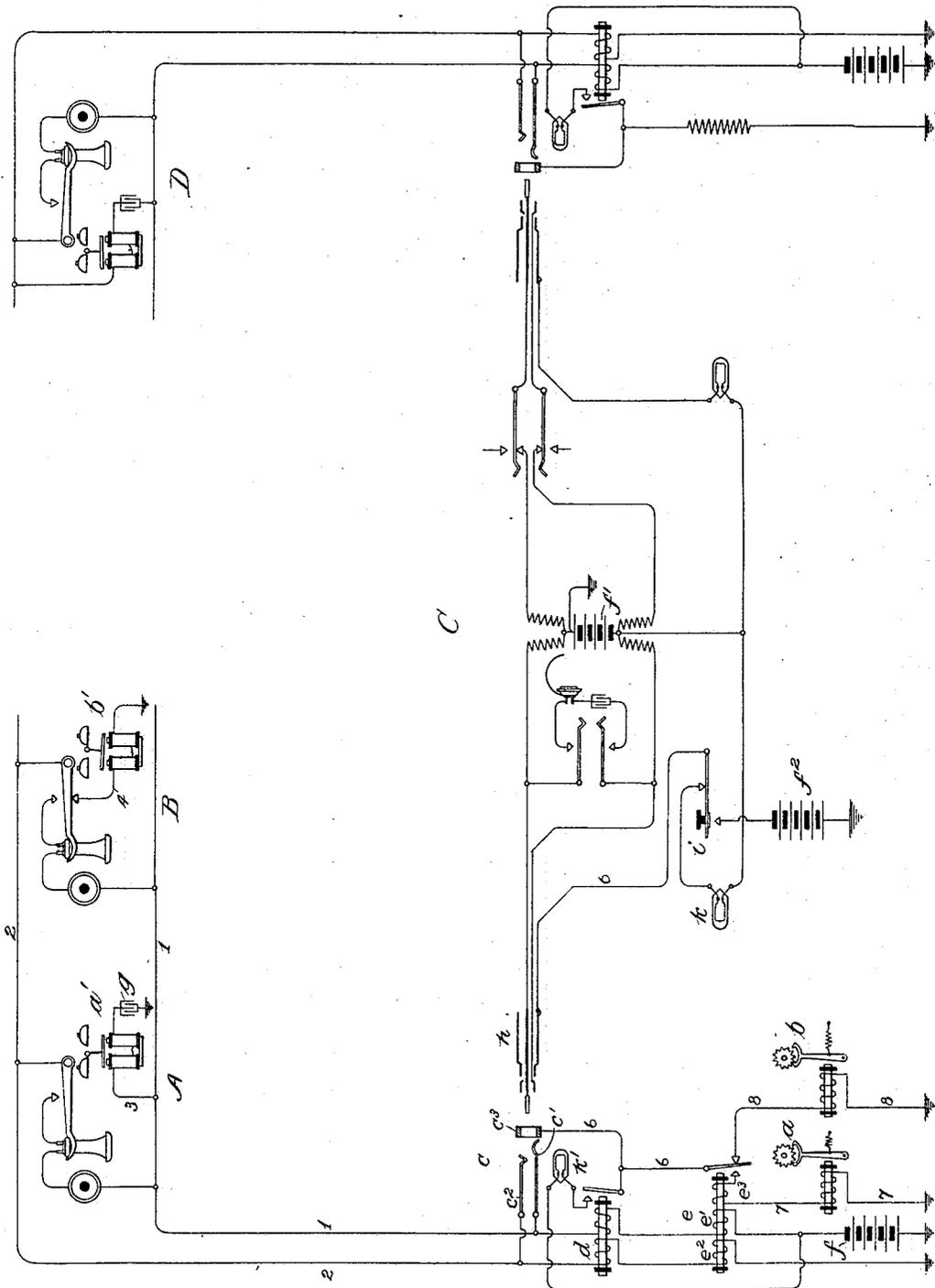


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J. L. McQUARRIE.
MEASURED SERVICE SYSTEM FOR PARTY LINES.
APPLICATION FILED DEC. 14, 1901.

NO MODEL.



WITNESSES:

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MEASURED-SERVICE SYSTEM FOR PARTY-LINES.

SPECIFICATION forming part of Letters Patent No. 766,192, dated August 2, 1904.

Application filed December 14, 1901. Serial No. 85,923. (No model.)

To all whom it may concern:

Be it known that I, JAMES L. McQUARRIE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Measured-Service Systems for Party-Lines, of which the following is a full, clear, concise, and exact description.

My invention relates to the measurement of telephone service, and has for its object to provide an improved system in which the calls from the different stations of a party-line may selectively be registered, each station of the party-line having at the central office an individual connection-register or service-meter corresponding thereto, which will register only the calls initiated at that particular station to the exclusion of the calls from other stations, so that each subscriber whose instrument is located on a party-line may be charged only for his proportionate share of the exchange service, according to the extent to which his particular instrument has been used.

My invention will be described in connection with the accompanying drawing, and the features or combinations which I regard as novel will be pointed out in the appended claims.

The drawing represents a party-line having two stations and another line with one station, both lines extending to a central office C, with a pair of plugs and the essential plug-circuit apparatus for uniting the lines, the system being organized and equipped for the measurement of the exchange service rendered each station of the party-line in accordance with my invention.

The party-line extends in two limbs 1 2 from the substations A and B to the line-springs e' e'' of a spring-jack terminal e at the central office, and thence through the windings of a line-signal relay d and the differential windings of a special relay e to the poles of a central battery f . The pole of the battery which is connected with the limb 2 of the line is connected to earth or other return-conductor. Besides the differential windings e' e'' , which are included, respectively, in the limbs

1 2 of the telephone-line, the relay e has a locking-winding e^3 , to which further reference will hereinafter be made.

At each of the substations of the party-line the usual telephone apparatus is provided in a bridge between the line conductors 1 2, such bridge being normally open at the contacts of the usual telephone switch-hook. A call-bell for receiving signals is provided at each station. The call-bell a' at station A is included in a branch 3 to ground or other return conductor from the limb 1 of the line, and the bell b' at station B is included in a branch 4 to ground from the other limb 2 of the line. The branch 3 at station A is kept always open as to direct currents by a condenser g included therein, the condenser, however, being adapted to permit the passage through it of alternating or pulsating currents, such as are used to ring the call-bells. There is no condenser in the ground branch 4 at the other substation B; but this branch is controlled by the lower contact of the telephone-switch hook, so that when the receiving-telephone is taken from its hook for use the circuit of the branch 4 will be opened. These call-bells are of high impedance to prevent the shunting of telephone-currents; but the resistance of the bell b' is so proportioned to the resistance of the windings e' e'' of the relay e at the central office that when the bridge at station A is closed by the telephone-switch sufficient current will be shunted from winding e'' through the branch 4 at substation B to unbalance the relay e and cause the same to attract its armature.

When the telephone at substation B is taken for use, the ground branch 4 is opened, and the flow of battery-current is substantially equal in both of the windings e' e'' of the relay e , so that the magnetic effects of said windings balance one another, and the armature of the relay remains unattracted.

Besides the line-springs e' e'' the spring-jack of the party-line has a third contact or testing e^3 , which is adapted to register with the third contact or sleeve of a plug which may be inserted in the jack, whereby the local circuit 6 of central battery f' in the plug-cir-

circuit may be completed. This circuit 6 has two branches 7 8, which are controlled by the differential relay e . Normally the circuit of branch 8 is closed through the armature-switch lever and normal resting-contact of said relay e ; but when the relay draws up its armature it breaks the circuit of the branch 8 and closes the branch 7 in its alternate contacts. A responsive device, such as a connection-counter, may be included in each of the branches 7 8, and a switch is provided for the local circuit 6, associated with that portion of the circuit which terminates in the third contact of the answering-plug h for changing the electrical condition of the circuit to actuate whichever of the said responsive devices may have been brought into operative relation to the circuit.

The responsive devices are illustrated diagrammatically as toll-counters or connection-registers of a simple type which is well-known in the art, adapted to effect a registration upon each current impulse of suitable strength, and the device for operating said responsive devices is a switch or push-button i , connected with the plug-circuit, adapted when depressed to apply to the circuit an impulse of current from a battery f'' stronger than that which is normally applied to the circuit from battery f' .

The taking of the telephone for use at either of the substations A and B thus determines which of the connection-registers a or b shall be brought into operative relation to the circuit 6, and the register thus selected is then operated when the key i is depressed.

While the battery f in the line and the battery f' in the plug-circuit are shown separate for convenience and clearness of illustration, it should be understood that these two batteries may be and preferably are one and the same central battery in accordance with the usual practice.

A supervisory signal-lamp k may be included in the portion of the circuit 6 which is associated with the answering-plug h , and a line signal-lamp k' may be provided in a branch from battery f , controlled by the line-relay d . Said line-relay, which is normally inert, but which is excited whenever the line-circuit is closed by the telephone-switch at either substation, controls both the line and supervisory signals in accordance with a well-known plan.

When the line-relay is first excited, it closes branch containing the line-lamp k' to earth by way of conductor 7 or conductor 8, as the case may be. The lamp thus becomes lighted, and the operator responds to the signal by inserting her answering-plug h in the spring-jack of the calling-line. The other branch from battery f' of the plug-circuit, containing the supervisory lamp k , is thus brought into parallel with lamp k' , and the magnet of the service-meter a or b (as the case may be) being included in the undivided portion of the circuit

neither of said lamps receives sufficient current for its illumination—that is, each “shunts out” the other. Then at the end of the conversation the line-relay d , becoming inert, opens the branch containing the line-lamp k' , whereby the other branch containing the supervisory lamp k receives increased current, so that said supervisory lamp is lighted to constitute a disconnect-signal.

The other telephone-line D is of a well-known type, as is the plug-circuit apparatus, with the exception of the switch device i for actuating the toll-counter of lines equipped with them. A particular advantage of my measured system is that it may be applied to ordinary telephone-exchanges without requiring extensive alterations.

The plug and spring-jack switches are so adapted to each other that the tip of the plug will clear the longer line-spring of the jack as the plug is being inserted. This is to prevent the accidental operation of the relay e by the completion of a circuit to earth from the longer line-spring of the jack by way of the tip-strand of the plug-circuit during the insertion of the plug.

To review briefly the operation, when subscriber A takes his telephone to initiate a call he closes a bridge of the line so that the circuit of battery f is completed through the relays d and e . Since the limb 2 of the line is grounded at station B, the winding e^2 of the special relay e at the central office is shunted, and the relay being thus unbalanced draws up its armature and closes the branch 7, containing the connection-register a . The line-relay d is also excited and brings about the display of the line-lamp k' .

The branch 7 contains, besides the magnet of the connection-register a , the locking-winding e^3 of magnet e , so that after the circuit 6 has once been completed the magnet-armature, if it has been attracted, will be locked up and rendered independent of further movement of the telephone-switch at the substation.

When the subscriber at substation B initiates a call, the removal of the telephone from its hook closes a bridge of the line and at the same time cuts off the ground connection 4. The flow of current is therefore equal in the two windings e^1 e^2 , and the armature of the magnet e will remain in its unattracted position, closing the circuit of branch 8, and so bringing the toll device b into operative relation to the circuit 6.

Whether the call is initiated at station A or station B, the line-relay d is excited in either case and brings about the display of the line-signal k' . The central-office operator perceiving the signal inserts her answering-plug h in the spring-jack c and bringing her telephone into circuit in the usual way inquires the number of the subscriber with whom connection is desired. Having received this in-

formation and after having made the usual test to determine whether or not the called line is free, she completes the connection by inserting the other or calling plug of the pair into the jack of the line wanted and transmits a call-signal in the usual way, then depresses the special key *i* to register the connection. Although the circuit 6 is closed as soon as the answering-plug is inserted, the immediate flow of current in the circuit is not sufficient to cause the operation of the connection-register, which only operates upon the increased current caused by the depression of key *i*.

The connection registers or counters *a* and *b*, therefore, are selectively operated, each one registering only those connections which originate at the station which it represents. The selection of the counter to be operated is effected automatically through the agency of the switch-hook at the substation as the call is made, and the actuation of the counter thus selected is effected by the operator by means of the special key *i*, which may be depressed after the calling subscriber is placed in communication with the called subscriber. The point that determines which of the two counters shall be operated is the presence or absence from the limb 2 of the line at the substation B of the ground connector 4.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent, the following:

1. The combination with a main telephone-circuit extending between two substations and a central station; a telephone-suspension switch at each substation; and switchboard devices at the central station uniting said main circuit with other substation-circuits; of a local switchboard-circuit leading through and controlled by said switchboard devices; two service-meters or connection-registers at the central station corresponding to the said substations, respectively, and connected in alternative branches of said local circuit; and an electromagnetic switch adapted to transfer the said local circuit between the said alternative service-meter branches, the said electromagnetic switch being responsive to the operation of the suspension-switch at one substation, but irresponsive to the operation of that at the other; substantially as set forth.

2. The combination with a party telephone-line extending from two substations to a central office, of means for making connection with the line at the central office, two connection-registers for the line at the central office, corresponding to the two substations, means controlled at the substation of each line for selecting or bringing into operative relation the connection-register corresponding to such station, to the exclusion of the other register, and means adapted to be brought into action in the course of establishing a connection between the said telephone-line and another line

for operating the register so selected, whereby each register records only the calls initiated at the station to which it corresponds.

3. The combination with a party telephone-line extending from two substations to a central office, of means at the central office for uniting said line with another, a local circuit established in making connection with the line, two connection-registers corresponding respectively to the two substations of the party-line associated with said circuit, an electromagnetic switch adapted alternatively to bring either one of said connection-registers into operative relation to said local circuit, means at the central office adapted to be actuated in the course of establishing a connection from the party-line to another line for changing the condition of said local circuit to actuate whichever of the connection-registers may have been brought into operative relation thereto, and means controlled at each substation for determining the operation of said electromagnetic switch, whereby each register is caused to record only the calls initiated at the substation to which it corresponds.

4. The combination with a party telephone-line extending from two substations to a spring-jack terminal at a central office, of a plug and plug-circuit at the central office for making connection with the line, a local switchboard-circuit established in registering contacts of the plug and spring-jack, having two branches, a relay normally closing the circuit of one of said branches and adapted to open said branch and close the circuit of the other branch in its alternate contacts, a switch associated with the local circuit and means controlled thereby for changing the electrical condition of the circuit, responsive devices one in each branch, adapted to respond to the change produced by the switch, and means actuated in the use of the telephone at one of the substations but not the other, for exciting the relay, whereby the selection of the responsive device which is to be actuated is determined according to the substation which transmits a call.

5. The combination with a metallic circuit party telephone-line extending from two substations to a central office, of means for making connection with the line at the central office, a source of current at the central office, one pole of which is connected to a return-conductor, a relay having two differential windings, the two limbs of the telephone-line being led through the two differential windings respectively of said relay to the poles of said source of current, bridges of the line at the substations, a telephone-switch at each station controlling the bridge thereof, a connection from one limb of the telephone-line to the return-conductor at one of said stations, controlled by the telephone-switch at such station, whereby one of the windings of

the differential relay may be shunted, an armature switch-lever for the relay, two branch circuits adapted to be closed by the relay-armature according to the attracted or inert
5 position thereof, responsive devices, one in each branch circuit, and means for producing a flow of current to actuate the responsive device in the closed branch, whereby one or the other of said responsive devices is actu-

ated according to which of the two stations has its telephone in use.

In witness whereof I hereunto subscribe my name this 25th day of November, A. D. 1901.

JAMES L. McQUARRIE.

Witnesses:

EDWIN H. SMYTHE,
FREDERICK A. WATKINS.