and to restore said equipment.

46. In a measured service telephone system, a calling and a called subscriber's line, means for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled by current in one direction to hold the coin accessible to the subscriber whereby he may remove the same without actuating said magnet, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device.

47. In a measured service telephone system, a calling and a called subscriber's line, means including automatic switches for extending a connection between said lines, a coin-collecting device on the calling line, said device controlled by current in one direction to hold the coin accessible to the subscriber whereby he may remove the same without actuating said magnet, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said coin-collecting device to collect a coin deposited therein.

48. In a measured service telephone system, a calling and a called subscriber's line, means for extending a connection between said lines, a coin-collecting device on the calling line including a coin chute, a stop normally preventing a coin from passing down said chute, a magnet for controlling said stop, said magnet controlled by current in one direction to hold the coin for the subscriber, and means for reversing the current through said magnet upon the response of the called subscriber to remove said stop to permit the coin to pass down said chute and be collected.

49. In a measured service telephone system, a calling and a called subscriber's line, means including an automatic switch for extending a connection between said lines, a coin-collecting device on said calling line, a magnet for controlling the operation of said coin-collecting device, said magnet controlled by current in one direction to hold the coin for the subscriber, and means for reversing the current through said magnet upon the response of the called subscriber to collect the coin deposited in said device.

50. In a measured service telephone system, a calling and a called subscriber's line, means for extending a connection between said lines, a coin-collecting device on the calling line, controlled by current in one direction to hold the coin for the subscriber, and means operated upon the response of the called subscriber for reversing the flow of current on the calling line to operate said

coin-collecting device to collect a coin deposited therein.

51. In a measured service telephone system, a calling and called subscriber's line, means for extending a connection between said lines, a coin-collecting device on the calling line operative in one direction by the operating current to hold a coin deposited therein for the subscriber, and means operated upon the response of the called sub-

scriber for reversing the flow of current on the calling line to operate said device in the other direction to collect said coin.

Signed by me at Chicago, Cook county, Illinois, this 16th day of November, 1911. 15

BERNARD D. WILLIS.

Witnesses:

ARTHUR J. RAY,
E. D. FALES.

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