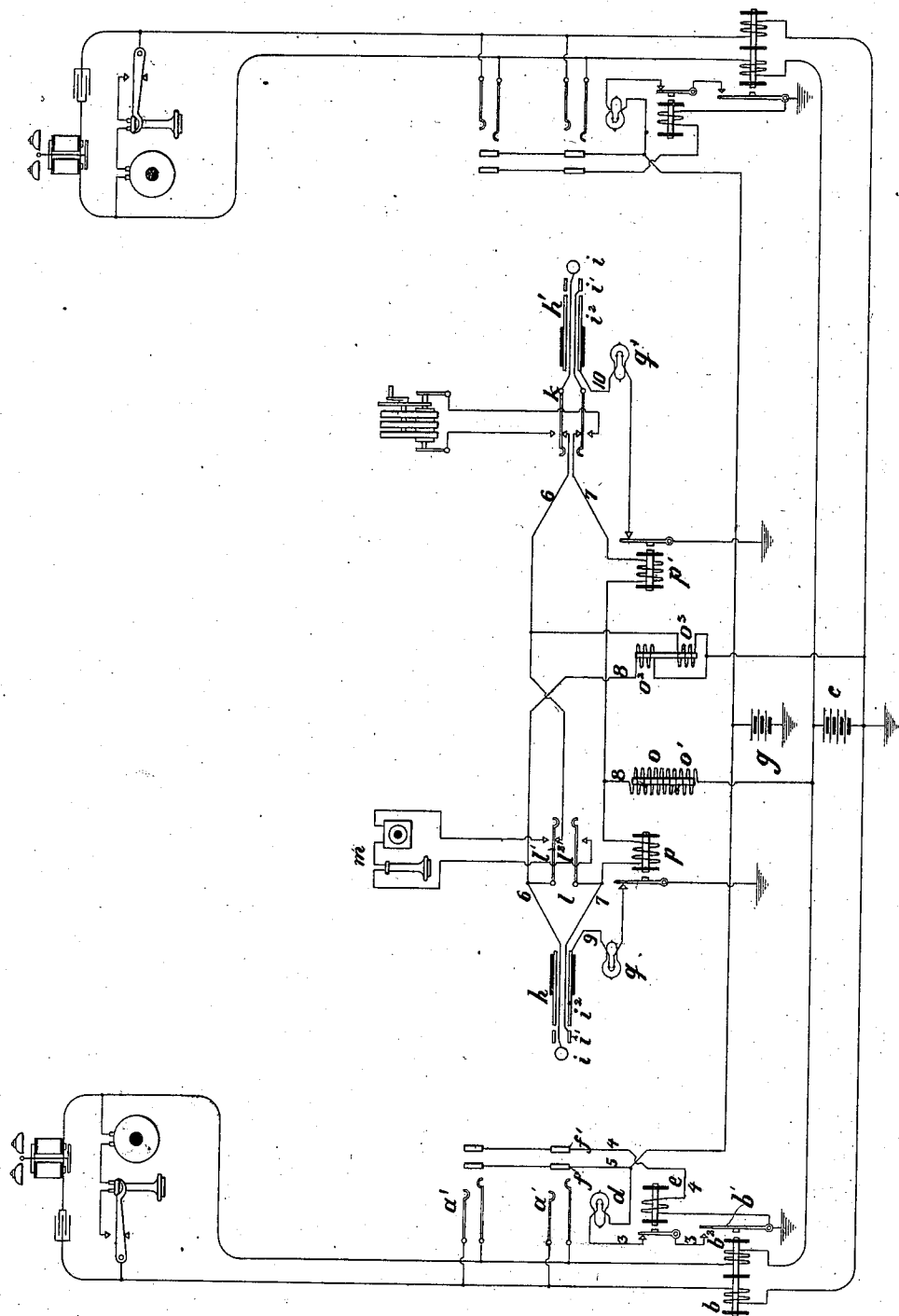


(No Model.)

C. E. SCRIBNER.
APPARATUS FOR TELEPHONE SWITCHBOARDS.

No. 587,406.

Patented Aug. 3, 1897.



Witnesses:
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 587,406, dated August 3, 1897.

Application filed December 18, 1896. Serial No. 616,127. (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. 434,) 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 concerns the signaling appliances in telephone-switchboards for lines centering therein.

It consists in means for effacing the signal displayed in association with the line to indicate a call in the establishment of connection with the line. It also concerns the supervisory signals designed for temporary association with the lines during connection with them and means for exciting these signals controlled by the telephones at substations.

In certain switching systems of well-known construction the apparatus at the substation is so arranged that current is produced in the line during the use of the telephone; and in the switchboard a relay is provided in connection with the line and responsive to current in it, which controls a subsidiary signal associated with the spring-jacks of the line. Further, other signals termed "supervisory" signals are associated with the connecting-plugs used for uniting lines and controlled by other relays interposed in the conductors uniting the plugs.

My invention pertains to switching systems of this type and comprises means for effacing or preventing the display of the subsidiary line-signal, consisting of a magnet and an armature therefor, and switch-contacts adapted to interrupt the local circuit including the subsidiary signal when the magnet is excited, together with a peculiar local circuit including the magnet, and normally open at separated terminals in the spring-jacks of the line which become crossed together by an inserted plug, and supervisory lamp-signals associated with the terminal plugs and brought into local circuits through the agency of the plugs and the contact-pieces of the spring-

jacks, the signals being controlled by relays included in circuits of the plugs.

The invention is illustrated in the accompanying drawing, wherein two substations are represented with line conductors led to signaling and switching appliances in the switchboard, a single pair of plugs and their plug-circuit being shown in the switchboard in position for uniting the two lines.

The apparatus at the substation is of well-known type, the apparatus being adapted to close the line-circuit as to continuous currents while the telephone is in use. The line conductors are connected in the switchboard at the central office with the line-contacts of spring-jacks *a* and *a'* and are extended through windings of the relay *b* to the poles of a battery *c*, which is common to the different lines of the exchange. The spring-jacks are assumed to be upon different sections of a multiple switchboard. The armature *b'* of the relay *b* with its contact *b²* control a local circuit 3, which includes a signal-lamp *d*, associated with spring-jack *a'*, together with a source of current. This local circuit 3 is controlled also by switch-contacts of a relay *e*, which is included in a portion 4 of another local circuit, which terminates in thimbles or contact-rings *f* of the spring-jacks of the line, the relay *e* being constructed to break the circuit 3 when it is excited. The complementary portion of the latter circuit is a conductor 5, which terminates in opposing contact-pieces *f'* in the spring-jacks, and which includes a battery *g*. These parts *f* and *f'* are designed to register with and be crossed together by a separate contact-piece in the plug which is used with them. The type of spring-jack is well known in the art of telephony.

The connecting-plugs *h* and *h'* have each a pair of line-contacts *i* and *i'*, which register with the springs *f²* and *f⁴* of the spring-jack, and a sleeve *j²*, which crosses together the contact-pieces *f* and *f'* of the spring-jack. The tips *i* of the plugs are united by a conductor 6 and the rings *i'* by another conductor 7. These conductors constitute the plug-circuit. The usual calling-key *k* is interposed in them in position to interrupt the connection between the two plugs and to loop a gen-

erator of calling-current into circuit with the plug h' , and the usual operator's listening-key l is furnished to bring the operator's telephone m into a bridge of the plug-circuit. In a permanently-closed bridge 8 of this circuit the source of current c is contained together with windings of impedance-coils o . One of the windings o' is included between one pole of the battery and the conductor 7. Two other windings o^2 and o^3 are interposed between the battery and conductor 6. They are normally connected in multiple, but their multiple connection is controlled by switch-contacts l' and l^2 of the operator's listening-key for purposes of testing, as will be hereinafter described. That pole of battery which is connected with conductor 6 is also grounded. The sleeves i^2 of the plugs h and h' constitute the terminals of grounded conductors 9 and 10, respectively, whose continuity is controlled by the switch-contacts or relays p and p' . The magnet of the former of these is included in conductor 7 of the plug-circuit between the plug h and the point of connection of battery c with the plug-circuit. That of the latter is similarly included in conductor 7 between plug h' and the battery. Hence each of the relays will respond to current created by the battery in the plug-circuit and through the conductors of one only of the lines—that one with which the plug corresponding to the relay is connected. These conductors 9 and 10 include supervisory lamp-signals q and q' , respectively, each of which is associated with the plug forming the terminal of the conductor which includes it. The operation of these signals is as follows: The removal of the receiving-telephone from its switch at a substation permits the battery c to create a current in the line-circuit and through the windings of relay b , whereby the magnet is caused to close the local circuit 3, including the subsidiary signal-lamp d . The lighting of this lamp calls the attention of the operator, who responds to the signal by inserting plug h into the answering-jack a' . This act creates an extension of the line conductors 1 2 through the conductors 6 and 7 of the plug-circuit, and thence to the operator's telephone, the key l having been depressed, so that the operator is brought into communication with the subscriber. It also closes the local circuit 4 5 by crossing together the contact-pieces f and f' of the spring-jack, whereby the armature of the relay e is attracted and the signal-lamp d is extinguished. At the same time the electrical condition of test-rings f' of the line is altered to indicate the busy condition of the line to an operator at a distant switchboard, the rings being raised to a difference of potential from the earth corresponding to the electromotive force of battery g . The conductor 9, terminating in the sleeve i^2 of the plug, also becomes connected with this battery g in condition to permit the illumination of supervisory lamp q , when the break in the

conductor shall be closed by relay p . It will be observed that this relay is now excited by current flowing from battery c through conductor 7, line conductors 1 and 2, and conductor 6 of the plug-circuit, returning to battery c at the central office. Having learned the order for the connection required, the operator makes the usual test of the line called for by applying the tip i of plug h' to the test-ring f' of the spring-jack of the required line. Obviously if no connection exists with that line no test-signal will be received, since the circuit, which is completed from earth through winding o^3 , conductor 7 to the tip of the plug, and conductor 4 to earth, includes no source of current. If, however, a connection with the line be already in existence, there will be a branch from the rings f through the plug, whereby the connection has been made to the contact-piece f' , and thence through battery g to earth. Then at each application of the test-plug to the testing a current will flow through the winding o^3 of the impedance-coil to earth, whereby a current will be induced in winding o^2 , which will circulate in the circuit including the operator's telephone and will make an audible signal therein.

It will be noted that the conductor 6 of the plug-circuit forms a portion of the return circuit of current from battery c through the line, and hence its electrical condition will be altered by various changes in the conditions of the line and its utility as a portion of a circuit for testing the electrical condition of other lines would be impaired. The function of contacts l' and l^2 and of windings o^2 and o^3 is to separate the portion of conductor 6, leading to the tip of the plug, from the remainder of the plug-circuit, preserving only an inductive connection between them. Then no change in the conditions of the circuit external to the portion of the plug-circuit including helix o^3 and extending to the tip of the plug can affect this portion. When the operator's telephone is disconnected after a test has been made, the break in the conductor 6 is closed and the windings o^2 and o^3 are brought into parallel circuits and act as a single helix of the impedance-coil.

Having tested the line called for and found it free for connection, the operator inserts plug h' into the spring-jack just tested and depresses the calling-key k . The insertion of the plug into the spring-jack brings the spring-jacks of that line into condition to test "busy" subsequently. It also causes the excitement of magnet e of that line to break the lamp-circuit 3 and brings the battery g into circuit with conductor 10, including the supervisory signal q' . Since no circuit as yet exists through the subscriber's line to the station called, the telephone at that station being still on its switch-hook, the relay p' is inert and permits the closing of the break in conductor 10. Hence the supervisory lamp q' is lighted and remains in that condition

until the response of the subscriber called permits the battery *c* to create a current in the line.

While both supervisory lamps *q* and *q'* remain dark, the operator may assume that the subscribers are in conversation. When both become lighted, this may be taken as indicating a signal for disconnection, after which the plugs may be removed from the spring-jacks and the appliances returned to their normal condition.

My invention is defined in the following claims:

1. The combination with a telephone-line, a source of current in the line, and means at the substation for determining the flow of current consequent on the use of the telephone, of a line-signal associated with the line in the central office and controlled by currents in the line, a relay adapted to break the circuit through the said signal when excited, a local circuit including said relay, and means for closing the said local circuit in the act of making connection with the line, whereby the line-signal is effaced when connection is made with the line, as described.

2. The combination with a telephone-line and means for producing current therein during the use of the substation-telephone, of a relay in the line-circuit at a central office, a subsidiary line-signal in a local circuit controlled by the relay, an electromagnet controlling switch-contacts adapted to interrupt the current through the subsidiary signal when excited, a circuit including the said magnet together with a source of current, and switch-contacts controlling the last-mentioned circuit closed together in the act of making connection with the line, substantially as described.

3. The combination with a telephone-line provided with means for creating current in the line during the use of the telephone, spring-jacks for making connection with the line, a relay included in the line at the central office, a subsidiary line-signal in a local circuit controlled by the relay, a magnet controlling switch-contacts adapted to interrupt the current through the subsidiary signal when the magnet is excited, a local circuit including the magnet, said local circuit including a source of current and being interrupted at normally-separated contact-terminals in the spring-jacks, one of said contacts in each spring-jack being a test-ring, and means for connecting the said contact-pieces together when a plug is inserted into any spring-jack;

whereby the line-signal is effaced and the electrical condition of the test-rings is altered when a plug is inserted into a spring-jack, as described.

4. The combination with a telephone-line and means for producing current therein during the use of the telephone, of a relay in the line and a subsidiary signal controlled thereby, an electromagnet controlling switch-contacts adapted to interrupt the current through the subsidiary signal, a local circuit including the said electromagnet together with a source of current normally interrupted at separated contact-pieces in each of the spring-jacks, a plug adapted for insertion into the spring-jack and constructed to connect together the said contact-pieces and the plug-circuit thereof, a conductor terminating in that contact-piece of the plug which registers with the said terminals of the local circuit adapted to be brought into parallel with the said electromagnet when the plug is in the jack, a supervisory signal in the said conductor, and a relay in the plug-circuit controlling the current through the said supervisory signal in response to currents in the line-circuit; whereby the subsidiary line-signal is effaced, the condition of the test-rings is altered, and current is provided for exciting the supervisory signal, when the plug is inserted into a spring-jack, as described.

5. The combination with a telephone-line, a line-signal associated therewith, means for causing the display of the line-signal, and spring-jacks for the line each having two normally-separated local contact-pieces, of an electromagnet adapted to efface the line-signal in a circuit connected with one of said local contact-pieces in each spring-jack, a source of current connected to the other contact-piece in each spring-jack, a plug for making connection with the line, a contact-piece in the plug adapted to make connection with both of said local contact-pieces in the spring-jack, a circuit terminating in the said plug-contact, a lamp-signal in the last-mentioned circuit, and means for controlling the signal; whereby the said magnet is excited and current is provided for lighting the lamp when the plug is inserted into a spring-jack, substantially as described.

In witness whereof I hereunto subscribe my name this 11th day of November, A. D. 1896.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,
LUCILE RUSSELL.