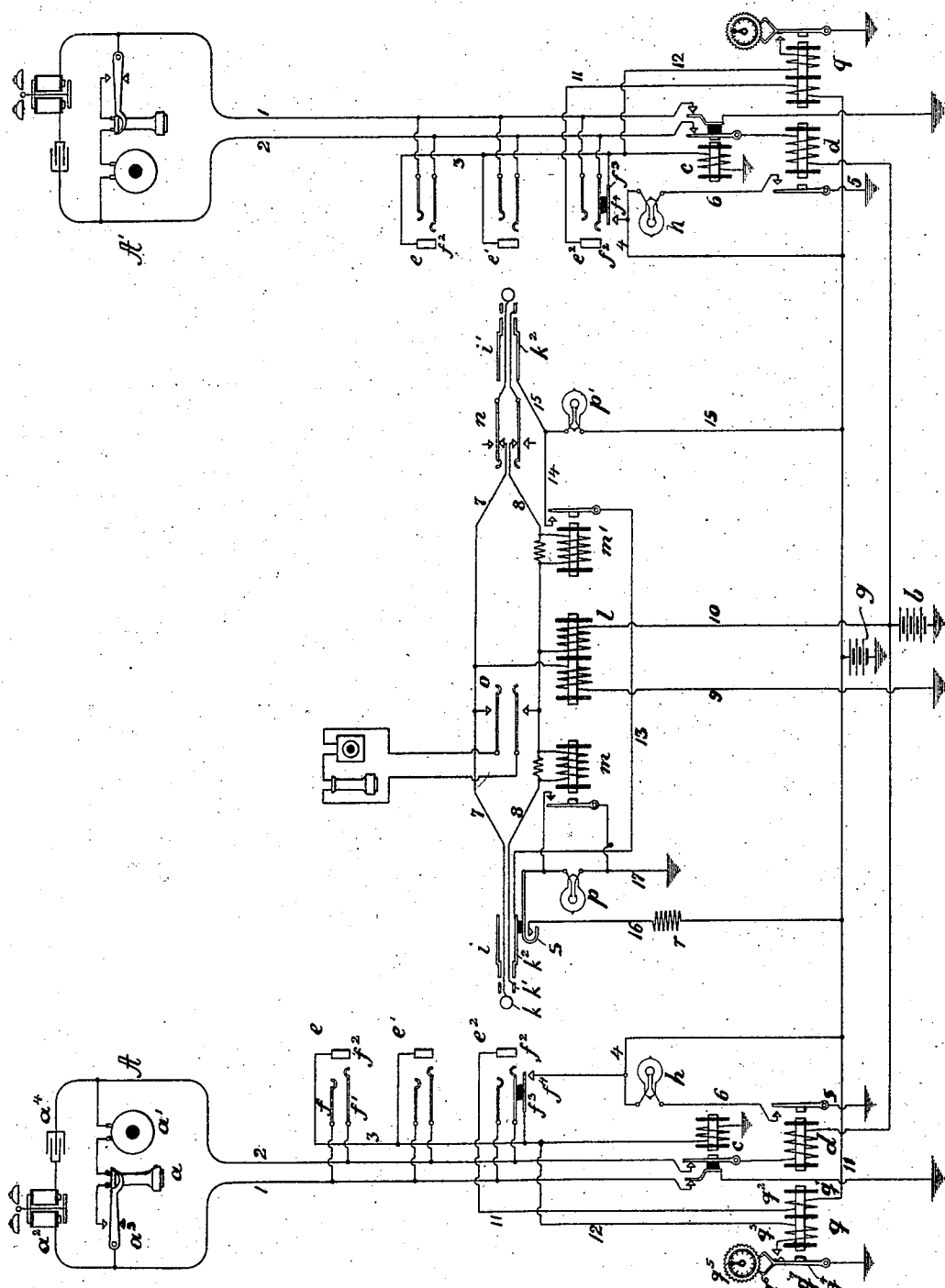


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CONNECTION COUNTING MECHANISM FOR TELEPHONE LINES.

(Application filed Mar. 15, 1897.)

(No Model.)



Witnesses:

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UNITED STATES PATENT OFFICE.

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CONNECTION-COUNTING MECHANISM FOR TELEPHONE-LINES

SPECIFICATION forming part of Letters Patent No. 617,539, dated January 17, 1899.

Application filed March 15, 1897. Serial No. 627,588. (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-Counting Mechanism for Telephone-Lines, (Case No. 442,) 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 apparatus designed for counting or registering calls originating at the substations of telephone-lines and attaining response at the correspondent stations.

It has been proposed to associate connection-registering mechanism with a telephone-line, together with mechanism making the connection-registering appliance operative only in the case of calls initiated at the station of the same line, the actuation of the registering appliance being controlled in the response to the call-signal at the called station.

The present invention relates to connection-counting mechanism of this type, and has in general two objects. One of these objects is to provide means for determining the operation of the counting mechanism in connection with the call-originating line only in coupling lines. The other is to associate the counting mechanism in question with a particular system of switchboard-circuits arranged for the automatic display of signals and for the severance of the normal line connections of the lines in the process of uniting them.

The organization of the present invention to these ends may be described in general terms as follows: Each telephone-line is provided with an answering-jack and a line-jack. Pairs of plugs are furnished for uniting lines, of which one member is adapted for use in connection with the answering-jack and the other in connection with the line-jack, and the circuits of the connection-counting appliance are so arranged that they are brought into operative condition through the agency of registering contact-pieces of the answering-plug and answering-jack only, the final actuation of the appliance being determined, however, in the response to the call at the called

substation in conformity with the general plan. This arrangement insures the operation of the connection-counter of the call-originating line only.

The switchboard organization alluded to, with which the present invention is designed to associate the connection-counting appliance, comprises a line-signal for each line, a "cut-off relay" for each line adapted when excited to sever the normal connections of the line-signal, a local circuit closed in making connection with the line by means of a plug in a spring-jack thereof, including the cut-off relay, plugs, and a plug-circuit for uniting lines, supervisory lamp-signals, and relays in the plug-circuit controlling the supervisory signals.

The present invention aims to combine the connection-registering appliance and the before-described feature thereof with this system of signals in an operative organization with as little mechanism as possible. To this end a local battery-circuit is provided, which becomes completed through the cut-off relay of the called line through the agency of registering contact-pieces of the connecting-plug and the line-spring-jack of that line. A portion of this local circuit is divided into two parallel branches, of which one includes the supervisory signal-lamp of the calling-plug, while the other is made up of a portion permanently associated with the answering-jack and including a winding of the magnet controlling the counting mechanism, together with a conductor terminating in the answering-plug, these portions being brought into connection in inserting the answering-plug into the answering-jack, this latter branch being closed by the relay controlling the supervisory signal and responsive to current in the called line determined in the removal of the telephone at the called station for use.

The invention further provides means for exciting the cut-off relay of the calling line, consisting in auxiliary switch-contacts in the answering-jack controlling a local circuit, including the magnet of the relay, which becomes closed together upon the insertion of an answering-plug in the spring-jack.

The invention also provides means for pre-

venting the actuation of the counting mechanism more than once during a connection, in a local circuit completed through the agency of the counter-actuating magnet, maintaining the subsequent excitement of the magnet during the connection.

The invention is illustrated in the attached drawing, with reference to which its several features may be more clearly set forth.

The drawing represents two telephone-lines extending from substations to a telephone-switchboard in a central office provided with the usual connecting and signaling appliances and each equipped with mechanism for registering connections.

The appliances at the substation may comprise the usual receiving and transmitting telephone a and a' , signal-bell a^2 , and switch a^3 for changing the circuits during the use of the telephone. This apparatus should be arranged to alter the resistance or circuit connections of the line to produce or to change the strength of current in the line during the use of the telephone. A condenser a^4 may be interposed in the circuit of the bell, so that the line-circuit becomes closed through the telephone only during its use. The line-conductors 1 and 2 are led from the substation to the central office, where they are continued to earth and to the pole of a battery b , respectively. In both these conductors are interposed the normally closed switch-contacts of a cut-off relay c . Conductor 2 includes the magnet of a signal-controlling relay d , designed to show the subscriber's call. Branches from the line-conductors are led to suitable contact-pieces in line spring-jacks e and e' , which may be in different sections of a multiple switchboard, and to an answering-jack e^2 at one section of the switchboard. These spring-jacks comprise the usual three contact-pieces, two springs f and f' , which are designed to serve as the terminals of the line in the spring-jack, and a thimble or ring f^2 . The springs f of the different spring-jacks form open branch terminals to conductor 1, while springs f' constitute similar terminals of conductor 2. The rings f^2 of line spring-jacks e and e' are united by a wire 3, which is led to earth through the winding of the magnet of cut-off relay c . This relay should have a moderately low resistance, twenty ohms being sufficient. The answering-jack e^2 is furnished with an additional pair of contact-pieces f^3 f^4 , constructed to be closed together when a plug is inserted in the spring-jack, the former of which is connected with wire 3, while the latter forms a normally open terminal of a wire 4, leading to a pole of the grounded battery g . The line-relay d controls a local circuit made up of two wires 5 and 6, the former of which leads to earth, while the latter leads to battery g and includes the secondary lamp-signal h , which is associated with the answering-jack e^2 in the switchboard.

The usual connecting-plugs i and i' are furnished for the use of the operator in coupling

lines. Each plug contains three contact-pieces k , k' , and k^2 , the former two of which are constructed to register with the line-springs f and f' of a spring-jack and the latter with the thimble f^2 . The tips k of the two plugs are united through a conductor 7, while the sleeves k' are united by conductor 8, these conductors 7 and 8 constituting the plug-circuit. Two wires 9 and 10, leading from conductor 7 to earth and from conductor 8 to the battery b , respectively, form, in effect, a bridge of the plug-circuit, including the battery b , together with a winding of the impedance-coil l at each side of the battery in the usual way. The magnets of relays m and m' are interposed in conductor 8, one at each side of the before-mentioned bridge, the magnets being shunted by non-inductive resistances to furnish paths devoid of impedance for the telephonic currents. The usual calling-key n is interposed in the plug-circuit for connecting the plug i' with the terminals of a generator of signaling-current, (not shown,) and an operator's listening-key o is provided for connecting the operator's telephone in a bridge of the plug-circuit. The function of relays m and m' is to control supervisory signals p and p' , associated with plugs i and i' , respectively. Such control is accomplished through the agency of a system of circuits involving also the connection-counters, which will now be described.

A connection counting or registering device q is associated with each line. This comprises a magnet q^1 , having two windings q^2 and q^3 , a lever q^4 , controlled by the magnet, a suitable counting or registering wheel or train q^5 , actuated by the lever, and a pair of contact-points q^6 q^7 , one of which is carried on the lever q^4 , and which become closed together when the armature is attracted to the magnet. The winding q^2 is included in a wire 11, leading from the terminal of battery g to thimble f^2 of the answering-jack. It should have a resistance equal to or somewhat less than that of supervisory lamp-signal p' . The winding q^3 is included in a wire 12, connected with wire 3 in the switchboard and terminating in the contact-anvil q^6 , while the contact q^7 , which may be in electrical connection with the lever q^4 , is grounded.

The sleeve k^2 of the answering-plug i , which is designed to be used always in connection with the answering-jack e^2 , forms the terminal of a wire 13, connected with one of the contact-points of relay m' . The other contact-point of relay m' forms the terminal of a wire 14, which joins a wire 15, leading from the local battery g and terminating in the sleeve k^2 of the connecting-plug i' , the junction being made at a point intermediate of the supervisory lamp p' , included in wire 15, and the contact-piece of the plug.

The supervisory lamp p is located in a separate local circuit 16 17, which includes a resistance-coil r and the supervisory signal p and which is controlled by a plug-seat switch s

for plug *i*, which closes the local circuit when the plug is removed from its socket. The relay *m* when excited closes a shunt or short circuit about the lamp *p* to extinguish it.

5 The process of establishing connection between lines and of registering the connection in the response of the called subscriber may now be traced. A subscriber, as at station A, desiring to secure connection with another
10 line removes his telephone from its switch, whereby the latter is permitted to close the line-circuit and furnish a path for current from battery *b* through the line-relay *d*. This relay being thus excited closes its switch-con-
15 tacts, completing the local circuit 5 6 of battery *g*, and brings about the illumination of signal-lamp *h*. The operator in attendance upon that line answering the call inserts plug *i* into the spring-jack and brings her
20 listening-key *o* into position to connect her telephone with the plug-circuit 7 8. These acts on the part of the operator bring about the following arrangement of circuits: The plug-circuit 7 8, and, consequently, the tele-
25 phone are brought into connection with line conductors 1 and 2. The contact-pieces *f*³ *f*⁴ in the answering-jack are closed together, whereby a circuit is completed, including wire 4 and a portion of wire 3, through the cut-off
30 relay *c*, which being excited separates its switch-contacts and breaks the connection of line conductors 1 and 2 with earth and with relay *d*, respectively, whereupon the latter appliance permits its switch-contacts to inter-
35 rupt the current through signal-lamp *h*. The plug-seat switch *s* is permitted to close the local circuit 16 17 through the supervisory lamp *p*; but since the battery *b* instantly cre-
40 ates a current through the bridge 9 10, the plug-circuit 7 8, and the subscriber's line 1 2, in which the supervisory relay *m* is included, the switch-contacts of this relay are closed together and complete the short circuit of
45 lamp *p*. The sleeve *k*² of the plug is brought into contact with the thimble *f*² of the answering spring-jack.

The operator having learned the order may test the line called for in any suitable way. No special test system has been represented
50 in connection with this multiple switchboard, inasmuch as numerous test systems easily applicable to switchboards of this type are well known. Having ascertained the line called for to be free for use, the operator in-
55 serts plug *i'* into a line spring-jack *e'* of the line and operates the calling-key *n* to ring the bell at the station A'. The insertion of this plug in the spring-jack causes a rear-
60 rangement of the circuits of the called line in a manner somewhat similar to that just traced for the calling line. The conductor 15 becomes connected with the thimble *f*² of spring-jack *e'* and with wire 3, whereby a
65 current is permitted to flow, which illuminates the supervisory lamp *p'* and excites the cut-off relay *c* of the called line, causing the latter appliance to break the normal line

connections with earth and with the relay *d*. When the subscriber at station A', respond-
70 ing to a call, removes his telephone from its switch, this act permits current to flow from battery *b* through the wires 9 and 10, plug-circuit 7 8, and line conductors 1 and 2 to station A', whereby the relay *m'* is excited
75 and caused to attract its armature. The movement of its armature connects wires 13 and 14, completing a parallel or shunt cir-
80 cuit about the supervisory lamp *p'*, made up of wire 11, contact-pieces *f*² *k*², and wires 13 and 14. Since this circuit has a resistance low compared to that of lamp *p'*, the current
85 through this lamp becomes insufficient to light it, while at the same time the current diverted through the winding *q*² of the counting mechanism excites the magnet thereof
90 and causes the actuation of the registering-train. The movement of lever *q*⁴ to operate this train brings contact-pieces *q*⁸ *q*⁷ into con-
95 nection, and thus closes a ground branch from wire 3 through wire 12, including the wind-
ing *q*⁸ of the counter-controlling magnet. After the completion of this circuit the excitement of the magnet is obviously inde-
pendent of the circuit through wires 11, 13, 14, and 15, being dependent only on the con-
tinuance of current through wires 3 and 4, which exists as long as the answering-plug *i'* remains in the answering spring-jack *e*².

The replacement of the receiving-telephone on its switch at either subscriber's station will
100 be indicated by the illumination of the corresponding supervisory signal *p* or *p'*, the lighting of the former being brought about through the opening of the shunt about it
105 by relay *m* and that of the latter being brought about by the breaking of the shunt 11 13 14, closed about it by the relay *m'*. The replacement of both telephones on their
switches causes the illumination of both lamps *p* and *p'*, which may be accepted as a
110 signal for disconnection and may be followed by the removal of the plugs *i* and *i'* from the spring-jacks of the lines. The removal of
plug *i* breaks the circuit 15 3 and brings
115 about the extinction of supervisory lamp *p'* and deprives the cut-off relay *c* of the called line of current, permitting that appliance to reestablish the normal line connections of
120 the line. The removal of plug *i* from spring-jack *e*² breaks the circuit 4 3 and the cir-
cuit 4 3 12, permitting the cut-off relay *c* to become inert and close the normal line con-
125 nections of the calling line and at the same time permitting the counting mechanism to resume its normal inert condition. The re-
placement of plug *i* in its socket breaks the circuit 16 17 and deprives lamp *p* of current.

It will be observed that the counting mech-
anism can be brought into operative condi-
130 tion only through the insertion of answering-plug *i* into answering-jack *e*² of the line. The insertion of plug *i'* into a line-jack of the line leaves the counting mechanism of that line devoid of circuit connections by which it may

be brought into operation. Hence the registering mechanism of the call-originating line only becomes operative during a connection, and the actuation of that mechanism is determined in the response of the called subscriber to the call-signal through the agency of the relay *m'*, controlling the supervisory lamp-signal associated with the line.

I claim as my invention—

1. The combination with a telephone-line and a connection-counter associated therewith, of a line-jack and an answering-jack connected with the line, a connecting-plug for use with the spring-jacks, and circuit connections of the said connection-counter with the answering-jack only adapted to cooperate with circuits terminating in the said plug to render the connection-counter operative, as described.
2. The combination with a telephone-line and a connection-counter associated therewith, of a line-jack and an answering-jack connected with the line, circuit connections of the counter with the answering-jack, an answering-plug and a connecting-plug with their plug-circuit for uniting an answering-jack of one line with a line-jack of another line, and circuit connections with the answering-plug adapted to cooperate with the local-circuit connections terminating in the answering-jack to render the counter operative, as described.
3. The combination with a telephone-line, a connection-counter associated therewith, a line-jack and an answering-jack connected with the line, an answering-plug and a connecting-plug and their plug-circuit for uniting the answering-jack of one line with the line-jack of another, circuit connections of the said counter closed in registering contact-pieces of the answering-jack and answering-plug, and a relay in the plug-circuit responsive to current in the called-line controlling the said circuit connections to determine the operation of the counter, as described.
4. The combination with two telephone-lines and conductors uniting them, of a connection-counter associated with one of the lines and a relay responsive to current in the other line, a local circuit divided at one point into parallel branches, a supervisory signal in one of the branches and a controlling-magnet of the said counter in the other branch, whereby the supervisory signal is shunted and the connection-counter is actuated when the relay responds to current in the line, as described.
5. The combination with telephone-lines, spring-jacks therefor and plugs and a plug-circuit uniting the spring-jacks, of a connection-counter associated with one of the lines having a controlling-magnet, a relay associated with the other line and responsive to current therein determined in the use of the line, a local circuit including a winding of the counter-controlling magnet closed in registering contacts of the plug and spring-jack

of the line having the counter, said local circuit being controlled by the said relay, a second local circuit including also a winding of the said counter-controlling magnet, said second local circuit being controlled by a magnet in said first-mentioned local circuit to maintain the continued excitement of the counter-controlling magnet after the closure of said first-mentioned circuit, as described.

6. The combination with a telephone-line and a spring-jack therefor, of a connection-counter having a controlling-magnet with two windings associated with the line, a plug and plug-circuit for making connection with the line, a local circuit including one winding of the said magnet closed in registering contact-pieces of the plug and spring-jack, and a switch also controlling the said local circuit, a second local circuit including another winding of the magnet, also completed in contact-pieces closed in the insertion of the plug into the spring-jack, said second local circuit being controlled by switch-contacts closed together in the movement of the armature of said magnet when attracted, substantially as described.

7. The combination with a telephone-line having means for determining current in the line during the use of the telephone, a signal-controlling magnet in the line responsive to such current, and a cut-off relay adapted to break the normal connections of the line with the said signal-controlling magnet, of line spring-jacks and an answering-jack connected with the line, a pair of plugs and their plug-circuit, a connection-counter associated with the line, a local circuit including the magnet of the cut-off relay terminating in normally open contact-pieces in the line-jacks, and in registering contacts therefor of one of the plugs, and also in switch-contacts associated with the answering-jack and adapted to be closed together in the insertion of a plug therein, a local circuit including the controlling-magnet of the connection-counter terminating in a normally open contact-piece of the answering-jack and in a contact-piece of the answering-plug for registering therewith, and a switch associated with the plugs controlling the latter local circuit, substantially as described.

8. In combination two telephone-lines each provided with means at its station for determining the flow of current in the line during the use of the telephone, a signal-controlling device for each line responsive to such current, a cut-off relay for each line adapted to break the normal line connections with said instrument, line spring-jacks and an answering-jack for each line, a local circuit including the cut-off relay for each line, said local circuit being controlled by switch-contacts closed together at any spring-jack when a plug is inserted therein, a connection-counter associated with each line, a local circuit including the said counter, and registering contact-pieces of the answering-jack and an-

swering-plug adapted to complete said circuit at one point, a relay and circuit connections therefor to make the relay responsive to current in the line in whose line-jack the connecting-plug is inserted, the local circuit of said connection-counter being controlled by said relay, substantially as described.

9. In combination two telephone-lines, each provided at its station with a device determining the flow of current in the line during the use of the telephone, a signal-controlling device for each line responsive to current in the line and a cut-off relay for each line adapted to sever the normal line connection with said signal-controlling device, linespring-jacks and an answering-jack for each line, an answering-plug in the answering-jack of one line, a connecting-plug in the line-jack of the other line, and a plug-circuit uniting the plugs, a local circuit including the cut-off relay of one line closed in switch-contacts of the answering-jack through the agency of the plug therein of the same line, a connection-counter associated with the same line, a local circuit including the cut-off relay of the

other line together with a source of current closed in registering contact-pieces of the connecting-plug and the line-jack, said local circuit being divided at one point into two parallel branches, a supervisory lamp-signal included in one of said branches, a winding of the controlling-magnet of said connection-counter included in the other of said branches, together with registering contact-pieces of the answering-plug and answering-jack completing the said branch at one point, a relay connected with the plug-circuit and responsive to current in the called line, said last-mentioned branch of the local circuit being completed by said relay when excited, and means for maintaining the continued excitement of the controlling-magnet of said counter during connection, as described.

In witness whereof I hereunto subscribe my name this 25th day of January, A. D. 1897.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,
MYSTA F. GREEN.