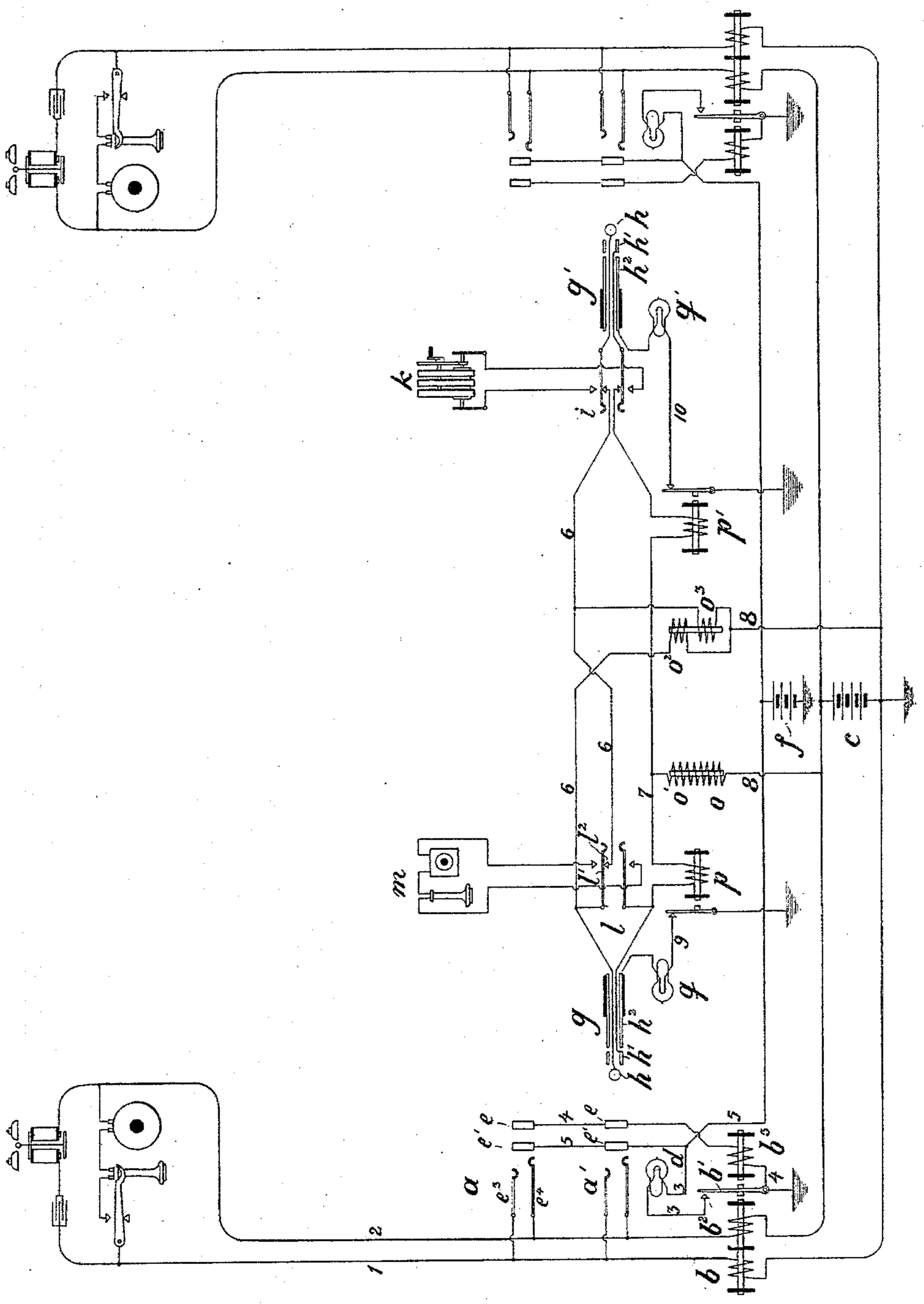
(No Model.)

C. E. SCRIBNER.

APPARATUS FOR TELEPHONE SWITCHBOARDS.

No. 597,787. Patented Jan. 25, 1898.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 597,787, dated January 25, 1898.

Application filed December 18, 1896. Serial No. 616,128. (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. 438,) 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 means for automatically controlling line-signals of telephone-lines in switchboards through the agency of the station apparatus of the line and for causing the effacement of the signal in the establishment of the required connection with the line.

Prior to this invention signaling appliances have been used consisting of subsidiary signals in the switchboard associated with the lines and relays controlling the line-signals responsive to currents in the lines determined in the use of the telephones at the substations, and it has been proposed to cause the effacement of the line-signal or to return it to its normal inert condition in the operator's act of making connection with the line in response to an initial call through the agency of a second relay excited incidentally through suitable circuits changed in that act and acting to shift the circuits of the subsidiary signal in a suitable way to effect the desired end.

The present invention relates to organizations of this type; and it consists in a specific arrangement and construction of the relay connected with the line and controlling the signal to display it and of the relay excited in making connection with the line and controlling the same signal to efface it, as follows: The magnets of the two relays act upon an armature common to both. The relay in the line when excited brings this armature into contact with an anvil and thus closes a local circuit through the subsidiary line-signal. The other or local relay becomes excited when connection is made with the line in reply to this signal and retracts the armature in opposition to the force of the line-relay, thus breaking the circuit through the subsidiary signal and rendering that appliance inert. This local magnet is placed in a local battery-circuit terminating in normally-separated contact-pieces in the spring-jacks of the line, which become connected together by a plug inserted in the spring-jack.

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 b^2, controls a local circuit 3, which includes a signal-lamp d, associated with spring-jack a', together with a source of current. The armature b' is also within the field of a magnet b^3, which is included in a portion 4 of the local circuit which terminates in thimbles or contact-rings e of the spring-jacks of the line. The complementary portion of the local circuit is a conductor 5, which terminates in opposing contact-pieces e' in the spring-jacks. This conductor includes a battery f. These parts e and e' 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 magnet b^3 is constructed to have a greater effect upon the armature b' than the magnet b, and hence when excited acts to retract the armature to its normal position, in which it is separated from its switch-contact, and thus to open the local circuit 3.

The connecting-plugs g and g' have each a pair of line-contacts h and h', which register with the springs e^3 and e^4 of the spring-jack, and a sleeve h^2, which crosses together the

contact-pieces e and e' of the spring-jack. The tips h of the plugs are united by a conductor 6 and the rings h' by another conductor 7. These conductors constitute the plug-circuit. The usual calling-key i is interposed in them in position to interrupt the connection between the two plugs and to loop a generator k of calling-current into circuit with the plug g', and the usual operator's listening-key l is furnished to bring the operator's telephone m into 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 c which is connected with conductor 6 is also grounded.

The sleeves h^2 of the plugs g and g' constitute the terminals or grounded conductors 9 and 10, respectively, whose continuity is controlled by the switch-contacts of relays p and p'. The magnet of the former of these is included in conductor 7 of the plug-circuit between the plug g and the point of connection of battery c with the plug-circuit, and that of the latter is similarly included in conductor 7 between plug g' 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 magnet 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 g 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 e and e' of the spring-jack, whereby the armature b' of the relay is retracted and the signal-lamp d is extinguished. At the same time the electrical condition of test-rings e' 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 f. The conductor 9, terminating in the sleeve h^2 of the plug, also becomes connected with this battery f 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 h of plug g' to the test-ring e 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 e through the plug, whereby the connection has been made to the contact-piece e' and thence through battery f to earth. Then at each application of the test-plug to the test-ring 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 g' into the spring-jack just tested and depresses the calling-key i. 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 magnet b^3 of that line to hold the armature b' against any force which the other magnet b may exert and brings the battery f 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 and means for determining the flow of current in the line during the use of the telephone, of a magnet responsive to current in the line, an armature therefor, a secondary signal, and circuits including the secondary signal controlled by switch-contacts operated by the said armature, a second electromagnet adapted to retract the armature, a circuit including said second magnet, and circuits closed to excite the said magnet in the act of making connection with the line, as described.

2. The combination with a telephone-line and means at the station thereof determining the flow of current in the line during the use of the telephone, of a magnet in the line, an armature for the magnet and switch-contacts therefor closed when the armature is attracted, a secondary signal and a local circuit including the signal controlled by the switch-contacts, a second magnet acting on the same armature and adapted to retract it, a local circuit including the latter magnet, a spring-jack for the line and a plug therefor, and normally-separated switch-contacts crossed together by the plug in the spring-jack completing the last-mentioned local circuit, as described.

In witness whereof I hereunto subscribe my name this 14th day of November, A. D. 1896.

CHARLES E. SCRIBNER.

Witnesses:
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