

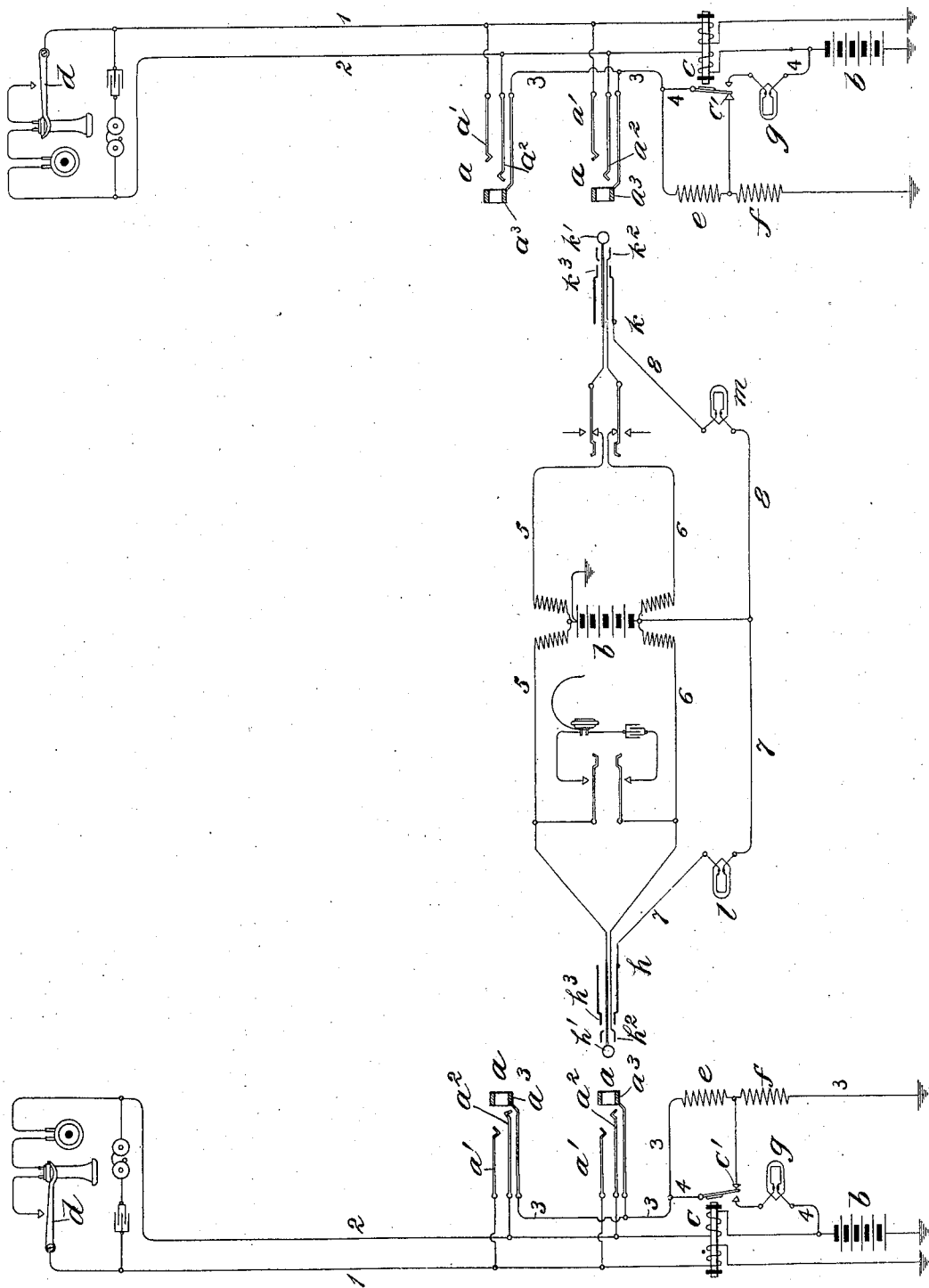
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F. R. McBERTY.

SUPERVISORY SIGNAL FOR TELEPHONE SWITCHBOARDS.

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WITNESSES:

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SUPERVISORY SIGNAL FOR TELEPHONE-SWITCHBOARDS.

No. 817,867.

Specification of Letters Patent.

Patented April 17, 1906.

Application filed January 24, 1902; Serial No. 91,031.

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 Supervisory Signals for Telephone-Switchboards, of which the following is a full, clear, concise, and exact description:

My invention relates to electrical signal devices and circuits therefor, and is intended more particularly to be used in connection with telephone-exchange systems for automatically indicating to the central-office operator a call from a subscriber for connection and also a subsequent call from the same subscriber for disconnection.

In a well-known automatic signal system for telephone-exchanges the line-relay of a subscriber's line which is responsive to the flow of current in the line controlled by the subscriber's telephone-switch controls a local circuit containing a source of current, a line-signal lamp, and a resistance. When the subscriber takes his telephone from its hook, as in initiating a call, this local circuit is closed, and when he replaces his telephone the line-relay allows its armature to fall back and open the local circuit. A second lamp—the supervisory signal—is included in a shunt-circuit about the line-lamp, said shunt being established in registering contacts of the plug and spring-jack switch by which the operator makes temporary connection with the line. When the subscriber first takes his telephone from its hook, the local circuit containing the line-lamp is closed. Then when the operator answers the call by plugging into the spring-jack of the line whose lamp is thus lighted the supervisory lamp is brought into a shunt of the line-lamp, and each lamp shunts the other, so that the illumination of the line-lamp ceases and the supervisory lamp remains dark. Then at the end of the conversation when the subscriber replaces his telephone on its hook the line-relay allows its armature to fall back and opens the path containing the line-lamp, thus removing the shunt about the supervisory lamp, whereby sufficient current flows through the latter to cause its illumination. This system just described requires careful proportioning of the resistances and of the source of current.

Should the resistances of the lamps vary after some period of use, which frequently happens, or if the potential of the battery be varied, the system will not work perfectly. The signals being designed to operate on slight margins of current are to this extent uncertain.

It is the object of my present invention to provide an automatic signaling system which will be as simple as the one just described and more certain in its operation. I provide a local circuit containing a line-signal and controlled by a switch which may be the line-relay of the subscriber's line, and the second signal—the supervisory signal—is included in a branch circuit which is adapted to be closed in a shunt of the first-mentioned signal by a switch which may be closed in making connection with the line, as in registering contacts of the plug and spring-jack. A resistance is included in the undivided portion of the circuit, and a switch-contact, which may be the back contact of the subscriber's line-relay, is arranged to shunt or short-circuit this resistance when the path containing the line-signal is opened. The supervisory signal is of considerably lower resistance than the line-signal, so that when both the parallel paths are closed the line-signal will be shunted by the supervisory signal; but in such a case the supervisory signal will not be excited, because of the resistance in the circuit. The line-signal, however, unless it is shunted by the low-resistance supervisory signal is adapted to be excited even with the resistance in the circuit. When the parallel paths containing the line and supervisory signals are both closed, neither signal will be excited; but when the branch containing the line-signal is opened the switch which short-circuits the resistance is also actuated and the supervisory signal will receive sufficient current for its excitation.

I will describe my invention in connection with the accompanying drawing, which illustrates diagrammatically two telephone-lines extending from substations to a central office and a pair of plugs and their plug-circuit at the central office for uniting lines, the system being organized and equipped for automatic signaling in accordance with my invention.

Each telephone-line extends in two limbs

1 2 from the usual substation apparatus to the contacts a' a^2 , respectively, of the several multiple spring-jacks a of the line at the central office, and thence through the wind-
 5 ings of the line-relay c to the poles of the central battery b . The apparatus at the substation comprises the usual telephone receiver and transmitter in a bridge of the line controlled by a gravity telephone-switch d , this
 10 switch being of the ordinary type adapted to close the circuit when the telephone-receiver is taken from the hook for use. The usual call-bell is shown included with a condenser in a bridge of the line at each substation.

15 The spring-jacks at the central office have the short and long line springs a' a^3 , which are connected, respectively, with the limbs 1 2 of the telephone-line, and said spring-jacks are also provided with the usual thimbles or
 20 test-rings a^3 . All the test-rings a^3 of each line are connected together by a conductor 3, which extends to earth through two resistances e and f . The resistance e may be seventy-five ohms and the resistance f may be
 25 forty ohms. A line-signal lamp of comparatively high resistance—say one hundred and forty ohms—is provided for each line in a local circuit from the battery b , said local circuit being made up of a conductor 4, extending
 30 from the free pole of the battery through the line-signal lamp g and the normally open switch-contacts of the line-relay c to the conductor 3 between the spring-jacks and the resistance e . When the line-relay is
 35 excited, therefore, the circuit of the battery b is completed through the lamp g and resistances e and f in series to earth. The line-relay is also provided with a normally resting contact c' , which is connected to short-circuit
 40 the resistance e when the armature of the relay is in its retracted position. In other words, when the armature of the line-relay is retracted it breaks the shunt containing the line-signal lamp g at its front contact and es-
 45 tablishes at its back contact a short circuit of resistance e .

I have shown the usual pair of plugs united by the cord conductors of a plug-circuit, whereby any two lines may be connected to-
 50 gether by inserting the plugs of the pair into the spring-jacks of such lines, the circuit being extended from one line to the other through the link conductors 5 6. The plug
 55 h is the answering-plug, and k is the calling-plug. Each plug has the usual tip, ring, and sleeve contact pieces, which are adapted to engage with the short and long line-springs and the test-ring, respectively, of any jack into which such plug may be inserted. The
 60 tips h' k' of the plugs are united by the tip-strand 5 of the plug-circuit, and the ring-contacts h^2 k^2 are similarly united by the ring-strand 6. The battery b is shown connected in a bridge of the plug-circuit con-

ductors 5 6 between the windings of a repeat- 65 ing-coil in the usual manner.

While I have for clearness shown in the drawing three batteries each marked b , it will be understood that in accordance with the well-known practice a single central 70 battery may be employed, connected as indicated.

Supervisory signal-lamps l m of, say, thirty-seven ohms resistance are associated with the answering and calling plugs h and k , 75 respectively, said lamps being included in conductors 7 8, respectively, which extend from the free pole of the battery b to the third contacts h^3 k^3 , respectively, of the plugs.

It is understood, of course, that each plug- 80 circuit may be provided with the usual ringing and listening keys with their associated apparatus, by which the operator can communicate with any subscriber whose line is connected to the plug-circuit and may send 85 signaling-current over such subscriber's line to ring the call-bell at the substation.

The operation of the automatic signals is as follows: When the subscriber desiring a connection with another subscriber removes 90 his telephone-receiver from its hook, his telephone-switch d automatically closes a bridge of the line containing his telephone apparatus, and thus completes the circuit of the central-office battery b through his line-relay 95 c . The line-relay being excited by the current draws up its armature and closes the local circuit 4 3, which contains the line-signal lamp g and the two resistances e and f in series. The signal-lamp g is adapted to be 100 lighted by the current flowing in this circuit, and its illumination constitutes a signal to the operator to make connection with the corresponding line. This she does by inserting her answering-plug h in the answer- 105 ing spring-jack, and by depressing her listening-key is brought into communication with the subscriber and asks him the number of the line with which he desires to be connected. Having received this information, she 110 inserts the other plug k of the pair into the spring-jack of the line wanted and sends the call-signal by means of her ringing-key in the usual manner. The insertion of the answer- 115 ing-plug h into the spring-jack of the calling-line brings the low-resistance supervisory lamp l into shunt of the line-signal lamp g , so that the line-lamp is shunted out. The supervisory lamp, moreover, is not lighted, because resistances e and f in the circuit cut 120 down the current below the amount required for its illumination. When, however, the armature of the line-relay is retracted, the shunt containing the supervisory lamp being closed at the plug and spring-jack switch, as 125 after the conversation has been finished and the subscriber has hung up his telephone the line-lamp will be cut out of the circuit and

the resistance e will be short-circuited at the back contact c' of the line-relay. Increased current will thus flow from the battery b through the supervisory lamp to the plug and spring-jack switch, through the conductor 3 and resistance f to earth, the resistance e being short-circuited, so that the supervisory lamp will be lighted and indicate to the operator a signal for disconnection. When the calling-plug is inserted in the jack of the called line, the supervisory lamp associated with such plug will of course be lighted until the called party responds, whereupon the line-relay switch will operate to interpose the resistance e in the circuit and cut down the current, so that the lamp will be darkened, and will remain dark until the called party hangs up his telephone after the conversation has been finished.

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

1. The combination with a source of current, of a local circuit having two parallel branches with a signal device in each branch, means for opening and closing each branch, a resistance in the undivided portion of the circuit and an electromagnetic switch controlling a shunt or short circuit of the resistance, the source of current, signal devices and resistance being proportioned to prevent the actuation of either signal device when both of said parallel branches are closed, one of said signal devices being adapted to be actuated by the increased current when the resistance is shunted by the switch, substantially as described.

2. The combination with a source of current, of a signal device and a resistance in a local circuit therewith, a shunt of said signal device containing a second signal device, a switch controlling said shunt, and a switch controlling the first-mentioned circuit adapted to cut out the first-mentioned signal device and shunt or short-circuit the resistance, whereby said second signal device receives increased current for its operation.

3. The combination with a telephone-line extending from a substation to a central office, of a source of current and a substation telephone-switch controlling the flow of current in the line, a line-relay responsive to the current so controlled, a line-signal of comparatively high resistance included with resistances e and f in a local circuit controlled at normally open contacts of the relay, a spring-jack for the line, a plug and plug-circuit for making connection therewith, a supervisory signal associated with the plug-circuit in a local shunt of the line-signal, adapted to be established in registering contacts of the plug and jack, the supervisory signal being of comparatively low resistance to shunt the line-signal and being adjusted or adapted to remain inert under the influence

of current from said battery flowing through the said resistances e and f , and a switch-contact closed by the armature of the line-relay when retracted, shunting or short-circuiting the resistance e , substantially as set forth.

4. The combination with a source of current, of a signal device l and resistances e and f in a local circuit therewith, a switch adapted to complete said local circuit, a switch c controlling a shunt or short circuit of the resistance e , the completion of said shunt or short circuit being adapted to bring about the actuation of the signal device l , and a second signal device g controlled jointly by the switch c and the first-mentioned switch.

5. In a telephone-exchange system, the combination with a telephone-line extending from a subscriber's station to an exchange and terminating thereat in a line-jack, of cord-connecting apparatus for uniting this telephone-line with another for conversation, a relay at the exchange operable from the substation, line and clearing-out lamps, parallel conductors including the lamps, a source of current for the line-relay and for the lamps, a resistance interposed between the parallel conductors containing the lamps and their source of current, means whereby the cord-circuit will complete the parallel branch containing the clearing-out lamp when connection is being established with the line, the armature of the relay serving to close the parallel branch containing the line-lamp when attracted, and a shunt closed by the armature of the relay when unattracted about a part of the resistance, substantially as described.

6. In a telephone-exchange system, the combination with a telephone-line extending from a subscriber's station to an exchange and terminating thereat in a line-jack, of cord-connecting apparatus for uniting this telephone with another for conversation, a relay at the exchange operable from the substation, line and clearing-out lamps, parallel conductors including the lamps, a source of current for the line-relay and for the lamps, a resistance interposed between the parallel conductors containing the lamps and their source of current, means whereby the cord-circuit will complete the parallel branch containing the clearing-out lamp when connection is being established with the line, the armature of the relay serving to close the parallel branch containing the line-lamp when attracted, and means controlled by the armature when unattracted for cutting out a portion of the resistance in circuit with the clearing-out lamp, the clearing-out lamp requiring more current for its operation than the line-lamp, circuit being established through the clearing-out lamp by the engagement of contacts associated with the plug and engaged jack, substantially as described.

7. In a telephone central-exchange system,

the combination with the line-relay having front and back armature contacts; a supervisory signal associated with a switch-cord and a switch-plug thereof; and a local circuit
5 containing said signal; of a resistance device associated with said local circuit to govern the strength of current therein and thereby to determine the display or non-display of
10 said signal; and a short circuit or shunt round said resistance device leading through the back armature contacts of said line-relay, and adapted to be closed when said relay is unexcited, and opened when the same is excited, whereby the display of said supervisory
15 signal is made dependent upon the attraction or retraction of the armature of said line-relay; substantially as set forth.

8. A telephone system comprising a subscriber's line, a source of current connected
20 with the line, a line-relay, a line-signal adapted to be brought into operation by the energization of said relay, a plug-switch, a supervisory lamp connected and arranged to shunt out the said line-signal when the plug-switch
25 is closed, and a shunt controlled by said relay and arranged to reduce the resistance of the supervisory-lamp circuit when the line-circuit is open and the plug-switch closed.

9. A telephone system comprising a subscriber's line, a substation-switch for closing
30 the line-circuit, a source of current-supply connected with the line, a relay connected with the line, a line-signal associated with said relay and controlled thereby, a plug-switch and a supervisory signal connected
35 and arranged for shunting out said line-signal when the line-circuit is closed, and a normally closed shunt controlled by said relay and adapted for reducing the resistance of

the supervisory signal circuit, said shunt
40 closing when the line-circuit is opened by the substation-switch.

10. The combination of a normally open signal-circuit, a normally closed shunt in
45 said circuit, means in said circuit for supplying current, a normally open line-circuit including said source of current, and a relay included in said line-circuit and adapted when energized to open said shunt when the signal-circuit is closed, so as to prevent the display
50 of said signal, said relay when deenergized being adapted to close said shunt, so as to cause the display of said signal.

11. The combination of a subscriber's line, a subscriber's switch, a line-relay, a suitable
55 source of current for supplying current to the line through said relay, a normally open circuit including said source of current, a supervisory signal in said open circuit, a suitable resistance in said circuit, and a normally
60 closed shunt in said normally open circuit extending around said resistance, said shunt being controlled by said line-relay, whereby the closing of said subscriber's switch opens
65 said shunt, so as to prevent the display of said supervisory signal when the normally open circuit is closed, and whereby the opening of said subscriber's switch operates to
70 close said shunt, so as to cause a display of said supervisory signal when the said normally open circuit is closed.

In witness whereof I hereunto subscribe my name this 28th day of December, A. D. 1901.

FRANK R. McBERTY.

Witnesses:

GEORGE P. BARTON
EDWIN H. SMYTHE.