

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

Patented Oct. 26, 1897.

Fig. 1b.

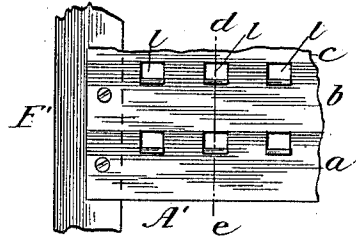
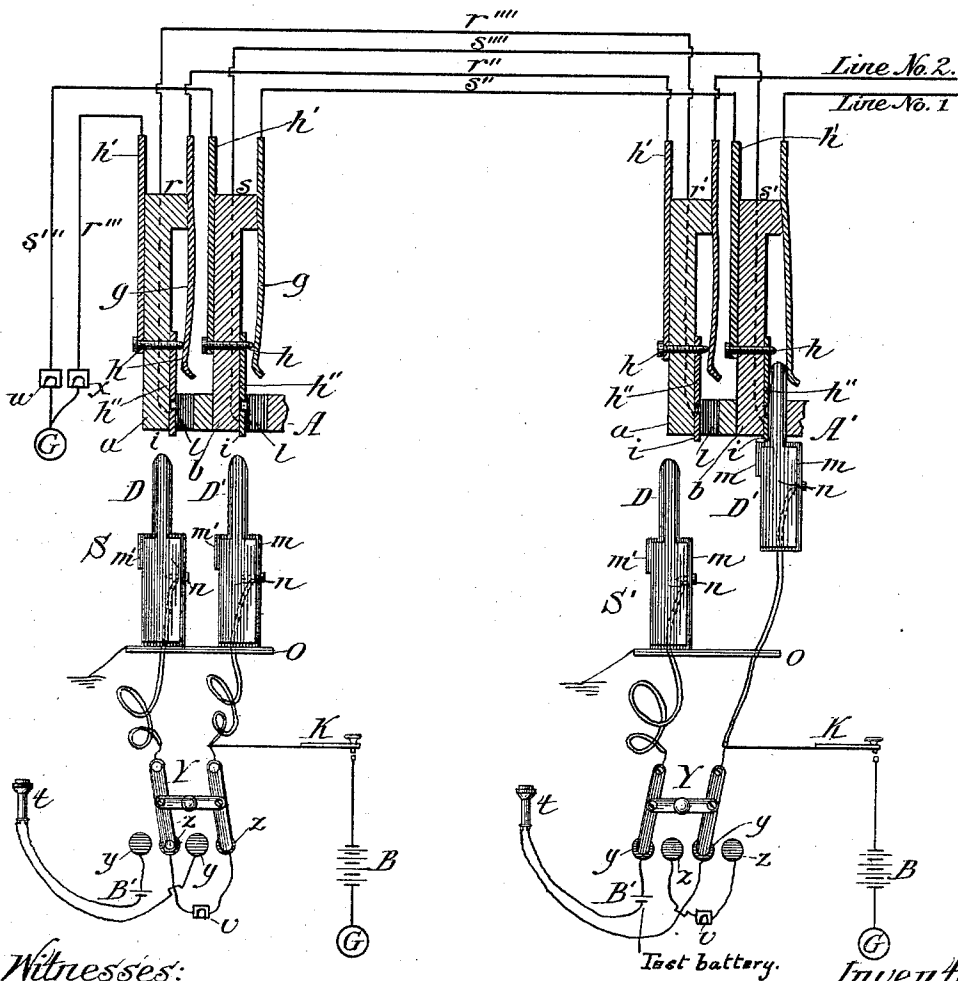


Fig. 2.



Battery. *Inventor:*
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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF SAME PLACE.

MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,303, dated October 26, 1897.

Application filed May 19, 1887. Serial No. 238,728. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, (Hyde Park,) Illinois, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone-exchange systems in which the subscribers' lines are normally grounded at the central office.

It consists, first, of a multiple-switchboard system of operating an exchange and testing at any board to determine whether any given line is in use, which system I shall hereinafter describe and claim in detail.

It consists, secondly, of a certain construction of spring-jack switch, which I shall hereinafter describe and claim in detail, said switch being adapted for use in said multiple-switchboard system and in other systems of telephone-exchange switchboards.

It consists, thirdly, of a certain system of cords with plugs, apparatus, and circuits for answering, calling, switching, testing, and clearing out subscribers' lines, which I shall hereinafter describe and claim in detail, said system being applicable to said multiple-switchboard system and to other systems of telephone-exchange switchboards.

In my multiple-switchboard system I place as many switchboards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines. On each board I place for each line which centers at the office a spring-jack or similar switch having three insulated contact-points, two of which are normally in contact, said switch being adapted to receive a plug, and when the plug is inserted to disconnect the two points and connect one of them to the flexible conducting-cord of the plug and the other one of them to the other contact-point of the three, and when the plug is withdrawn to again connect the contact-points which are normally in contact and disconnect the other point from either of them.

Figures 1^a and 1^b of the drawings are front

views of sections of two multiple switchboards to which the same wires are connected. Fig. 2 shows a complete diagram of the boards with their connections and all the central-office apparatus, circuits, and connections necessary to operate them according to my invention.

In the drawings like parts and apparatus are indicated by the same letters of reference.

In Fig. 2, A is a sectional view of the switchboard shown in Fig. 1^a, as indicated by line *d e*, and A' is a sectional view of the switchboard shown in Fig. 1^b, as indicated by line *d e*.

a b represent rubber strips on which the metal parts of the spring-jack switches are mounted. These strips may be long enough to receive any convenient number of spring-jack parts.

ll are rectilinear holes through the fronts and at the edges of the strips adapted to receive the switch-plugs. The contact-springs *g g* are mounted to the rear of and are parallel to the holes *ll* to which they belong, as shown. The contact-points *h h*, on which the contact-springs or spring-levers *g g* normally bear, pass through the rubber strips, as shown, and each has a connecting-piece *h'* and a contact-piece or extension *h''*, as shown, extending to the front of the point and along the lower face of the switch-hole. In the front of the switch-holes and along their lower faces I place the contact-pieces *i i*, as shown. These pieces come in proximity to but do not touch the contact-pieces *h''*, and they extend far enough to the front of their respective holes so that test-plugs may be applied to them. The switch-plugs are substantially as shown and as will hereinafter be described.

The several parts mentioned above are so made, shaped, arranged, and adjusted that when a switch-plug is inserted into a switch-hole, as shown, it raises the spring-lever in the rear of the hole from the contact-point on which it normally bears, and the flexible cord is connected to the spring-lever, while the contact-point *h* and the contact-piece *i* are electrically connected through the medium of the piece *m'* of the switch-plug, which then touches *i* and *h''* of the switch.

Each section of the rubber strip, with its spring-lever, contact-point, contact-pieces, and the hole, all arranged and operating as above, may be called a "spring-jack switch."

5 The rubber strips are placed one above the other, as shown. The lower edge of one strip therefore provides the upper edges of the holes in the strip which is below it. The holes may be of any convenient shape adapted to the
10 shapes and arrangement of the parts used.

Two subscribers' lines are shown. They are marked line No. 1 and line No. 2. $s s'$ are the spring-jack switches of line No. 1 on the two boards shown, and $r r'$ are the switches of
15 line No. 2 on the two boards shown. The circuits of the lines are as follows: Line No. 1, for instance, after entering the office passes first to spring-lever g of switch s' , and thence through contact-point h and connecting-piece
20 h' of that switch and wire s'' to spring-lever g of switch s , and thence through contact-point h and connecting-piece h' of that switch and wire s''' to its annunciator w , and thence to ground. The contact-pieces i and i' of
25 switches s and s' are connected together by wire s''' , as shown. The other lines of the exchange would be connected to their switches on the different boards and to ground in like manner, and the contact-pieces $i i'$ which be-
30 long to the switches of a line would also be connected together in a like manner to that above. Other boards might be added to the exchange, and the connections of lines and the switches on the different boards would be
35 similar to the above and such as will be evident to those skilled in the art.

$S S'$ in Fig. 2 are operators' systems of
40 cords, with plugs, keys, switches, clearing-out annunciators, operator's telephone, calling generator or battery, testing-battery, and circuits. One system is shown at each board and is intended for one operator. Only one pair of cords, with its plugs, key, switch, and clearing-out annunciator, is shown in each
45 system. Others could be added in a manner which will be apparent to those skilled in the art.

$D D'$ are the two switch-plugs connected to the cords and adapted to be inserted into the
50 line-switches.

$m m$ are the metal pieces of the plugs, adapted to come in contact with the spring-levers g of a switch and connect therewith the cords of the plugs.

55 $m' m'$ are metal pieces of the plugs, adapted to come in contact with the pieces h'' and i and connect them together.

$n n$ are the rubber insulations of the plugs. The pieces $m m$ extend to the bottom of the
60 plugs, as shown, and are adapted to rest on the metal strip o , as shown, and normally connect the cords with the ground. The plugs should be inserted into the switches in such a position that the connections above described will be
65 made. A plug is shown thus inserted in switch s' in Fig. 2. Weights in the usual

manner, or similar devices, may be used to bring the bottoms of the plugs on o and form good connection from the cords to the ground.

Y is a looping-in switch.

$y y$ and $z z$ are the contact-bolts of the switch, on which the operator may at will place the pair of switch-levers.

k is the calling-key, constructed, connected, and operating as shown. A switch or simi-
75 lar device might be used in its place.

v is a clearing-out annunciator.

t is the operator's telephone, B is her signaling generator or battery, and B' is her testing-battery. The circuits are substantially
80 as shown.

The cross-piece between the levers of the switch Y may be of rubber, as is usual.

The letter G in each case represents a ground connection.

It is evident that when a switch-plug is placed in a line-switch, as described, (the other plug of the pair being used remaining on strip o), and the levers of the switch Y are placed on $y y$ the line is disconnected from
90 the ground through its annunciator and is grounded through the operator's telephone, and the contact-piece i of the line-switch (and consequently all contact-pieces i to which it is connected) is grounded through the switch-
95 board-circuit and calling-annunciator of the line. If the other plug of the pair is placed in another line-switch, that line is also disconnected from the ground and the contact-pieces i of that line are also grounded and
100 the two lines are connected together for conversation. The contact-pieces i of a line are normally (or when there is no plug in any switch of the line) disconnected from the
105 ground.

The testing system is as follows: When an operator desires to test any line at her board to see whether it is in use at another board, she moves the levers of the switch Y of a pair of cords to the bolts $y y$, and, placing the
110 piece m of one of the plugs of the cords on the test-piece i of the line to be tested, she will hear a click in her telephone if the line is in use and will hear nothing if the line is not in use. The other plug of the pair may,
115 when the test is made, remain on the strip o or may be in the spring-jack switch of another line. If the line tested is in use when the test is made, there will be a circuit from the ground to the other plug of the pair used,
120 either through strip o or a subscriber's line, through the telephone and testing-battery, the test-bolt at the board tested, the wire between that bolt and the test-bolt when the line is switched, and thence by the piece m'
125 of the plug by which the switching is done to the ground, and the test-battery, being thus in a closed circuit with the telephone, will occasion a click in the telephone when the test is made. If the line is not in use, there will
130 be no such closed circuit and consequently no click in the telephone.

The method of operating the exchange system at either board, including answering calls, making connections, sending signals, clearing out connections, &c., is such as will be apparent on an examination of the apparatus and circuits shown.

It is obvious that some features of my exchange may be used on lines having impedance-coils or annunciators in circuits permanently connected to line.

The test-bolts of a line on the different boards may be separate and distinct from the contact-pieces of the switches which are crossed with the ground connection of the line, provided they are in electric connection with said pieces.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, with a strip of insulating material having a plug-hole through it, transverse to its front, of the metal parts of a spring-jack switch mounted thereon, said parts containing a spring-lever placed transverse to the front of said strip and in rear of the plug-hole, and two contact-pieces, normally insulated from each other, said contact-pieces being mounted with their contact-surfaces in the same plane, and on the face of said plug-hole and one of said contact-pieces being normally (or when a plug is not in said hole) in contact with said spring, substantially as and for the purpose set forth.

2. A spring-jack switch with its metal parts mounted on a strip of insulating material, said strip having a plug-hole through it, transverse to its front, and said metal parts consisting of a spring-lever mounted in the rear of said plug-hole, and transverse to the front of said strip, and two contact-pieces normally insulated from each other, said pieces being mounted with their contact-surfaces in the same plane and on the face of said plug-hole and one of said contact-pieces being normally (or when a plug is not in said hole) in contact with said spring, in combination with a switch-plug with two contact-surfaces, insulated from each other, and one of which is connected with a switch-cord, said plug being adapted to be inserted into said hole, and when inserted to disconnect said spring from said normal contact with one of said contact-pieces, and connect said spring with said switch-cord, and at the same time electrically connect together said two contact-pieces, and insulate them from said lever and switch-cord, substantially as and for the purpose set forth.

3. A spring-jack switch with its metal parts mounted on a strip of insulating material, said strip having a rectilinear plug-hole through it, transverse to its front, and said metal parts consisting of a spring-lever mounted in the rear of said plug-hole, and transverse to the front of said strip, and the two contact-pieces normally insulated from each other, both pieces being mounted with their contact-surfaces in the same plane, and on one of the

faces of said rectilinear plug-hole, and one of said contact-pieces being normally (or when a plug is not in said hole) in contact with said spring, in combination with a switch-plug adapted to fit said plug-hole, and having two contact-pieces insulated from each other, and to one of which is connected a switch-cord, said plug on its insertion disconnecting said spring-lever from said normal contact with one of said contact-pieces, and connecting it with said switch-cord, and at the same time electrically connecting together said two contact-pieces and insulating them from said lever and switch-cord, substantially as and for the purpose set forth.

4. In a spring-jack switch, the contact-pieces *h* and *i* mounted along the face of the switch-hole, and with contact-surfaces in the same plane, in combination with the spring-lever *g*, substantially as and for the purpose set forth.

5. In a spring-jack-switch device, the contact-pieces *h* and *i*, mounted along the face of the switch-hole, and with contact-surfaces in the same plane, and the spring-lever *g*, in combination with the switch-plug, with contact-pieces *m* and *m'*, substantially as and for the purpose set forth.

6. In a spring-jack switch, the combination of a contact point or piece having a metal surface in line with a face of the switch-hole and extending toward the front of and along said hole, a spring contact-lever in the rear of said hole and transverse to it, and normally or when no switch-plug is in the hole, in contact with said contact-point, and a contact-piece, normally insulated from the other pieces, mounted on a face of said hole with its contact-surface in the same plane as said metal surface, and adjacent to it and reaching to or near the front of said hole, substantially as and for the purpose set forth.

7. The combination, with a spring-jack switch having two contact-points which are normally (or when no plug is in the switch-hole) in contact, and a third contact-point which is normally insulated from the other two, a telephone-line connected to one and a ground connected to the other of said contact-points, which are normally in contact, of a switch-plug and a switch-cord, said plug having two insulated contact-pieces to one of which is connected said switch-cord, and adapted, on the insertion of the plug into the switch-hole to separate and insulate the points which are normally in contact, connect the line contact-point with the cord, and said third contact-point with the ground contact-point.

8. In a multiple-switchboard exchange, a closed test-circuit for a ground-circuit line which is in use, said circuit including, in the order named, a ground connection, a test outfit and plug, a test contact-piece for the line temporarily connected to said plug for testing, thence to a contact in some other switch of the line where the line is switched for use,

and thence to a contact directly connected thereto, mounted on the plug in said switch, but not then connected with the circuit of the line, and thence to a second switch-contact connected to said plug-contact while the plug is in the switch but otherwise insulated from said circuit connection, thence to ground.

9. In a multiple-switchboard exchange, a closed test-circuit for a ground-circuit line which is in use, said circuit including, in the order named, a ground connection, a test instrument and plug a test contact-piece for the line temporarily connected to said plug for testing, thence to a circuit connection connecting all the contacts of said line together, thence to a contact in some other switch of the line where the line is switched for use, and thence to a contact directly connected thereto mounted on the plug in said switch but not then connected with the circuit of the line, and thence to a second switch-contact connected to said plug-contact while the plug is in the switch but otherwise insulated from said circuit connection, thence to the cut-off portion of the line through any pair or pairs of normally closed jack-contacts which may be in said portion, and to ground, and means in said test-circuit to cause said test instrument to respond when connected to said closed test-circuit.

10. In a multiple-switchboard exchange, two or more multiple boards, switches, one for each line on each board, each switch having three contacts, a test-contact, a contact connected to the ground, and a contact connected to the line, said test-contacts being electrically united but disconnected normally from the other contacts, and plugs at each board adapted to be inserted into the switches and each having a conducting-piece adapted to connect said test-contact and said ground-contact of the switch by cross-connecting or electrically bridging said test and ground contacts of the switch without connecting said test-contact to the line-circuit.

11. In a multiple-switchboard exchange, two or more switchboards, switches, one for each line on two or more boards, each switch having a test-contact, said test-contacts for each line being connected together and normally ungrounded, a contact connected to the ground, and a contact connected to the line, switch-plugs at each board, each plug adapted to be inserted into each switch at each board and each having two insulated contacts, one contact of said plug adapted to be connected to said line-contact, the other contact of said plug adapted to be directly connected to both the test and ground contacts of the switch in which it is inserted and thereby cross-connect

or electrically bridge said test and said ground contacts.

12. In a multiple-switchboard exchange, test-contacts one at each board, for each line, the test-contacts of each line being electrically united together and normally ungrounded, a common grounded conductor, a circuit connection between said test-contacts and said common grounded conductor, normally open but closed or bridged by a plug-contact adapted to form a part of said circuit connection while the line is switched for use, a test outfit connected on one side to said conductor, and on the other adapted to be connected to a test-contact for testing, and a test-battery for the test-circuit when established.

13. In a multiple-switchboard exchange, switches, one at each of two or more boards for each line, a common conductor, a contact in each switch normally insulated therefrom, a circuit connecting said contacts, one additional contact, in each switch connected to said common conductor, a bridging or cross-connecting contact mounted on a plug, adapted while the line is in use to be directly connected to said contacts and thereby electrically unite them, a test outfit connected on one side to said common conductor and on the other adapted to be connected to a test-contact for testing and a test-battery for said test-circuit.

14. In a multiple-switchboard exchange, line-circuits, each connected to a jack at each board, each jack provided with a strip of insulating material having a plug-hole through it, transverse to its front, of the metal parts of a spring-jack switch mounted thereon, said parts containing a spring-lever placed transverse to the front of said strip and in the rear of the plug-hole, and two contact-pieces, normally insulated from each other, said contact-pieces being mounted with their contact-surfaces in the same plane, and on the face of said plug-hole, and one of said contact-pieces being connected to a common test-conductor, and normally or when the plug is not in said hole in contact with said spring, a bridging or cross-connecting insulated contact mounted upon a plug and adapted when said plug is inserted into a line-jack to be directly connected to both of said contacts thereby electrically connecting them, a test receiving instrument connected for testing, on one side to said common conductor and on the other to a plug or device adapted to be applied to the other contact-piece.

MILO G. KELLOGG.

Witnesses:

WALLACE L. DE WOLF,
FRANCES D. KELLOGG.