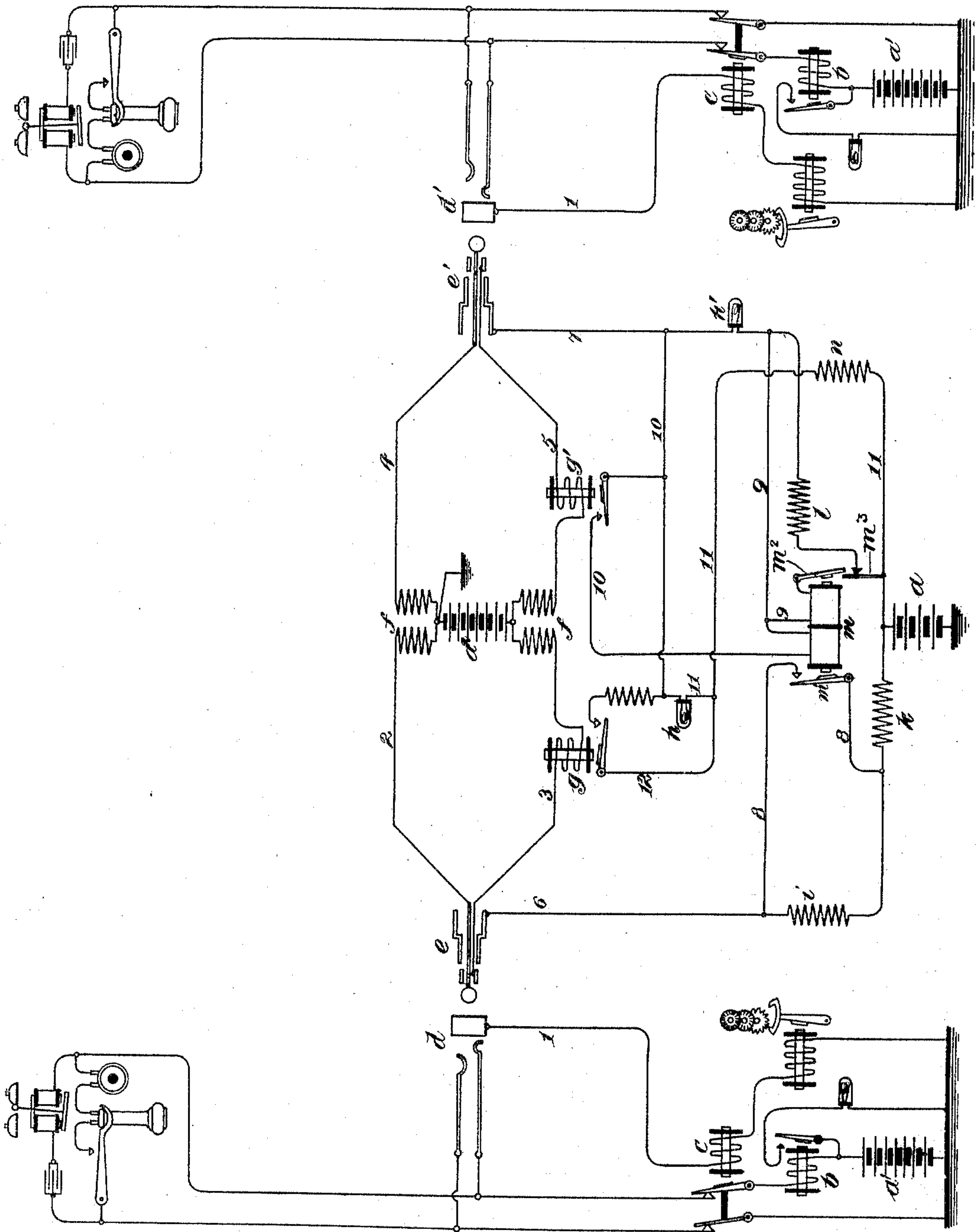


No. 777,217.

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F. R. McBERTY.  
TELEPHONE SERVICE METER.  
APPLICATION FILED APR. 16, 1900.

NO MODEL.



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# UNITED STATES PATENT OFFICE.

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## TELEPHONE SERVICE-METER.

SPECIFICATION forming part of Letters Patent No. 777,217, dated December 13, 1904.

Application filed April 16, 1900. Serial No. 13,010. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK R. McBERTY, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Telephone Service-Meters, of which the following is a full, clear, concise, and exact description.

This invention concerns service-meters for automatically counting or recording calls which result in completed connections between lines and are answered at the called station. In Reissue Patent No. 12,185, granted December 22, 1903, I have described and claimed a type of service-meter in which the service-meter permanently associated with the calling-line is actuated by a current determined in taking the telephone for use at the called station. The present invention concerns the further development of the same type of service-meter, being specially addressed to its use in conjunction with a relay-switchboard.

The principal feature of this invention has for its object to insure the registration of each call by making the action of the service-meter jointly dependent upon the presence of the calling-plug in a spring-jack of the called line and on the position of the telephone-switch at the called station.

To this end this feature consists in a service-meter associated with the calling-line in a local circuit of the line, a relay in the path of current to the called station, and a self-locking relay forming part of a local circuit which must be closed at two points—namely, between the registering-sleeve and contact-piece of the calling-plug and a spring-jack of the called line and between switch-contacts of the before-mentioned relay—this self-locking relay being constructed to close the local circuit of the service-meter when it is excited by the taking of the telephone for use.

Minor features of the invention look to the association of these appliances with supervisory signals and controlling-relays usual in a relay-switchboard.

The invention is shown diagrammatically in the attached drawing, which represents two

substations furnished with telephone instruments connected by line-wires with spring-jacks and signaling apparatus in a telephone-switchboard, a service-meter for each line, plugs and a plug-circuit for uniting the lines in the switchboard, and the necessary local-circuit connections for effecting the operation of the service-meter in accordance with this invention.

The apparatus at the substations is of the type characteristic of the relay-switchboard. The circuit at the substation is normally open with respect to currents from a constant source, but is closed by the action of the telephone-switch when the receiving-telephone is taken for use.

The line-circuit from each substation leads to the poles of a central source of current  $a'$  at the central office. One line conductor contains the magnet of a relay  $b$ , which controls a secondary lamp-signal, which is the individual line-signal. Normal extensions of the line to the central battery traverse the switch-contacts of a cut-off relay  $c$ . The line conductors are connected with the usual spring-jacks  $d$  and  $d'$  in the multiple switchboard. Special contact-rings of these spring-jacks form the multiple terminals of a conductor 1, which includes the magnet of cut-off relay  $c$ . Spring-jacks of lines are united by means of plugs  $e$  and  $e'$ , which form the terminals of a plug-circuit 2 3, 4 5. Conductors 2 and 4 of the plug-circuit and conductors 3 and 5 are united, respectively, through the windings of a repeating-coil  $f$ , and the points of junction of the pairs of conductors so united are connected with the poles of the battery  $a^2$ , this device being that usual in the relay-switchboard for maintaining the continuity of the plug-circuit with respect to telephone-currents while supplying the two substations with current for signaling and exciting the transmitting-telephones independently of one another. In each of the conductors 3 and 5 is a supervisory relay, these being designated  $g$  and  $g'$ , respectively, each in control of a secondary signal  $h$  and  $h'$ , respectively, of which the former is placed near the plug  $e$  and the



latter near the plug  $e'$  in the switchboard to indicate the position of the telephone-switch at the station with which the plug is connected. In equipping lines in such a switchboard with a service-meter the actuating-magnet of the meter is placed in the conductor 1, which contains also the cut-off relay of the corresponding line. The service-meter is designed to operate on a current considerably greater than is required by the cut-off relay. For example, a cut-off relay as usually constructed is operated when traversed by one-tenth of an ampere. The service-meter may then be operated only when traversed by about three-tenths of an ampere. The contact-sleeve of the answering-plug  $e$  is made the terminal of a conductor 6, leading to the pole of battery  $a$  opposite to that with which the conductors 1 are connected. This conductor 6 contains two resistance-coils  $i$  and  $k$ , which may have resistances of one hundred ohms and thirty ohms, respectively, the battery  $a$  being of twenty-four volts electromotive force. The like contact of plug  $e'$  forms the terminal of a wire 7, which includes the signal-lamp  $h'$ , together with a resistance-coil  $l$ , which wire leads to the same pole of battery  $a$ . This latter circuit is controlled, however, by a switch-spring  $m^3$  and its normal resting contact, said spring being adapted to be engaged by the armature  $m^2$  of a relay  $m$ , whereby circuit is first completed from the battery  $a$ , through spring  $m^3$ , to said armature, and as the armature is further attracted the circuit through the resistance-coil  $l$  by way of the back contact of spring  $m^3$  is broken. The armature  $m^2$  forms the terminal of a conductor 9, which includes one winding of the magnet of relay  $m$  and is connected with wire 7 between the resistance-coil  $l$  and the lamp  $h'$ . The relay is also provided with another armature,  $m'$ , and a front contact therefor, controlling a shunt 8 about the resistance-coil  $i$ . When the magnet  $m$  is excited, the branch 9 is completed by the armature  $m^2$  before the branch containing resistance-coil  $l$  is broken at the back contact of spring  $m^3$ . A conductor 10 forms a shunt about the lamp  $h'$ , which is controlled by the switch-contacts of relay  $g'$  and which includes also another winding of the magnet of relay  $m$ . An additional branch 11 from battery  $a$  terminates in the sleeve of contact-plug  $e'$ , which includes the signal-lamp  $h$ , together with a resistance-coil  $n$ . This circuit also is provided with a shunt 12 about the lamp  $h$ , which is controlled by the relay  $g$ . The resistance of coils  $l$  and  $n$  and of that winding of relay  $m$  which is in conductor 9 may each be one hundred and ten ohms. Likewise the resistance of lamps  $h$  and  $h'$  when lighted may be approximately one hundred and ten ohms each. The resistance of the winding of relay  $m$  which is in conductor 10 may be about forty ohms. The resistance of the cut-off relays  $c$  may be thirty ohms each and of the actuat-

ing-magnets of the service-meters about ten ohms each.

When in response to a subscriber's call a spring-jack of the calling-line is united with a spring-jack of the called line through the medium of plugs  $e$  and  $e'$  and their connecting plug-circuit, the local circuit 6 1 is closed through the answering-plug and the spring-jack of the calling-line and the multiple branches 7 and 11 are connected with the conductor 1 of the called line through the registering contacts of the calling-plug and the spring-jack of the line. The shunt 8 about the resistance-coil  $i$  being open, the current in circuit 6 1 while sufficient to excite the cut-off relay  $c$  of the calling-line is inadequate to move the armature of the service-meter. Likewise the current through branches 7 and 11 and conductor 1 of the called line is sufficient to excite the cut-off relay of that line to sever the normal battery connections of the line; but by reason of the resistance-coils and of the high resistance of the signal-lamps it is insufficient to operate the service-meter of the called line. The current, however, excites or tends to excite the lamps  $h$  and  $h'$ . Simultaneously with the closure of the local circuit in the answering-plug and the spring-jack of the calling-line, however, a current is permitted to flow in the line from the source  $a^2$  in the plug-circuit, which excites the supervisory relay and shunts the lamp  $h$ . Hence this lamp remains dark. The lamp  $h'$  is lighted. When the telephone at the called station is taken for use, the relay  $g'$  closes the shunt-circuit 10 of lamp  $h'$ , and thus excites the relay  $m$  and causes it to bring its levers  $m'$  and  $m^2$  against their front contacts. The movement of lever  $m^2$  breaks the direct path of current from the battery through the lamp  $h'$  and completes a new circuit through the other winding of magnet  $m$ , which thereafter maintains the excitement of the magnet independently of the shunt 10 and subject only to the completion of the circuit 7 9 1 through the local contacts of the calling-plug and the spring-jack of the called line. The movement of the switch-lever  $m'$  against its contact by closing the shunt 8 produces in the circuit 6 1, through the answering-plug and the local conductor of the calling-line, a current sufficient to operate the service-meter of that line, which is thereby caused to register or record the completed and answered connection. The service-meter is then held in its attracted position until the circuit is broken between conductors 7 and 1 of the plug  $e'$  and the spring-jack of the called line at the termination of conversation. Both signal-lamps  $h$  and  $h'$  meantime remain subject to the controlling-shunts 12 and 10, respectively, so that they indicate to the operator the condition of the telephone-switches at the united stations and permit visual supervision of the connection. The magnet of the service-meter associated with the called line will not receive



sufficient current for its actuation, by reason of the high resistance included in circuit therewith.

It is customary for users of telephones to give a number of orders for connections with wanted lines in quick succession, and the operation of making the required connections is greatly facilitated by leaving the answering-plug in the spring-jack of the calling-line, removing the calling-plug only from the spring-jack of the called line upon the flashing of the calling-subscriber's signal-lamp  $\frac{1}{2}$  and inserting said plug in the spring-jack of another wanted line. In all service-meters heretofore provided which depend for their operation on completed connections this practice has been rendered impracticable on account of the failure of the meter to register all connections made after the initial connection. It will be noted that in the invention herein disclosed the removal of the calling-plug from the spring-jack of the called line after the response of the called subscriber breaks the local circuit which actuates the service-meter of the calling-line, and thus places it in readiness to record a second completed connection which attains response at the called station.

While I have for convenience of illustration shown four batteries in the drawing, it will be understood that in practice these may be one and the same source of current.

It will be noted that by reason of the inclusion of the two supervisory signals in multiple branches of the local circuit closed in registering contacts of the calling-plug and the spring-jack of the called line the service-meter of the calling-line, which is the only one to be operated in the course of a connection, is included in a local circuit independent of and distinct from the signaling-circuits of the system, except in so far as such circuit is influenced by the supervisory relay of the called line.

I claim as new and desire to secure by Letters Patent—

1. The combination with telephone-lines and spring-jacks thereof, and an answering and a calling plug with their plug-circuit for uniting the lines, of a service-meter and a circuit therefor, a switch for temporarily closing the service-meter circuit, a locking device adapted to maintain the excited condition of the service-meter, in a local circuit controlled in registering contacts of the calling-plug and spring-jack of the called line, the continued operation of the locking device after its initial response being dependent upon said registering contacts.

2. The combination with a calling and a called line, and an answering and a calling plug with their plug-circuit for uniting said lines, of a service-meter, a relay in the path of current to the called line, a circuit for the service-meter controlled by said relay, a local circuit established in registering contacts of

the calling-plug and spring-jack of the called line, and a locking device for said service-meter included in the last-mentioned circuit.

3. In combination, two telephone-lines, plugs and a plug-circuit for uniting them, a service-meter associated with the calling-line, and a relay associated with the called line in the path of current therein determined in the use of the telephone, a local circuit of the service-meter closed at one point in registering contacts of the answering-plug and spring-jack of the calling-line, said local circuit being controlled through the agency of said relay, and locking apparatus, the active condition whereof is controlled by registering contacts of the calling-plug and the spring-jack of the called line, said locking apparatus while active being adapted to prevent the control of said relay over the service-meter, as described.

4. The combination with a calling and a called telephone-line, of a spring-jack for each line, an answering and a calling plug and a plug-circuit for uniting the lines through the medium of said spring-jacks, a source of current in a bridge of the plug-circuit, supervisory relays, one in the path of current to each line, supervisory signals controlled by said relays, a cut-off relay and a service-meter for each line in a normally open branch from a contact of the spring-jack of such line, conductors including a source of current terminating in corresponding contacts of said plugs, said contacts being adapted to register with the aforesaid contacts of said spring-jacks, and thereby to establish local circuits for said cut-off relays and service-meters, the supervisory signals being included in multiple branches of the conductor terminating in the calling-plug, the resistance of both circuits as thus completed preventing the operation of either service-meter, and means controlled by the supervisory relay of the called line for controlling the circuit containing the service-meter of the calling-line to operate the same.

5. In combination, two telephone-lines each having a telephone-switch adapted to close the circuit during the use of the telephone, spring-jacks for the lines, a pair of plugs and their plug-circuit for uniting them, a source of current in the plug-circuit, two supervisory relays associated with the answering and calling plugs, respectively, located in the path of current from the aforesaid source to each of the united lines, a service-meter for the calling-line and a local circuit including the same, closed in registering contacts of the answering-plug and the spring-jack of said line, a local circuit established in registering contacts of the calling-plug and the spring-jack of the other line, the portion of said last-mentioned circuit which terminates in the calling-plug being divided into multiple branches, two supervisory signals, one associated with each supervisory relay, both said signals being included in the aforesaid multiple branches of the cir-



cuit leading to the calling-plug, a shunt about each signal controlled by the corresponding supervisory relay, a relay *m* having a winding included in the shunt about the supervisory signal associated with the calling-plug, switch-contacts of said relay *m* controlling the circuit of the service-meter, and a locking-winding on said relay *m*, said relay having switch-contacts adapted when operated to include said locking-winding in the local circuit leading to the calling-plug; whereby the service-meter is operated through the agency of the switch at the called station upon the response of the called party and is thereupon rendered irresponsive to said switch.

6. The combination with a calling and a called telephone-line, of a service-meter for the calling-line, a spring-jack and a plug for making connection with the called line, a circuit of the meter closed in registering contacts of the plug and spring-jack of the called line, and independent means for controlling said circuit to operate the meter; whereby the meter may be operated only when the circuit is completed with the called line, as described.

7. The combination with a calling and a called line, of a service-meter associated with the calling-line, and a link conductor for uniting the calling with the called line, a circuit of said meter closed through said link conductor, and a conductor of the called line, means actuated in the use of the called line controlling said circuit of the meter to operate the meter; whereby the meter is actuated during each connection with the called line, as described.

8. The combination with a calling-line and the spring-jack thereof, and the called line and a spring-jack therefor, and plugs for uniting the spring-jacks, of a service-meter associated with the calling-line, and a temporary actuating-circuit thereof extended through the spring-jack and the answering-plug, means

for controlling said circuit to actuate the meter, and a locking circuit or device made operative in the first response of said meter, the operative condition of said locking device being dependent on the presence of the calling-plug in a jack of the called line; whereby the locking device is made inoperative when connection with the called line is broken, as described.

9. The combination with a telephone-line and a service-meter associated therewith, of an actuating-circuit for the service-meter and means for closing the circuit to operate the meter, a locking-circuit for the meter brought into action in the control of the meter, said locking-circuit being controlled by the plug and spring-jack of the called line; whereby the locking-circuit is rendered inoperative when connection with the called line is broken, as described.

10. The combination with a calling and a called line, and answering and calling plugs with their plug-circuit for uniting the lines, a supervisory relay for the called line controlled through the agency of a switch at the substation thereof, a service-meter associated with the calling-line, a local circuit for said service-meter, a switch operated through the agency of said supervisory relay, controlling the service-meter circuit, a locking-magnet and means controlled thereby for maintaining the service-meter circuit closed independent of the supervisory relay, and a circuit for said locking-magnet closed in registering contacts of the calling-plug and the spring-jack of the called line.

In witness whereof I hereunto subscribe my name this 22d day of January, A. D. 1900.

FRANK R. McBERTY.

Witnesses:

ELLA EDLER,  
GEORGE P. BARTON.