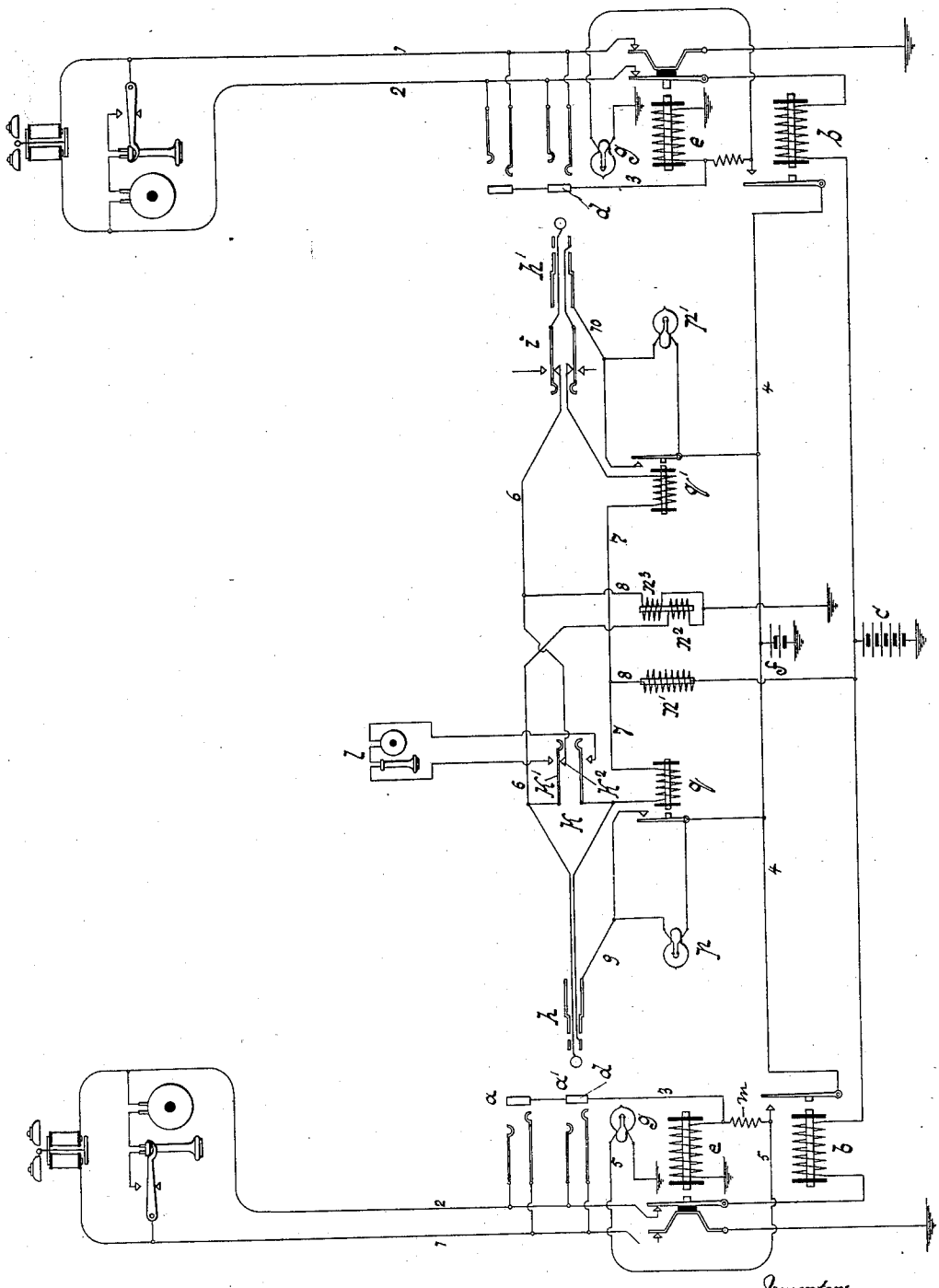
(No Model.)

C. E. SCRIBNER.

TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS.

No. 596,629. Patented Jan. 4, 1898.



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UNITED STATES PATENT OFFICE.

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

TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 596,629, dated January 4, 1898.

Application filed December 8, 1896. Serial No. 614,876. (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 Testing Apparatus for Multiple Switchboards, (Case No. 436,) 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 test system which is commonly used in multiple switchboards, particularly those which are employed in connection with subsidiary line-signals controlled from the substations of the telephone-lines. It is a device for altering the electrical condition of the test-contacts of the line to make the line test "busy" through the agency of the device controlling the subsidiary signal, so that the line shall be caused to test "busy" by the removal of the substation-telephone from its switch.

My invention is intended for use in connection with a particular system of this type in which the subsidiary line-signal is in a local circuit controlled by a relay responsive to currents in the line and in which a separate relay is provided in a local circuit which becomes closed when connection is made with the line and which serves more or less directly to break the continuity of the circuit including the subsidiary signal. The circuits are so arranged in the system in question that the test-contacts in the spring-jacks of the line become connected with a source of current through the agency of the plug used in making connection with the line. The present invention is designed to effect a similar change in the electrical condition of the test-rings through the agency of the relay or magnet controlling the line-signal.

The invention is shown in connection with such a system of signals in the attached drawing. Therein two substations are represented connected by telephone-lines with spring-jacks in different sections of a multiple switchboard and with suitable signal-controlling appliances. A single pair of operator's plugs and their plug-circuit are shown in position to unite the spring-jacks of the two lines. The appliances at the substation are of the well-known type and arrangement for automatically operating signals in the central office, the line-circuit normally containing a high resistance, but being closed through the telephones during the use of these instruments. The line conductors 1 and 2 lead from the apparatus of the station to spring-jacks a and a' in different sections of a multiple switchboard, and extensions from them lead to earth and through a relay b and battery c to earth, respectively. The spring-jacks are provided with the usual test-contacts in the form of rings d in front of the line-contacts and accessible for testing. These rings are united by a grounded conductor 3, in which is included a relay-magnet e, controlling two pairs of switch-contacts, which are interposed in the line conductors 1 and 2, respectively, and serve to break the earth connections of these conductors when the relay e becomes excited. The relay b controls through its armature a pair of switch-contacts included in a local circuit 4 5, containing a source of current f and a subsidiary signal g, which may be a small incandescent lamp. This lamp, which constitutes the line-signal, may be associated with one of the spring-jacks of the line in one section of the switchboard.

The conductor 5 of the local circuit is connected with the test-rings through a resistance-coil m. This coil may have a resistance of one hundred ohms and may for convenience be wound non-inductively on the spool of the cut-off relay e.

The usual plugs h and h' are furnished the operator for uniting spring-jacks of different lines. The like line-contacts of the plugs are united by conductors 6 and 7, which constitute the plug-circuit. The switch-contacts of the usual calling-key i are interposed in these conductors for connecting a source of signaling-current (not shown) with the calling-plug h'. A listening-key k is also furnished for connecting the operator's telephone l in a bridge of the plug-circuit. A permanently-closed bridge of the circuit 6 7 is formed by a conductor 8, which includes the source of current c, together with the windings of two impedance-coils. The winding n' of one of these impedance-coils is located in

the conductor 8, between the battery and conductor 7 of the plug-circuit, and the two windings n^2 and n^3 of the other are interposed between the other pole of the battery and conductor 6 of the plug-circuit, being normally connected in multiple at their outer extremities through the agency of contact-points k' k^2 of the listening-key, which are closed together when the key is in position to disconnect the telephone from the plug-circuit. The peculiar arrangement of helices n^2 and n^3, together with the ground connection of conductor 8, is for the purpose of isolating the tip of plug h' during the act of testing in order that false test-signals may not be produced by changing electrical conditions in the remainder of the plug-circuit with which it is associated.

The plugs h and h' are provided with sleeves which register with the rings d of the spring-jacks into which they are inserted. These sleeves constitute the terminals of conductors 9 and 10, leading to the free pole of the grounded battery f. Interposed in these respective conductors are supervisory signal-lamps p and p', each of which is associated with one of the plugs h and h'. The current through these supervisory signals is controlled by relays q and q', whose magnets are interposed in the conductor 7 of the plug-circuit on opposite sides of the connection therewith of battery c and which act when excited to close shunts about the supervisory signals.

In the operation of this switching system the removal of the receiving-telephone from its switch at a station permits the creation of a current in the circuit by the central battery c, whereby the relay b is excited and the local circuit 4 5, including the subsidiary line-signal g, is closed. This operation causes the lighting of the subsidiary line-signal, and at the same time connects battery f with the test-rings d of the line, thereby changing their electrical condition. In response to the display of the line-signal the operator inserts plug h into the answering-jack a', at the same time bringing her telephone into connection with the plug-circuit 6 7 by means of key k. She is then in position to communicate with the calling subscriber and to learn his order for the required connection. It will be observed that the insertion of the plug into the spring-jack has caused the excitement of cut-off relay e through the agency of circuit 9 3, and hence has effected the severing of line conductors 1 and 2 from their normal earth connections, and has thus brought about the opening of circuit 4 5 and the extinction of line-signal g. The test-rings of the line remain still electrified to a difference of potential from earth on account of their connection through wire 9 with battery f, although their other connection with the battery has been broken. The operator makes the test of the required correspondent line in the usual way by applying the tip of plug h' to a test-ring d of the line. Obviously if these test-rings are in their normal condition no electrical change in the condition of the test-plug will be effected. If, however, battery f be connected with them through the action of the line-relay b or through the action of a plug inserted in the spring-jack of the line to make a connection upon a distant section of the switchboard, current will flow from the test-ring to the tip of the plug and thence through the portion of conductor 6 including winding n^3 to earth. This current will create a corresponding induced current in the helix n^2, which will find circuit through the operator's telephone and will produce a characteristic test-signal therein. Having tested the line and found it free for use, the operator inserts the plug h' fully into the spring-jack and operates the signal-bell at the substation by means of alternating current applied through the calling-key i. When upon the insertion of plug h into the spring-jack a' of the calling-line current was permitted to flow in conductor 9, including the supervisory signal p, this signal was not lighted, because current was simultaneously created through the relay q, whereby the current was diverted from the supervisory lamp. In the instance of the insertion of plug h' into the spring-jack of the line called for current is similarly set up in conductor 10, terminating in that plug, whereby the cut-off relay e of the correspondent line is caused to break the ground connections of that line; but since the line-circuit is as yet incomplete at the substation the relay q' remains inert and the shunt about the supervisory lamp p' is open. Hence this lamp becomes lighted by the current through it and remains in that condition until the circuit at the substation becomes closed in the removal of the telephone there from its switch-hook for use. If either of the connected subscribers should replace his telephone upon its switch, the corresponding supervisory lamp p or p' will become lighted. When both signals have thus become lighted, their simultaneous display may be taken as indicating a discontinuance of conversation, and the plugs may be removed and returned to their normal conditions.

I claim as new and desire to secure by Letters Patent—

1. The combination with a telephone-line, spring-jacks therefor in different sections of a multiple switchboard and test-contacts in the spring-jacks, of a relay responsive to currents in the line and a signal controlled thereby, a cut-off relay adapted to interrupt the current through the said signal-controlling relay when excited, and means for applying current to the cut-off relay in the act of making connection with the spring-jack, a source of electric current, and a circuit therefrom to the test-rings closed by switch-contacts actuated by the said signal-controlling relay; whereby the circuit connecting the

battery with the test-rings is closed when the signal-controlling relay becomes excited, and is broken when connection is made with the line, as described.

2. The combination with a telephone-line, spring-jacks thereof in different sections of a multiple switchboard, and test-contacts in the spring-jacks, of a relay responsive to currents in the telephone-line during the use of the line, a local circuit including a source of current together with a subsidiary signal controlled by the relay in the line, the relay being adapted to bring the source of current into connection with the test-rings when the said circuit is closed, a cut-off relay adapted to interrupt the current through the line-relay when excited in a circuit terminating in the test-contacts, a conductor forming the terminal of a source of current adapted to be applied to the test-rings through a plug inserted in one of them, and means for testing the electrical condition of the said contacts, substantially as described.

3. The combination with a telephone-line and means for producing current therein while the telephone is in use, spring-jacks for the line in different sections of a multiple switchboard, and test-contacts in the spring-jacks, of a relay responsive to currents in the line, one switch-contact of the relay being connected to earth through a source of current, and the other being connected with the test-rings through a resistance-coil and to earth through a subsidiary signal, a cut-off relay adapted, when excited, to break the current through the signal-controlling relay in a ground branch from the said test-rings, a connecting-plug, and a conductor terminating therein adapted to be brought into connection with the test-rings and including a grounded battery, 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.