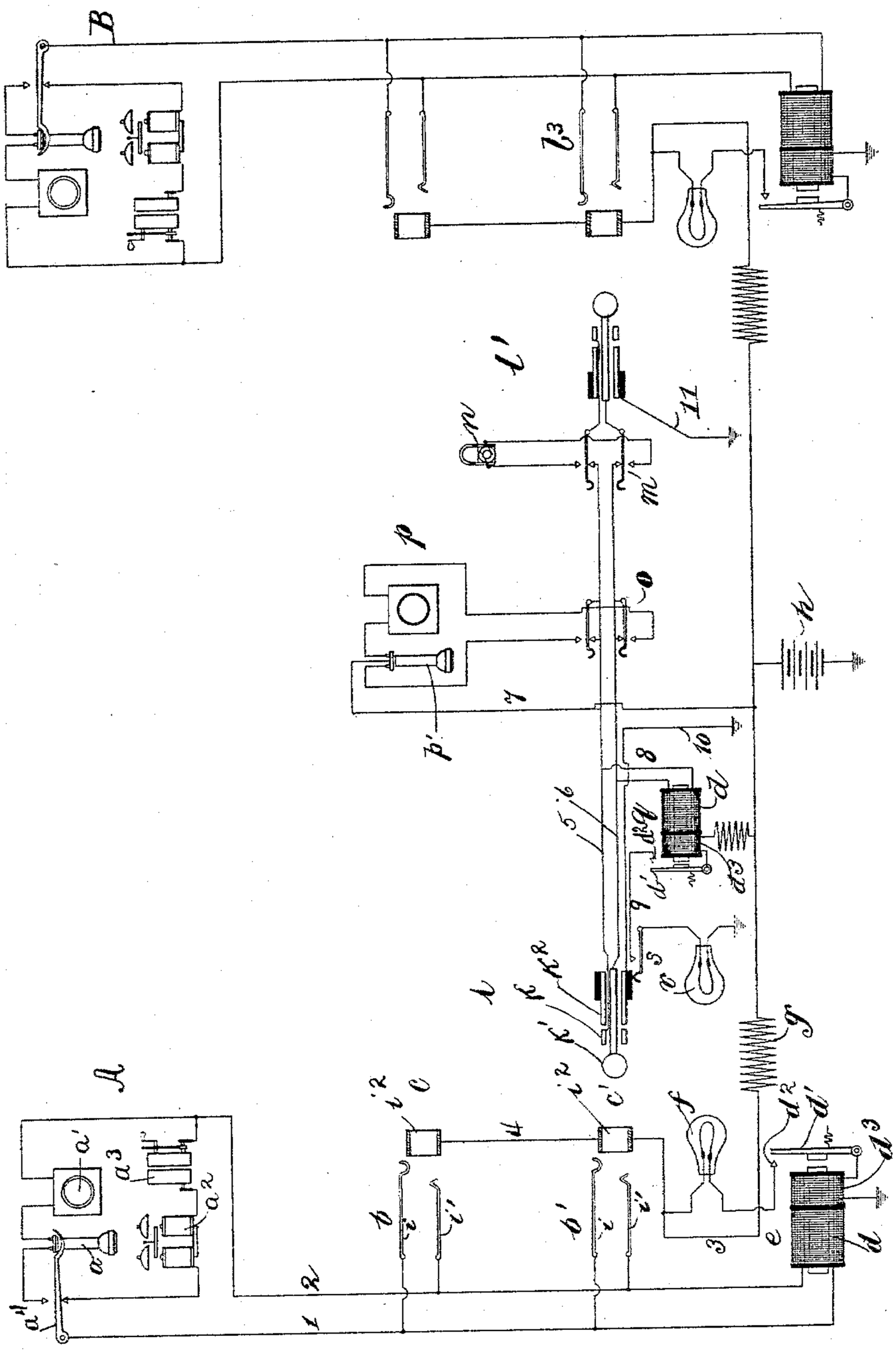
(No Model.)

C. E. SCRIBNER.

APPARATUS FOR TELEPHONE SWITCHBOARDS.

No. 597,785. Patented Jan. 25, 1898.



Witnesses:
De Witt C Tanner.
George L. Cragg.

Inventor
Charles E. Scribner
By Burton Brown
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 597,785, dated January 25, 1898.

Application filed April 16, 1895. Serial No. 545,854. (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 Apparatus for Telephone-Switchboards, (Case No. 380,) 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.

My invention relates to signaling apparatus for use between substations and the central station of a telephone-exchange, particularly to the type of signaling mechanism in which a relay in the line-circuit controls a subsidiary or auxiliary signal in a local circuit.

The object of my present invention is to construct a system of this type adapted for use with momentarily-actuated generators of signaling-current located at substations, making the display of the subsidiary signals attendant upon the operation of the generator of signaling-current at the substation, but permitting its subsequent continued display independent of current in the line-circuit.

A further object is to return the displayed subsidiary signal to its normal inert condition when connection is established with the line in response to a call, leaving the subsidiary signals free for further operation after the withdrawal of the connections.

The primary object of my invention is attained by the combination, with a telephone-line provided with a suitable source of signaling-current in its circuit, such as a momentarily-actuated generator at the substation, and terminating in a telephone-switchboard, of a relay and a local circuit including a subsidiary signal and a source of current controlled by the armature of the relay and a secondary or auxiliary magnet-coil upon the relay included in the local circuit. By this device the establishment of current in the line-circuit magnetizes the relay, which closes the local circuit and excites the subsidiary signal, at the same time energizing the auxiliary magnet-coil on the relay and thus retaining its armature in position to maintain the excitement of the subsidiary signal without further dependence upon the current in the line-circuit.

The second-mentioned object of the invention is attained by an arrangement of circuits and switch-contacts for short-circuiting or otherwise deënergizing the auxiliary magnet-helix of the relay when connection is established with the line, whereby the relay is permitted to resume its normal condition and the subsidiary signal to become inert. Conductors from opposite terminals of the auxiliary magnet-helix are led to registering contact-pieces in the spring-jacks of the line and in the connecting-plugs which are adapted for use with them. Thus when a plug is inserted into a spring-jack the auxiliary magnet-helix is short-circuited. I have found small incandescent lamps to be suitable subsidiary signals for use in such local circuits. The auxiliary magnet-helix, the contact-points of the relay, the subsidiary lamp-signal, a resistance-coil, and a source of current are included in the order of naming in the local circuit. A connection is taken from this circuit at a point between the lamp and the resistance-coil to a contact-piece in a spring-jack, or in each spring-jack connected with the same line if the switchboard be of the multiple type, and another conductor is led from the contact-piece in each connecting-plug to a point between the battery and the auxiliary magnet-helix, these latter points being common to the different pairs of cords and local circuits. Thus when in establishing connection with a line a connecting-plug is inserted into a spring-jack of the line a shunt or short circuit is formed about the auxiliary magnet-helix, the contact-points of the relay, and the lamp, whereby the relay is demagnetized and the lamp is extinguished. When the connecting-plug is withdrawn from the spring-jack, there being then no current either in the line-circuit or in the local circuit, the relay remains in its inert condition in readiness to respond to a subsequent signaling-current in the line.

While the individual or line signal of any line is rendered inoperative during the use of the line, it is of course necessary that some means be provided for receiving or indicating

a signal, such as a signal for disconnection or removal of the connection between two corresponding lines. For this purpose in my system I have arranged a device for responding to a clearing-out signal, which is temporarily associated with two connected lines, consisting of substantially the same mechanism with the same general arrangement as employed in the line-circuit. The main or line magnet of a relay is connected in a bridge between the different conductors of the plug-circuit uniting the two connecting-plugs, and the switch-contacts of the relay control a local circuit, including a source of current, a subsidiary lamp-signal, and the auxiliary magnet of the relay. When the line-magnet of the relay is excited by a signaling-current in the line subsequent to the establishment of connection with the line and, as before described, closes the local circuit, it illuminates the subsidiary lamp-signal and creates at the same time an exciting-current through the relay which is independent of the current in the line. Upon the return of the connecting-plugs to their normal or idle position the local circuit is interrupted by a suitable switch actuated in the replacement of one of the plugs in its resting-socket.

I have illustrated my invention in the accompanying drawing, which is a diagram representing two substations connected by line-circuits with relays and spring-jacks in a telephone-switchboard, the relays being associated with local circuits and subsidiary signals, as before described. A single pair of connecting-plugs is shown, the plugs being equipped with the clearing-out device mentioned.

The mechanism provided at the subscriber's station comprises the usual telephone-receiver a and transmitter a', signal-bell a^2, and generator of signaling-current a^3, together with a switch a^4, arranged to support the telephone and constructed to close the circuit alternately through the telephone instruments and the signaling appliances. The line-circuit, consisting of direct and return conductors 1 and 2, connects this apparatus with spring-jacks b and b' in a multiple telephone-switchboard of two sections c and c', and includes the "line-helix" d of a relay e, located at the central station. The armature d' and contact-anvil d^2 of this relay control the continuity of a local circuit 3, which extends serially through an auxiliary magnet-helix d^3 on relay e, a signal-lamp f, a resistance-coil g, and a battery h. The signal-lamp f is located in any convenient position in the switchboard where it may be under the supervision of the attendant, preferably near the spring-jack b' of the line on section c' of the switchboard. A suitable lamp may have a resistance of ten ohms. The resistance of magnet-helix d^3 should be comparatively low in order to avoid waste of energy in the local circuit, five ohms being sufficient. The resistance of coil g may also be ten ohms. The electromotive force of battery h should of course be sufficient to cause the illumination of signal-lamp f when the relay-contacts are closed.

The spring-jack which constitutes the terminal of the line in each section of the switchboard is of well-known construction. It comprises two springs i and i', which are connected with line conductors 1 and 2, respectively, and a contact ring or thimble i^2. The thimbles i^2 of the different spring-jacks are united by a conductor 4, which is connected with the local circuit 3 at a point intermediate of the lamp and the resistance-coil.

The connecting-plug employed is constructed with three contact-pieces k, k', and k^2, which are adapted to register with the different contact-pieces i, i', and i^2 of a spring-jack, into which a plug may be inserted. The contact-pieces k and the contact-pieces k' of two plugs l and l' are united by two conductors 5 and 6, which constitute the "plug-circuit." These conductors include the switch-contacts of a calling-key m, which is adapted to disconnect the plug l' from plug l and to loop into circuit with the former a source of calling-current n for the purpose of signaling a subscriber. Conductors 5 and 6 are connected with the switch-contacts of a listening-key also, which acts when depressed to bridge the operator's telephone set p across the plug-circuit. A conductor 7 is led from the central point of the resistance in the magnet-helix of the telephone-receiver p' to a point on circuit 3 intermediate of the battery h and the resistance-coils g to provide means for testing, as will be hereinafter described.

The line-coil d of a "clearing-out" relay q is permanently connected in a bridge 8 between conductors 5 and 6. The switch-contacts d' d^2 of this relay control the continuity of another local circuit 9, which likewise includes an auxiliary magnet d^3 on the relay, a signal-lamp r, and a battery. The same battery h is employed, the local circuit 9 being placed in parallel with the local circuit 3 about the battery. The continuity of this circuit 9 is further controlled by a plug-seat switch s in the resting-socket of plug l, the plug-seat switch being arranged to close the circuit when the plug is withdrawn from its socket. The contact-pieces k^2 of the two plugs are grounded through conductors 10 and 11, respectively.

In the normal condition of the apparatus the telephones at the different substations rest upon their switch-hooks and no currents exist in the line-circuits. The armatures of the relays are retracted from their contact-points. The local circuits are open and the different line-signals are inert or unilluminated. The plugs l of the different pairs of cords provided for each operator rest in their sockets, whereby the different circuits 9 are interrupted.

To illustrate the operation of the system,

assume that the subscriber at station A desires to have his line connected with station B. The subscriber at the former station operates his generator a^3 of signaling-current in the usual way, thus creating in the line-circuit 1 2 a current which traverses the line-magnet d of relay e. The relay is excited and closes the local circuit 3. The current of battery h of this local circuit illuminates the signal-lamp f, associated with the spring-jack of that line on switchboard c', and at the same time further excites the relay e, so that after the cessation of the signaling-current in the line-circuit the relay still holds its armature and maintains the illumination of lamp f. The attendant at section c' of the switchboard, observing the signal, raises plug l from its socket and inserts it into the spring-jack b'. The raising of the plug from its socket permits the plug-seat switch s to close one break in the local circuit 9, thus leaving this circuit with its clearing-out signal-lamp controlled only by the relay q. The insertion of plug l into the spring-jack extends the line conductors 1 2 to the conductors 5 6 of the plug-circuit through the medium of the registering contacts of the spring-jack and the plug. At the same time a ground connection is completed from ring i^2, through contact-piece k^2 and conductor 10, terminating therein, which constitutes a shunt or short circuit about the lamp f, the contact-points of relay e, and the magnet d^3 of the relay. The lamp f is thus extinguished, and the magnetizing-helix d^3 becomes inert and permits the armature of the relay to fall away from its contact.

The operator connects her telephone set with the plug-circuit by means of key o in the usual manner, and having thus established communication with the subscriber at station A learns his order. She tests the line to station B in the usual way—that is, by applying the tip of plug l' to the thimble or ring i^2 of spring-jack b^3. If the line be not in use, no difference of potential exists between the tip of the plug and the ring of the spring-jack, since these constitute the terminals of open circuits whose other terminals are connected with the same pole of battery h, the rings being the open terminals of the circuit 4 3 and the tip of the plug being the terminal of a circuit through conductor 6 to the listening-key and thence through the operator's telephone-receiver p' and conductor 7 to the battery h. If the line were in use, the ring i^2 of spring-jack b^3 would be grounded through conductor 10 or 11 of the plug-circuit, by means of which the connection with it was established, and battery h would find a circuit through the tip of the plug to earth at each application of the plug to the test-ring i^2. Finding the line free for the desired connection, she inserts plug l' into the spring-jack b^3 and operates the key m to ring the bell at substation B, as usual. The insertion of the plug into the spring-jack creates a short circuit about the lamp-signal f' and the magnet d^3 of relay e' by means of the conductor 11, connected with the plug in a manner similar to that established about the signal and relay magnet of the other line. Hence although a portion of the signaling-current traverses the line-magnet of relay e' the line signal-lamp f' is not illuminated. It will be understood that the signal-lamp f' may be upon any section of a multiple switchboard, and that its illumination by a signaling-current sent to operate the substation-bell would constitute a false signal, which would mislead the operator having supervision of the signal-lamp.

When the subscribers have terminated their conversation, either subscriber may transmit a signal for disconnection by turning his generator a^3 of signaling-current. The current thus created in the line finds circuit to the plug-circuit 5 6 and thence through the line-magnet d of the clearing-out relay q. This relay becomes excited and closes the local circuit 9, illuminating the clearing-out signal-lamp r and thus indicating the signal to the attendant. The continued excitement of the relay after the cessation of the signaling-current is attained, as before, by the magnetism of helix d^3. In response to the signal the operator removes the plugs l l' from the spring-jacks into which they are inserted and returns them to their resting-sockets. The plug-seat switch interrupts the local circuit 9, the relay-magnet becomes inert, and the mechanism of the clearing-out device is returned to its normal condition.

It will be noted that the relay e is not excited at the moment of withdrawal of plug l from spring-jack b', so that it remains in its normal position in readiness to indicate a subsequent line-signal.

I do not desire to limit myself to any particular mode of producing current in the line-circuit for the purpose of exciting the relay or to the location of the source of current at the substation, since my invention may be easily adapted to different systems involving various sources of current-supply for signaling.

In accordance with the foregoing specification I claim as new and desire to secure by Letters Patent—

1. The combination with a telephone-line, of means for producing a signaling-current in the line, and a relay in the circuit responding to such current, a local circuit including a subsidiary line-signal controlled by the relay, an auxiliary helix on the relay in the local circuit, means for establishing connection with the line, and switch-contacts actuated in the establishment of such connection adapted to interrupt the current through the said auxiliary helix, substantially as described.

2. The combination with a telephone-line and means for producing signaling-current therein, of a relay in the line-circuit, a local circuit including a subsidiary line-signal and

a source of current, controlled by the relay, an auxiliary magnet-helix on the relay, in the local circuit, spring-jacks and connecting-plugs for making connection with the line, and a normally open short circuit about the auxiliary helix and the subsidiary line-signal, and coöperating contacts in the plug and spring-jack adapted to close the short circuit, substantially as described.

3. The combination with a telephone-line and means for producing signaling-current therein, of a relay in the line-circuit, a local circuit including a subsidiary line-signal controlled by the relay, an auxiliary magnet-helix on the relay, included in the local circuit, spring-jacks connected with the line and a connecting-plug adapted to be inserted therein, and a normally open short circuit about the subsidiary signal and the auxiliary magnet-helix terminating in registering contacts in the spring-jack and connecting-plug.

4. The combination with a plug-circuit adapted to be temporarily connected with the telephone-line, of a relay having a line-magnet connected with the plug-circuit, a local circuit including a subsidiary signal controlled by the relay, an auxiliary magnet-helix on the relay included in the local circuit, and a plug-seat switch for one of the connecting-plugs adapted to open the local circuit while the plug is in its seat, substantially as described.

In witness whereof I hereunto subscribe my name this 3d day of April, A. D. 1895.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,

DUNCAN E. WILLETT.