

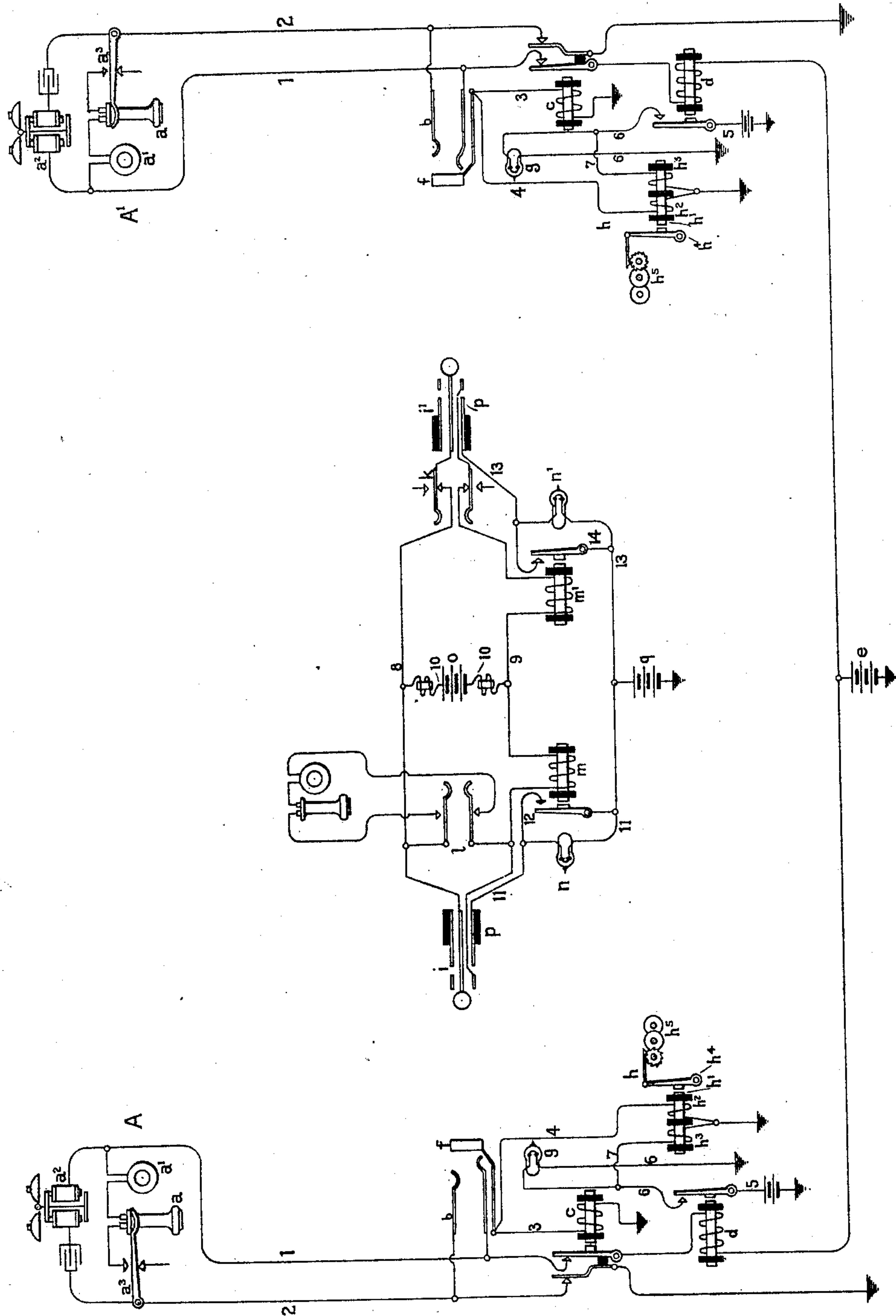
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Patented Sept. 3, 1901.

C. E. SCRIBNER.  
CONNECTION COUNTER FOR TELEPHONE LINES.

(Application filed Nov. 22, 1897.)

(No Model.)



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# UNITED STATES PATENT OFFICE.

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## CONNECTION-COUNTER FOR TELEPHONE-LINES.

SPECIFICATION forming part of Letters Patent No. 681,742, dated September 3, 1901.

Application filed November 22, 1897. Serial No. 659,467. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. SCRIBNER, 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 Connection-Counters for Telephone-Lines, (Case No. 454,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention concerns the registration of the use of telephone-lines by an appliance for each line in the central station. It is designed to make such registration or counting dependent on the consecutive closing of two local circuits, one controlled by the subscriber in calling and the other by the operator in making connection with the line.

To this end it comprises generally an electromagnet in the line-circuit responsive to current in the line determined by the telephone-switch at the substation, a circuit in part associated with the line, and a switch for closing this circuit in the act of making connection with the line, a magnet-winding in the last-mentioned circuit, means whereby both magnet-windings actuate registering mechanism, and a device for preventing the operation of the registering device in making connection to a line, as a called line.

The most satisfactory embodiment of the invention which I have provided is attained in its association with the well-known type of switchboard provided with signals in the switchboard in local circuits automatically controlled from the substations of the telephone-lines through the agency of relays responsive to currents in the lines determined by the telephone-switches at the stations. The best known form of this switchboard comprises a relay in each line-circuit with a source of current for exciting the relay when the circuit through the telephone is closed at the substation, a signal-lamp in a local circuit closed by the relay when excited, a cut-off relay adapted to sever the normal line connections with the line relay and battery, a local circuit including the cut-off relay, and switch-contacts closed in the spring-jack of

the line in making connection therewith for exciting the cut-off relay.

In applying my invention to lines in such a switchboard I provide an electromagnet with two windings, an armature for the magnet, and registering mechanism acted upon by the armature. I connect one winding of the magnet in circuit with the secondary line-signal and the other winding of the electromagnet in circuit with the cut-off relay, so adjusting the windings as respects the current flowing in them that neither acting alone on the magnet is sufficient to cause the attraction of the armature, and I so arrange the armature that, having been attracted through the combined action of both windings on its magnet, it may be retained through the attraction of either acting alone.

The attached drawing represents two telephone-lines extending between substations and a common central office, each equipped with a registering appliance after the manner of the present invention.

Telephones  $a$  and  $a'$ , a call-bell  $a^2$ , and telephone-switch  $a^3$  are provided at the substation, the arrangement of circuits being such that the line-circuit is normally open as to continuous currents, but becomes closed through the telephones when the switch is relieved of the weight of the receiving-telephone. The line conductors 1 and 2 from the instruments at the station extend to a spring-jack  $b$  in the switchboard, from which point they are continued through the switch-contacts of the cut-off relay  $c$  to earth. Line conductor 1 traverses the magnet-winding of line-relay  $d$  and includes a battery  $e$  or other source of electromotive force common to the different lines of the exchange. Spring-jack  $b$  is provided with a local contact-piece  $f$ , which constitutes the common terminal of two wires 3 and 4. The former of these traverses the winding of cut-off relay  $c$  and leads to earth, its function in joint with the plug used in establishing connection with the line being to excite the cut-off relay to sever the normal extensions of the line-circuit. Normally open switch-contacts of the line-relay  $d$  control a local circuit 5 6, including in part an earth return. The conductor 6 is made up in part



of the filament of an incandescent lamp  $g$ , which is associated with the spring-jack  $b$  in the switchboard and constitutes a secondary line-signal. Each line is furnished with a connection-registering appliance  $h$ . This comprises an electromagnet  $h'$ , with two windings  $h^2$  and  $h^3$ , an armature  $h^4$ , and a counting or registering train  $h^5$  to receive motion from the armature. Winding  $h^2$  is included in the grounded conductor 4, leading from the thimble  $f$  of spring-jack  $b$ . Winding  $h^3$  is contained in a grounded conductor 7 in multiple with the line-lamp  $g$ . The windings  $h^2$  and  $h^3$  should be of high resistance in order that they may not divert an appreciable proportion of the exciting-current from the cut-off relay and the line-lamp. They are so related to the circuits which contain them that they act jointly to excite the magnet  $h'$  when both are traversed by current. The armature  $h^4$  is adapted to withstand the attraction of the magnet when excited by either winding  $h^2$  or  $h^3$ , but to be drawn up when both are simultaneously excited, and when thus drawn up it must remain attracted during the continuance of current through either of the windings. This may be attained by arranging the armature at a considerable distance from its magnet, making its range of movement large or by other means familiar to those skilled in the application of electricity. The operator employed at the switchboard in making connections is equipped with pairs of plugs  $i$  and  $i'$ , whose like line contact-pieces are united by conductors 8 and 9, which are known as the "plug-circuit." These conductors include, as usual, the switch-contacts of a calling-key  $k$  and are connected with a listening-key  $l$ . Conductor 9 includes the magnet-windings of two supervisory relays  $m$  and  $m'$ , which control supervisory lamps  $n$  and  $n'$ , respectively, referring to the different plugs  $i$  and  $i'$ . Intermediate of the supervisory relays  $m$  and  $m'$  a bridge 10 of the plug-circuit is formed by a conductor which includes a source  $o$  of current, together with the windings of impedance-coils for preventing the shunting of telephonic currents through the bridge. Each plug is constructed with a contact  $p$  to register with the ring  $f$  of a spring-jack, into which it may be inserted. Piece  $p$  of plug  $i$  forms the terminal of a wire 11, leading to one pole of a battery  $q$  and including the supervisory signal-lamp  $n$ . The relay  $m$  controls a shunt 12 about this supervisory lamp, being adapted to close the shunt when the relay is excited. Piece  $p$  of plug  $i'$  similarly forms the terminal of a wire 13, leading to battery  $q$  and including supervisory lamp  $n'$ . A shunt 14 about this lamp is controlled by relay  $m'$ .

I will now very briefly trace the operations of calling for and establishing connection between lines, paying especial attention, however, to the mode of operating the register of the calling-line through the joint action of

the call-initiating subscriber and the operator who answers his call. The removal of the receiving-telephone from its switch  $a^3$  for use closes the line-circuit at the substation, permitting current to flow, which excites the line-relay  $d$  and through its agency closes the local circuit 5 6, including the secondary line-signal  $g$ . The circuit 5 7 is also closed; but the effect produced by current through winding  $h^3$  is insufficient to draw up the armature  $h^4$ . Observing the call for connection the operator inserts answering-plug  $i$  into spring-jack  $b$  of the calling-line. This act brings the plug-circuit 8 9 into a temporary extension of the line conductors 1 2, permitting the operator to communicate with the calling subscriber. It also completes a circuit from battery  $q$  through wires 11 and 3, which excites the cut-off relay  $c$  and breaks the normal extensions of the line conductors. Current is also supplied from wire 11 through conductor 4, including magnet-winding  $h^2$  of the register  $h$ . For a moment magnets  $h^2$  and  $h^3$  are both excited, and their joint action results in the drawing up of armature  $h^4$  and the registering of the answered call by the instrument  $h$ , associated with the calling-line. It will be apparent that the winding  $h^3$  is deprived of current very soon after the circuit 11 4 is completed, the duration of the current for drawing up the armature  $h^4$  being dependent on the time required for the magnet  $c$  to become excited and to move its switches, for the magnet  $d$  to become inert and release its armature, and for the magnet  $h'$  to lose its magnetism. This interval is sufficiently long, however, to produce a reliable movement of the armature  $h^4$ , bringing it into such position that it is drawn fully up and held after winding  $h^3$  has been deprived of current through the opening of the local circuit 5 7. Thus the act of making connection with the spring-jack of the calling-line in answer to the call severs the normal earth connections of the line, extinguishing the line-lamp, and operates the register  $h$  of the calling-line. A path is furnished for current from battery  $o$ , through the plug-circuit, to the station of the calling subscriber as soon as the plug is inserted into the spring-jack. Such current excites the relay  $m$  and deprives supervisory lamp  $n$  of current. Having learned the number of the line with which the calling subscriber desires connection, the operator makes the connection by means of plug  $i'$  and sends a calling-current to ring the bell at the station called. The insertion of plug  $i'$  into the spring-jack of the called line excites the cut-off relay of that line and the winding  $h^2$  of the register  $h$  of the same line; but inasmuch as the local circuit 5 7 had not been closed the register will not be actuated, and it obviously cannot be actuated in any subsequent act on the part of either the operator or the subscriber. No current finds circuit from battery  $o$  over line conductors 1 and 2 until some one at the called station responds to the call and re-



moves the telephone from its switch. Hence the supervisory signal  $n'$  remains lighted by current in wires 13 and 3 until the called subscriber responds to the call. When both subscribers, having finished their conversation, replace their telephones on their switches, both supervisory relays  $m$  and  $m'$  are deenergized and both lamps  $n$  and  $n'$  become lighted. This constitutes a signal for disconnection and is followed by the removal of the conductors linking the lines together. The withdrawal of plug  $i$  from the spring-jack  $b$  of the calling-line permits the registering instrument  $h$  to return to its normal inert condition in readiness to register another answered call.

My invention is defined in the following claims:

1. The combination with a telephone-line and means for producing current in the line to call, a magnet-winding in the central office excited through the agency of the calling-current, means for making connection with the line in the central office, a local circuit, and a switch for closing the said circuit in making connection with the line, a second magnet-winding in the said local circuit, registering mechanism and means actuated by the joint effect of said magnet-windings when simultaneously excited for operating the registering mechanism; whereby the registering mechanism is operated when a call is answered, as described.

2. The combination with a telephone-line, means for producing a calling-current in the line, and means for making connection with the line in response to a call, of a call-registering appliance associated with the line, said appliance containing two elements with means actuated by the joint action of said elements when simultaneously made operative to effect registration, one of said elements being controlled by calling-current in the line, and the other being controlled by current in the said local circuit determined in making connection with the line in response to a call; whereby answered calls only are registered.

3. The combination with a telephone-line, a line-relay therefor, a local circuit controlled by the relay, and a secondary line-signal in the local circuit, a spring-jack and plug for

making connection with the line, a local circuit, and switch-contacts of the plug and spring-jack for closing the said local circuit, of a registering appliance having two magnet-windings adapted when simultaneously excited to effect registration by their joint action, one of said magnet-windings being connected with the local circuit of the line-relay to receive current therefrom, and the other being connected with the local circuit closed in the registering spring-jack and plug; whereby answered calls are registered, as described.

4. The combination with a telephone-line having a switch at its station for closing the line in the use of the telephone, a relay at the central office responsive to current in the line, a local circuit controlled by the relay and a secondary line-signal in the local circuit, a spring-jack and plug for making connection with the line, a local circuit adapted to be completed by registering contacts of the said spring-jack and plug, a cut-off relay having its magnet in the portion of said local circuit associated with the line, and having its switch-contacts interposed in the normal connections with the line-relay, of a registering device comprising an electromagnet and two windings thereon adapted when simultaneously excited to operate the register by their joint action, one of said windings being connected with the local circuit containing the cut-off relay, and the other of said windings being connected with the local circuit controlled by the line-relay, substantially as described.

5. The combination with a telephone-line, the line-relay and secondary line-signal in a local circuit controlled thereby, the cut-off relay, the local circuit including the cut-off relay and means for closing the circuit, of a register having two windings on its magnet adapted when jointly excited to effect registration, one of said windings being in parallel with the cut-off relay and the other of said windings being in parallel with the secondary line-signal, substantially as described.

In witness whereof I hereunto subscribe my name this 30th day of September, A. D. 1897.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,

DUNCAN E. WILLETT.