

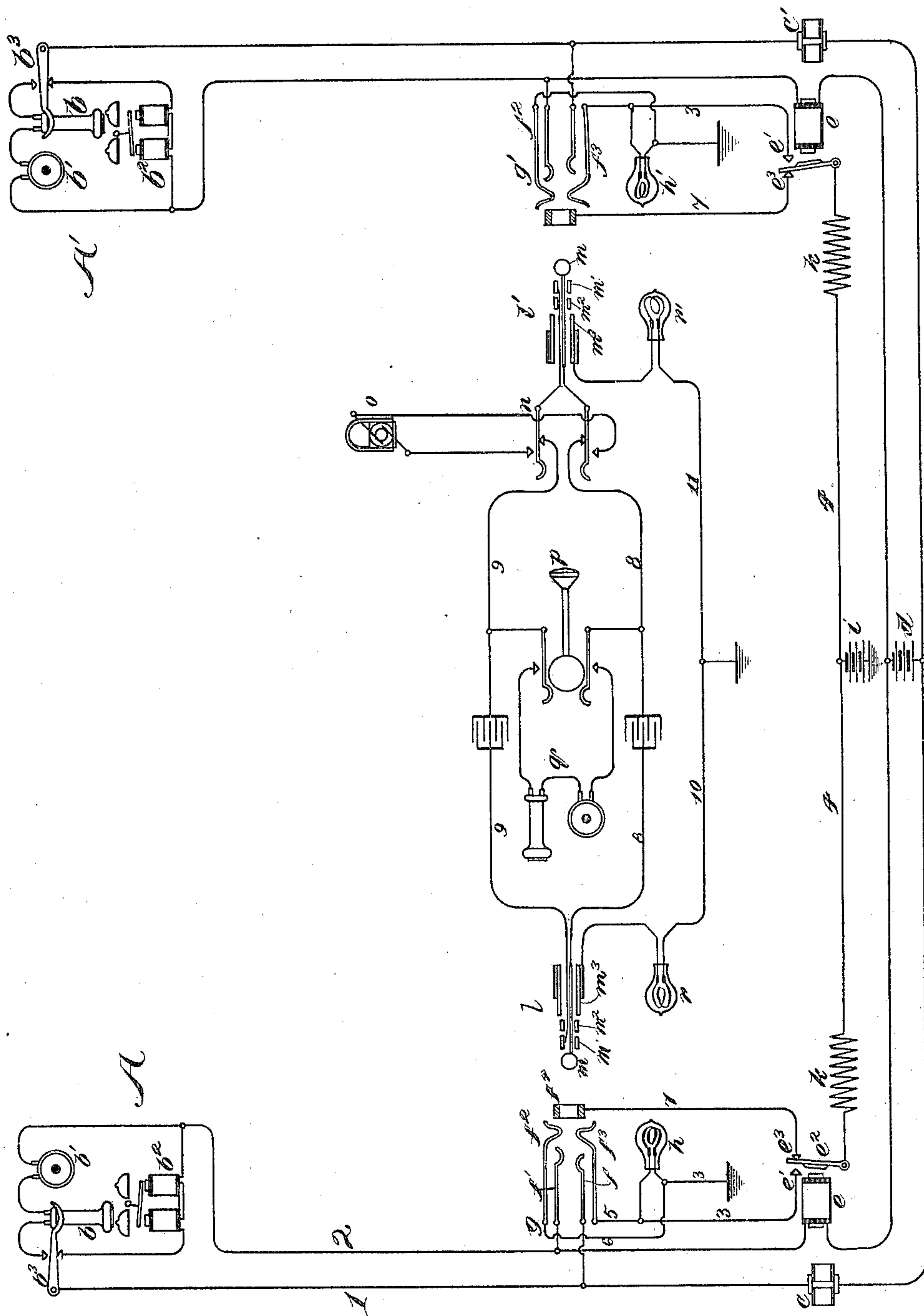
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F. R. McBERTY.
TELEPHONE EXCHANGE APPARATUS.

(Application filed Dec. 26, 1899.)

(No Model.)



Witnesses:
J. M. Skinkle.
W. H. Leach.

Inventor:
Frank R. McBerty,
By Lewis P. Barton,
Attorney.

UNITED STATES PATENT OFFICE.

FRANK R. MCBERTY, OF EVANSTON, ILLINOIS, ASSIGNOR TO THE WESTERN
ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 680,879, dated August 20, 1901.

Application filed December 26, 1899. Serial No. 741,574. (No model.)

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 Telephone-Exchange Apparatus, (Case No. 25^a), of which the following is a full, clear, concise, and exact description.

My invention relates to signaling apparatus of telephone-exchange systems. It concerns particularly the arrangement of annunciators for indicating signals from a substation for connection or disconnection at a telephone-switchboard. Its object is to provide means by which a single responsive device in the line-circuit, automatically operated in the use of the substation-telephone, shall control the different signaling instruments for indicating the signal for connection and that for disconnection, respectively. Hitherto two separate annunciators have been provided in connection with a line in use for conversation—one of them adapted when in its normal condition to indicate an initial call-signal, and the other, temporarily connected with the line, for the purpose of indicating a signal for disconnection.

In my invention I provide a single responsive device, as a relay, in connection with the line-circuit, arranged to be automatically operated by currents in the line during the use of the telephone, and two independent subsidiary signals in different circuits controlled by this responsive device, one of them being permanently associated with a spring-jack of the line and the other being temporarily connected with the line and associated with the connecting-plug, by means of which the line is united with another. I have arranged also a system of circuits by which the signal which is associated with the line—the “line-signal”—is prevented from displaying its signal during the connection of the line with another. Thus in effect the system comprises two subsidiary signals—the line-signal and a “clearing-out” signal—the latter of which is temporarily substituted for the former during connection of the line with another line, both signals being controlled by a single relay or responsive device permanently connected in the line-circuit.

My invention is suitable for use in connection with telephone-lines whose substations are furnished with switches automatically operated in the use of the telephone to close the line-circuit. In each such line at the central station a relay is included, together with a source of electric current. A pair of contact-points in this relay, which are adapted to be closed together when the relay is excited, control a local circuit through a subsidiary signal—preferably a small incandescent lamp—which is placed near and is associated with a spring-jack of the telephone-line in the switchboard. Branches are led from the terminals of this signal to normally-separated contact-pieces in the spring-jack. The connecting-plug for use in the spring-jack has a contact-piece which is adapted to make connection between these separated terminals, thus short-circuiting the line-signal, and at the same time to close another normally open circuit, which includes a clearing-out signal-lamp associated with the connecting-plug, the continuity of the latter circuit being controlled by other contact-points in the same relay. A single electromagnetic responsive device in the line-circuit is thus caused to control two different signaling devices, each of which is permitted to give its distinctive signal in response to the action of the relay.

My invention is shown in the accompanying drawing, which is a diagram of the circuits and apparatus employed therein.

The drawing represents two substations A and A', connected with spring-jacks and a relay in a telephone-switchboard, together with the usual appliances for uniting different telephone-lines in the switchboard. The apparatus at the substations may comprise a receiving-telephone *b* and transmitting-telephone *b'*, a signal-bell *b*², and an automatic telephone-switch *b*³ for connecting the telephone and the bell alternately in the line-circuit. The circuit from station A may be followed particularly in discussing the apparatus and its mode of operation. Line conductors 1 and 2 extend from the substation instruments to the telephone-switchboard. Here line 1 is connected, through an impedance-coil *c*, with one pole of a battery *d*, the other line conductor 2 being connected with

the other pole of the same battery through line-relay e . The line-contacts ff' of a spring-jack g in the switchboard are connected with conductors 1 and 2, respectively. A lamp-signal h is placed near the spring-jack g . This lamp is included in a conductor 3, of which one end is grounded and the other terminates in the front contact-piece e' of relay e . The lever e^2 of this relay is grounded through a conductor 4, including a battery i and a resistance-coil k . Two branches 5 and 6 from conductor 3 taken from opposite terminals of the lamp-signal h terminate in normally-separated contact-springs $f^2 f^3$ in the spring-jack g . The remaining contact-piece of the spring-jack—the contact-ring f^4 —is connected with one end of conductor 7, the other end of the conductor being fixed to the back contact-piece e^3 of the relay.

The apparatus at the substation A' and that connected with the line conductors thereof at the central station are identical with that just described in construction and arrangement.

Connecting-plugs $l l'$ are furnished for the operator for the purpose of looping different spring-jacks together. Each connecting-plug comprises four contact-pieces m, m', m^2 , and m^3 . Of these the first two constitute the line-contacts of the plug and are adapted to register with the line-terminals ff' in the spring-jack. The contact-ring m^2 , which is an insulated ring without any conductor extending to it, is arranged to make connection with the two contact-springs f^2 and f^3 of the spring-jack, and thus to connect them together. The remaining contact-piece m^3 is constructed to make contact with the ring f^4 . The like line-contacts of the two plugs are connected together through conductors 8 9, respectively, which constitute the plug-circuit. These conductors include the contact-points of a calling-key n , which is adapted to disconnect the plug l' from its mate and to loop into circuit with it a generator o of signaling-current.

Branches from conductors 8 9 extend to the switch-springs of a listening-key p , by means of which an operator's telephone set q may be bridged across the plug-circuit. Two grounded conductors 10 11 terminate in the contact-pieces m^3 of the plugs l and l' , respectively. Each of these conductors includes a signal-lamp, which is associated with the plug in which the conductor terminates, those lamps being designated r and r' , respectively.

In the idle condition of the apparatus the telephones at the substations rest on the switch-hooks b^3 . The line-circuits are therefore complete through the high-resistance signal-bells, and the current produced in the closed circuit by the battery d is insufficient to excite the relays e . The circuits through the line signal-lamps h are therefore incomplete and the lamps remain unilluminated.

Assume, in order to trace the operation of the system, that subscriber at station A wishes to communicate with subscriber at station A' . The calling subscriber at station

A by removing his telephone from its switch-hook permits the latter to close the line-circuit through the comparatively low-resistance telephone at the substation. Sufficient current is then set up in the line by the battery at the central station to excite the relay, which attracts its armature and closes the branch 4 from battery i to the ground branch 3, including the line-signal h . This lamp-signal is lighted, and thus indicates the call to the attendant at the switchboard. The operator then inserts the plug l into the spring-jack g , at the same time throwing the listening-key p into position to connect the telephone with the plug-circuit. The operator's telephone outfit q is thus brought into electrical connection with the telephone at station A , and the subscriber is permitted to give his order orally for the connection required. By the insertion of plug l into spring-jack g the contact-pieces $f^2 f^3$ become connected together through the ring m^2 on the plug, whereby the line-signal h is short-circuited and its indication is effaced. The conductor 10, including the clearing-out signal r , is at the same time connected with conductor 7, so that the clearing-out signal, which is free to respond to current through it, is substituted for the line-signal and placed in position to indicate further signals in the line. Having received the order for connection with station A' , the operator inserts plug l' into the spring-jack g' of that line and depresses the plunger of the calling-key n to ring the bell b^3 at the substation. The circuit through conductor 11, including a clearing-out signal r' , is now complete, since the relay of line to station A' is not yet excited, so that the signal r' is illuminated. It remains in this condition until the signaled subscriber has responded and removed his telephone from the switch-hook. The relay then becomes excited by the current created in the line through the telephone at the substation and draws its armature forward, interrupting the connection between conductors 7 and 4. It will be noted that the line-signal lamp h' is already short-circuited. Hence it is not illuminated when the relay-lever closes upon its front contact. If either subscriber replaces his telephone upon its switch-hook, the current in that line is interrupted and the line-relay at the central station returns to its inert position. The lever of the relay thus closes connection between conductors 4 and 7, completing a circuit to the conductor terminating in the inserted plug, and hence through the clearing-out signal included in that conductor. Thus if the telephone at station A were replaced upon its hook the local circuit formed would be from battery i through conductors 4, 7, and 10. The lamp r would thus indicate that the line connected with plug l , with which the lamp is associated, was no longer in use. When both subscribers have replaced their telephones upon their hooks, both signal-

lamps r and r' are illuminated. This condition of the signals is accepted by the operator as signifying that the connection is no longer required. She accordingly removes the plugs from the spring-jacks and returns them to their normal positions.

I claim—

1. The combination with a telephone-line, of a continuously-acting source of current in the line and a telephone-switch controlling the flow of current, a relay in the line-circuit responsive to currents therein, a local circuit including a source of current and a subsidiary line-signal controlled by switch-contacts of the relay closed when said relay is excited, and a clearing-out signal in a separate local circuit controlled by another switch-contact of the same relay and closed when the relay is inert, substantially as set forth.

2. The combination with a telephone-line, of a continuously-acting source of current in the line and a telephone-switch at the substation controlling the current, a relay in the line-circuit responding to currents therein, a line signal-lamp and a clearing-out signal-lamp, and switch-contacts in the relay adapted to close a circuit from a source of current alternately through the line-signal and through the clearing-out signal, as the relay is excited or inert, substantially as described.

3. The combination with a telephone-line, of a continuously-acting source of current in the line and a telephone-switch at the substation controlling the current, a relay in the line responding to currents therein, a line signal-lamp, a circuit including the said lamp, and switch-contacts adapted to close the circuit when the relay is excited, means for interrupting the current through the lamp when connection is made with the line, a clearing-out signal-lamp included in another circuit, and switch-contacts in the relay adapted to close the latter circuit when the relay is unexcited, substantially as described.

4. The combination with a telephone-line, and means for producing current in the line during the use of the telephone, of a relay included in the line adapted to respond to currents therein, a spring-jack connected with the line, a line signal-lamp associated with the spring-jack in a circuit controlled by the relay, to be closed when the relay is excited, means for interrupting the current through the lamp when a connecting-plug is inserted in the spring-jack, a clearing-out signal-lamp associated with a connecting-plug in a circuit normally open at two points, means for closing said circuit at one point when the connecting-plug is inserted into the spring-jack, and switch-contacts in the relay adapted to close the other break in the circuit when the relay is inert, substantially as described.

5. The combination with a telephone-line, of a relay in the line responding to currents therein, a line signal-lamp, and a local circuit therethrough controlled by the relay, a clearing-out signal-lamp, and means for temporarily connecting the clearing-out signal-lamp in a local circuit controlled by the same relay, said means consisting of a conductor terminating in the connecting-plug for making connection with the line, substantially as described.

6. The combination with a telephone-line provided with a switch at its substation adapted to close the line while the telephone is in use, of a source of current and a relay included in the line, a spring-jack connected with the line, and a line signal-lamp associated with the spring-jack, the line-signal being included in a local circuit controlled by the relay, to be closed when the relay is excited, and having its terminals connected with normally separated contact-pieces in the spring-jack, a connecting-plug adapted to fit the spring-jack having contact-pieces constructed to connect the said contact-pieces in the spring-jack together, a clearing-out signal-lamp associated with the connecting-plug in a circuit normally terminating in a contact-piece in the plug and in a registering contact-piece in the spring-jack, the continuity of the local circuit to the said registering contact being also controlled by the relay, substantially as described.

7. The combination with a telephone-line having a relay responsive to currents in the line, of a subsidiary signal in the circuit controlled by the relay, a spring-jack for the line and a plug and plug-circuit for making connection therewith, a second subsidiary signal and an independent local circuit for said last-mentioned signal, controlled by an independent switch-contact of the aforesaid line-relay, said local circuit of the last-mentioned signal being completed in making connection with the line, substantially as set forth.

8. The combination with a telephone-line, a continuously-acting source of current therein at the central office, and a telephone-switch for controlling the current at the substation, a relay in the path of current in the line, a local circuit controlled by the relay and a line-signal therein, a spring-jack for the line and a plug for making connection therewith, a normally broken short circuit of the line-signal independent of the switch-contacts of the relay, and switch-contacts controlling the short circuit, closed by the plug when in the spring-jack, substantially as described.

9. The combination with a telephone-line, a continuously-acting source of current in the line at the central office, and a telephone-switch controlling the line-circuit at the substation, a relay in the line responsive to current therein, a local circuit controlled by the relay, and a line-signal in the local circuit, a normally open short circuit of the line-signal independent of the switch-contacts of the relay, and means for closing the shunt when the connecting-plug is inserted in the spring-jack of the line, a clearing-out signal associated with the connecting-plug, and means for

controlling it in response to changes in the current strength of the line, the circuit through said clearing-out signal being completed through registering contacts of the 5 spring-jack and plug when connection is made with the line, substantially as described.

10 10. The combination with a telephone-line, of a source of current and a relay included in the line at the central office, a switch at the substation adapted to close the circuit through said relay in the use of the telephone, a subsidiary signal in a local circuit adapted to be closed by the relay when excited, a 15 spring-jack for the line and a plug and plug-circuit for making connection therewith, a switch actuated in making connection with

the line, adapted to deprive the subsidiary signal of current, a disconnect-signal associated with the plug-circuit, and a local circuit for said disconnect-signal, established in 20 registering contacts of the plug and spring-jack, and controlled by the switch-contacts of the relay, said circuit being closed by the said line-relay when inert, substantially as set forth. 25

In witness whereof I hereunto subscribe my name this 1st day of December, A. D. 1899.

FRANK R. McBERTY.

Witnesses:

GEORGE P. BARTON,
J. W. SKINKLE.