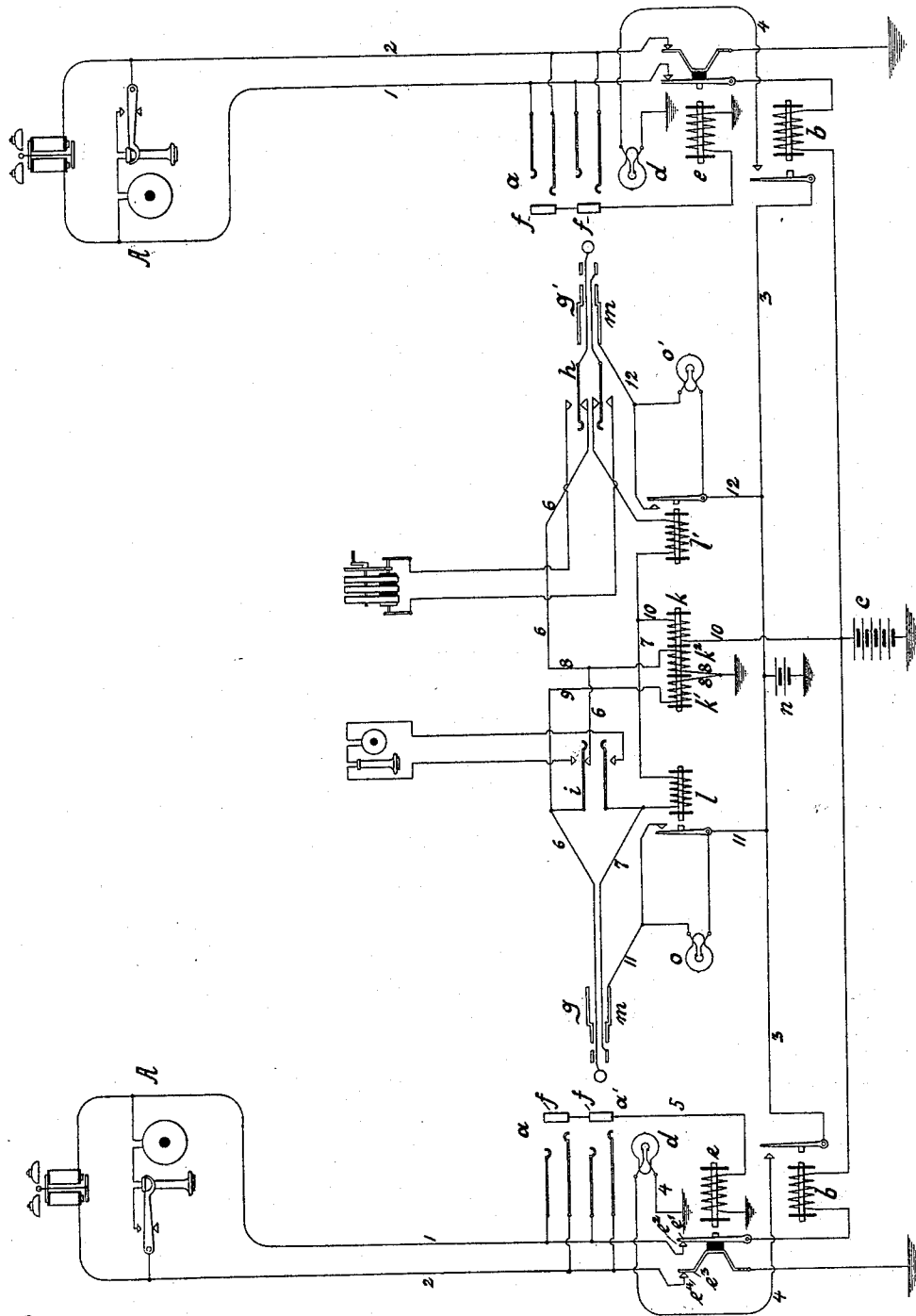


(No Model.)

C. E. SCRIBNER.
APPARATUS FOR TELEPHONE SWITCHBOARDS.

No. 596,630.

Patented Jan. 4, 1898.



Witnesses:
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UNITED STATES PATENT OFFICE.

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APPARATUS FOR TELEPHONE-SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 596,630, dated January 4, 1898.

Application filed December 8, 1896. Serial No. 614,877. (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. 437,) 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 is a contrivance for efficiently controlling subsidiary signals associated with connecting-plugs in a telephone-switchboard. It is designed for use particularly with the type of switchboards in which the individual or line signal of the line displayed in the act of calling for a connection is effaced through the agency of an electromagnet and a local circuit containing it and closed in making connection with the line, and including also subsidiary supervisory signals associated with the connecting-plugs, the same circuit being a part of the test system. It has been usual in switchboards of this type to control the current through the subsidiary signal by means of a relay interposed in the plug-circuit of the connecting-plugs and responding to current therein determined by the use of the telephone at the substation.

The present invention is designed to control the current through the subsidiary signal by diverting the current from it through a shunt closed by the relay, so that the current through the supervisory signal may be changed without altering the electrical condition of the test system or interrupting the current through the magnet controlling the line-signal. The shunt may, if desired, include a coil of wire having a resistance equal to that of the supervisory signal. When this device is used, the supervisory signal may be displayed or effaced by the relay without altering the electrical condition of the remainder of the circuit to any considerable extent.

The attached drawing illustrates the device applied to a switchboard of the type described.

The two substations A and A' have the usual telephones and polarized signal-bells, with switches which close the line-circuits

through the telephones during the use of these instruments, the circuits being open as to continuous currents during the idleness of the telephones. The line conductors of each line are connected with spring-jacks *a* and *a'* in different sections of a multiple switchboard. One of the conductors is connected to earth at the central office, while the other is connected through one winding of a relay *b* there to the free pole of a grounded battery *c*, which is common to the different lines of the exchange. The switch-contacts of this relay control a local circuit 3 4, which includes a signal-lamp *d*, associated with the spring-jack *a'*, together with any suitable source of current. A second relay *e* is provided, furnished with two pairs of switch-contacts *e' e²* and *e³ e⁴*, constructed to be separated by the relay when excited. These switch-contacts are interposed in the grounded extensions of line conductors 1 and 2, respectively, so that the excitement of relay *e* interrupts the connection of the line with the earth and with the relay *b*. The magnet of this relay *e* is included in a wire 5, one of whose terminals is grounded and the other of whose terminals is led to contact or test rings *f* in the different spring-jacks of the line.

The plugs for use in uniting lines comprise the usual contact-pieces for registering with the line-contacts of the spring-jack and third contact-pieces for making connection with the ring *f* of a spring-jack into which the plug may be inserted. The like line-contacts of the two plugs *g* and *g'* of a pair are united through conductors 6 7, which constitute the plug-circuit. Associated with these conductors are the usual calling-key *h* and listening-key *i*. Conductors 8 and 9 lead from the severed ends of wire 6 to earth, while a similar wire 10 leads from conductor 7 of the plug-circuit to the free pole of battery *c*. In each of these wires a winding of an impedance-coil *k* is interposed. There is thus in effect a bridge of the plug-circuit 6 7, which includes the source of current *c*, the windings of impedance-coil *k* acting to prevent the shunting of telephonic current from the plug-circuit. The listening-key *i* is provided with switch-contacts, which close the break in the conductor 6 while the telephone is cut off.

Two relays l and l' have their magnets connected serially in a conductor 7 of the plug-circuit, one upon each side of the point therein which is joined to wire 10. One of these relays is thus in the plug-circuit leading to each of the telephone-lines with which the plugs may be connected and in position to respond to current in that line.

The sleeves m of the plugs g and g' form the terminals of two conductors 11 and 12, respectively, which lead to the terminals of the source of current n . These wires include supervisory signals o and o' , respectively, which are associated in the switchboard with plugs g and g' . Each of the relays controls a shunt about the corresponding lamp, the relays being constructed to close the shunts when they become excited. Small resistance-coils may, if desired, be interposed in these shunt-circuits to prevent undue increase of current in the conductors when the resistance of the lamps is removed from the circuits.

The operation of this system is as follows: The removal of the receiving-telephone from its switch at a substation permits the latter to close the line-circuit. The battery c then creates a current in the line which excites the relay b and brings about the illumination of signal-lamp d . The attendant observing this call inserts plug g into the spring-jack of the calling-line, at the same time bringing her telephone into connection with the plug-circuit 6 7, and thus into connection with the line of the calling subscriber, by means of listening-key i . The registering contacts f and m of the spring-jack and plug complete a local circuit 11 5, which includes the battery n and the winding of relay e . This relay being excited separates the switch-contacts $e^1 e^2$ and $e^3 e^4$, and thus breaks the connection of the line with battery c and earth. The relay b becoming inert permits the extinction of lamp d . At the same time the test-rings f are raised to a difference of potential from earth, being that due to the resistance of magnet e in the circuit. Since the line-circuit of the calling subscriber had already been closed at the substation when the answering-plug g was inserted into the spring-jack, current was created from battery c through conductors 9 and 10 and through the relay l , whereby the latter was excited and caused to close the shunt about the supervisory signal o at the same time that current was created in conductor 11. Hence this supervisory signal remains dark. Having received the order for the required line from the calling subscriber, the operator tests the line in the usual way by applying the tip of plug g' to one of the test-rings f of the line. It will be observed that since the operator's listening-key is in position to connect her telephone with the plug-circuit the tip of this plug is in a circuit isolated from the remainder of the plug-circuit, including only a portion of conductor 6 and the winding k^2 of the impedance-coil. If the line tested be not in

use, the test-rings will have no difference of potential with the earth and no current will be produced in the test-circuit closed in the application of the plug to the test-ring; but if the line were in use, as is the case of line to station A, current would flow from battery n to the test-rings and thence to the tip of the testing-plug and through winding k^2 to earth. The pulsation of current would induce a corresponding current in the winding k' of the impedance-coil and thus would produce a characteristic test-signal in the telephone of the listening operator. Having found the line free for connection, the operator inserts plug g' fully into the spring-jack just tested and rings the bell at the station A, by means of key h , as usual.

It will be observed that the insertion of plug g' into the spring-jack causes the breaking of the ground branches of the line at the central office, and hence prevents any subsequent response on the part of the line-relay b to the closure of the line at the substation. At the same time the electrical condition of the test-rings f becomes altered to make the line-test busy.

As long as the line-circuit is interrupted at the called substation no current will flow through the relay l' , and hence the shunt about supervisory lamp o' will remain broken. The illumination of the lamp is an indication to the operator that the called subscriber has not responded. With the closure of the line during the use of the telephone the relay l' is excited and the supervisory lamp becomes dark. The simultaneous illumination of both lamps o and o' , indicating that both station-telephones have been replaced on their switch-hooks, may be taken as a call for disconnection and followed by the replacement of all the appliances in their normal positions.

It will be noted that the action of the relays l and l' in permitting current through the supervisory lamps or in diverting it from them does not affect the current flowing through the cut-off relays e nor the potential of the test-rings f to any considerable extent. Further, the closing of a shunt-circuit about the lamp when the relay becomes excited affords the greatest degree of security in the operation of the appliances, since the pressure closing the contacts of the relay together represents the maximum effort of the relay.

My invention is defined in the following claims:

1. The combination with a telephone-line, means for making connection therewith, an electromagnet associated with the telephone-line, and mechanism actuated by the electromagnet, of a local circuit including the electromagnet together with a supervisory signal, a relay responsive to currents in the line and a shunt of the said signal controlled by the relay, substantially as described.

2. The combination with a telephone-line, a line-signal associated therewith, an electromagnet controlling the display of the line-

signal, means for making connection with the line, a supervisory signal associated with the line, said supervisory signal and said electromagnet being included in a local circuit, a relay responsive to currents in the line and a shunt about the supervisory signal controlled by the relay, said local circuit being closed in registering contacts brought together in making connection with the line, substantially as described.

3. The combination with a telephone-line having means for producing current in the line during the use of the telephone, spring-jacks connected with the line, a relay responsive to currents in the line and a subsidiary line-signal controlled thereby, of a second relay adapted to interrupt the current through the line-signal, a plug for making connection with the spring-jack, a supervisory signal associated with the plug, a local circuit including the said second-mentioned relay and the said supervisory signal closed in registering contacts of the spring-jack and plug, a relay responsive to currents in the line, and a shunt of the supervisory signal controlled by the said relay, substantially as described.

4. The combination with a telephone-line and spring-jacks thereof in a multiple switchboard, of a signal associated with the plug, a local battery-circuit including the signal, and registering contacts of the plug and spring-jack to close the local circuit, said contact-pieces of the spring-jacks being adapted to serve as test-contacts, a shunt about the signal, and a switch adapted to in-

terrupt the shunt, whereby the electrical condition of the test-contacts remains substantially unchanged during the operation of the signal, as described.

5. The combination with a telephone-line having a switch at its substation to close the line during the use of the telephone, a source of current at the central office connected with the line, a relay in the line responsive to current therein, and a line-signal controlled by the relay, spring-jacks for the line on different sections of a multiple switchboard and test-contacts in the spring-jacks, a plug for making connection with the spring-jacks and a plug-circuit therefor, a source of current in a bridge of the plug-circuit, a signal-controlling relay in the plug-circuit and a supervisory signal associated with the plug, of a cut-off relay adapted to break the connection of the line with the relay controlling the line-signal, a local circuit including the magnet of the cut-off relay together with the supervisory signal and closed in a contact-piece of the plug registering with a test-ring in the spring-jack, a shunt about the supervisory signal controlled by the relay in the plug-circuit, a testing instrument and means for bringing it into a shunt of the magnet of the cut-off relay, substantially as described.

In witness whereof I hereunto subscribe my name this 5th day of November, A. D. 1896.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER.

DUNCAN E. WILLETT.