

(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCH BOARD.

No. 382,475

Patented May 8, 1888.

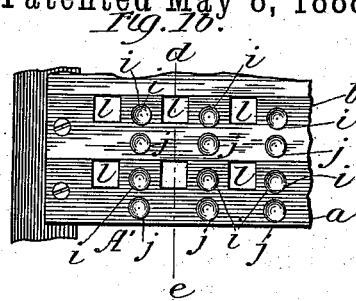
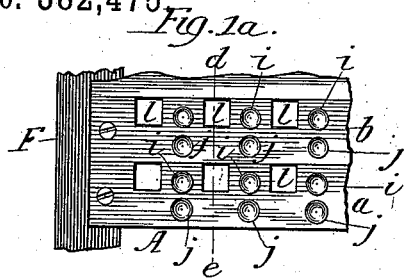
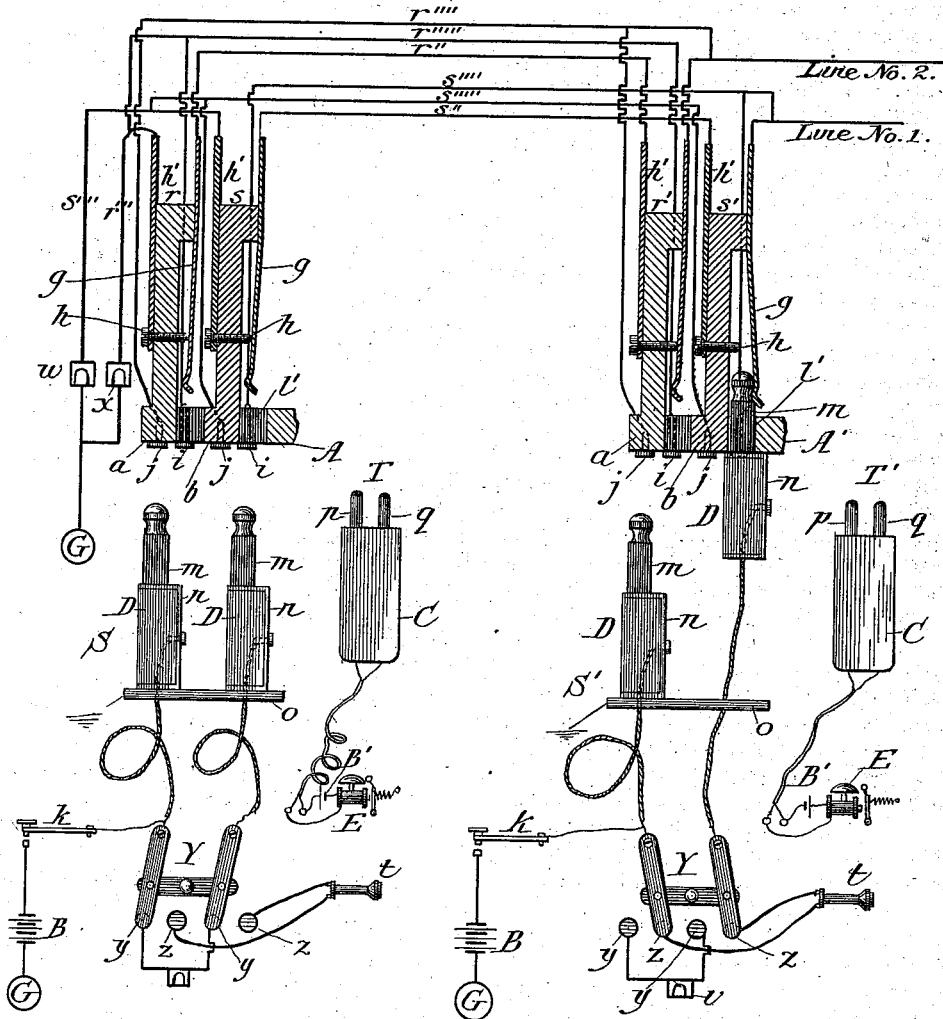


Fig. 2.



Witnesses:

Frank Blanchard  
Fried Gerlach

Inventor:

Milo G. Kellogg

# UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF HYDE PARK, ILLINOIS.

## MULTIPLE SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 382,475, dated May 8, 1888.

Application filed April 18, 1887. Serial No. 235,143. (No model.)

*To all whom it may concern:*

Be it known that I, MILO G. KELLOGG, of Hyde Park, Illinois, have invented certain new and useful Improvements in Multiple Switch-Boards 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 especially to a telephone-exchange system in which the subscribers' lines are single wires.

It consists, first, of a multiple-switch-board 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 switches and test-bolts, which I shall hereinafter describe and claim in detail, said invention in spring-jack switches and test-bolts being applicable to said multiple-switch-board system mentioned above and to other systems of telephone-exchange switch-boards.

It consists, thirdly, of an operator's central-office system of cords, with plugs, switches, keys, clearing-out annunciators, telephone, calling generator or battery, and circuits for answering, calling, switching, and clearing out subscribers' lines, which I shall hereinafter describe and claim in detail, said system being applicable to said multiple-switch-board system mentioned above and to other systems of telephone-exchange switch-boards.

In my multiple-switch-board system I place as many switch-boards 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 telephone-line which centers at the office a spring-jack or similar switch having two insulated contact-points normally in contact, said switch being adapted to receive a plug, and when the plug is inserted to disconnect the contact-points and connect one of them to the flexible conducting-cord attached to the plug, and when the plug is withdrawn to again connect the contact-points. On each board I also place for each of said telephone-

lines two test-bolts or contact-pieces insulated from each other and from the other parts of the apparatus, except by conducting-wires, as shown and described. The test-bolts of a line on a board may be adjacent to the spring-jack switch of the line, or they may be placed in any other situation, provided they are so marked or located that the operator may know to what line they belong. The switches of a line on the different boards may be called a "series of switches," and the test-bolts of a line on the different boards may be called a "series of test-bolts." As there are two test-bolts for each line on each board, they may also be called a "series of double test-bolts."

Figures 1<sup>a</sup> and 1<sup>b</sup> of the drawings are front views of sections of two multiple switch-boards, to which the same wires are connected. Fig. 2 shows a complete diagram of the boards with their connections, and with 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 switch-board shown in Fig. 1<sup>a</sup>, as indicated by line *d e*, and A' is a sectional view of the switch-board shown in Fig. 1<sup>b</sup>, as indicated by line *d' e'*.

*a b* represent rubber strips, of the shape substantially as shown, on which the metal parts of the spring-jack switches and the test-bolts are mounted. These strips may be of a length to receive any convenient number of spring-jack parts.

*l l*, &c., are square holes through the fronts and at the edges of the strips adapted to receive the switch-plugs. The contact-springs *g g* are mounted in the rear of and are parallel to the holes *l l*, to which they belong, as shown. The contact-points *h h* of the spring-levers pass through the rubber strips and have connecting-pieces *h' h'*, as shown.

The switch-plugs are substantially as shown. The several parts mentioned above are so shaped, arranged, and adjusted that when a plug is inserted into any of the holes it raises the contact-spring in the rear of the hole from the contact-point, (on which it normally rests,) and its cord is connected with the spring only.

Each section of a rubber strip, with its contact-spring, contact-point, and the hole, all arranged and operating as above, may be called a "spring-jack switch." 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. It is not necessary that these holes should be actually square. They may be of any rectilinear shape adapted to the shapes and arrangement of the parts used.

*i j*, &c., are the two test-bolts of a line on a board. For convenience they are placed one above the other and to the right of the spring-jack switch of their line and on the front of their rubber strip. They are connected to their line as shown in Fig. 2, and as will hereinafter be described.

*S S'*, Fig. 2, are operators' systems of cords, with plugs, keys, switches, clearing-out annunciators, operator's telephone, signaling generator or battery, &c. One system is shown at each board, and is intended for one operator. Only one pair of cords, with its plugs, switch, key, and clearing-out annunciator, is shown in each 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 pair of cords.

*m m* are the metal pieces of the plugs, adapted to be inserted into the switches.

*n n* are connecting-pieces.

*o* is a metal piece connected to the ground and on which the plugs normally rest, as shown, and by which the cords are normally connected to the ground.

*Y* is a looping-in switch.

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

*k* is a calling-key. A switch or similar device might be used in its place.

*v* is a clearing-out annunciator.

*B* is the operator's signaling generator, and *t* is her telephone outfit. The circuits are substantially as shown.

*T T'* are operators' testing systems at the two boards—one at each board.

*C* is the rubber handle of the test-plug.

*p q* are two contact-pieces, so made, placed, and adjusted that the operator can readily connect them simultaneously to any two double test-bolts, *i j*, of her board—as, for instance, *p* to *i* and *q* to *j*, respectively, or the reverse.

*E* is an electric bell or other test-receiving instrument, and *B'* is an electric battery, both in a loop which connects the two contact-pieces *p q*, as shown.

The connection between the apparatus *E* and *B'* and the plug is by flexible conductor of sufficient length, so that the operator may apply the contact-pieces of the plug to any pair of test-bolts *i j* at her board. The bell and battery should preferably be adjusted to each other so that the bell will respond when the battery is closed through a short cir-

cuit, but will not respond when the battery is closed through a circuit of considerable resistance.

Each operator has one testing system and one cord system. They should be placed in convenient arrangement at the board which she attends, so that she can conveniently operate the exchange system.

Two subscribers' lines are shown in the drawings. They are marked line No. 1 and line No. 2. They are single-circuit wires grounded at the subscribers' stations and passing through their series of switches on the boards, and thence through their calling-annunciator and to ground in the usual manner and as shown. The other wires would be connected to their switches in like manner. Other boards might be added, and the circuit of a line through its series of switches on the different boards would be such as is usual.

To each subscriber's line, after it enters the central office and before it passes to any of the spring jack switches, I connect one of its series of test-bolts on each board, either by running the line directly to them or by a branch or branch wires. *s''''*, with its branches, connects line No. 1, as above, to the test-bolts. I also connect each subscriber's line, after it has passed through its series of spring-jack switches and before it passes to its annunciator and ground, to the other bolt of its series of test-bolts on each of the boards. *s''''*, with its branches, connects line No. 1, as above, to its test-bolts. Line No. 2 is also connected in a similar manner to its test-bolts by wires *r''''* and *r''''* and their branches, as shown.

It is evident that when a switch-plug is inserted into any spring-jack switch of a line the line is opened between the contact-pieces *g h* of the switch, and is therefore disconnected from the ground and is connected to the flexible cord attached to the plug. It is also evident that when there is no plug in any switch of a series of a line there is a complete circuit through the switch boards from any test-bolt *i* of the line to its corresponding test-bolt, *j*, and that when there is a plug in any switch of the line the circuit between the two test-bolts is opened. If the operator, therefore, applies her test-plug to any pair of test-bolts *i j*, as indicated, and the bell responds, she knows that the circuit between these test-bolts is not open, and that the line is not switched for use at any other board. If the bell does not respond, she knows that the line is switched for use. It is, however, evident that when the operator makes a test and the line is in use there will be a completed circuit through her test apparatus from one test-bolt and thence to the ground, and from the ground at the distant end of the line, and also from the ground at the distant end of the line which is connected to it through the lines to the other test-bolt. The bell and battery should be adjusted to the circuits so that the bell will not respond when closed through such a resistance. In practice about one cell of battery and a

bell of corresponding resistance will meet the requirements of the system.

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 evident that when two subscribers are connected together for conversation, or when the switch-plug is in the switch of one line, the operator can, by moving the switch Y of the cords used, loop her telephone into the circuit of the cords.

The cross-pieces of the switches Y may be of rubber or other similar material, as is usual. The levers of the switches Y should remain on y y, except when the operator is using her telephone with the cords to which the switch belongs.

G in each case in the drawings represents the ground-connection.

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

1. The combination of two or more strips of insulating material placed one above the other, each having several spring-jack parts mounted thereon, each part containing a spring-lever placed transverse to the front of the strip, and a contact-point normally in contact with the spring-lever, with transverse rectilinear holes along one of the edges of each of said strips, one hole in front of each of said levers, whereby the edge of one strip provides one of the sides of the holes of another strip, substantially as and for the purpose set forth.

2. The combination of spring-jack switches mounted on an insulating-strip, and having their plug-holes through the front of said strip, with pairs of test bolts or pieces, one pair for each switch, and each pair being mounted on the front of the said strip adjacent to its switch, whereby the operator may know to what switch each pair of test-bolts corresponds, substantially as and for the purpose set forth.

3. In a telephone system, a telephone-line, a switching device in the circuit of said line, adapted to open and close said line at its contact-points, and a pair of test-bolts, one of the bolts being connected to the line on one side of the switching device and the other bolt being connected to the line on the other side, in combination with a testing plug or device having two contact-points connected by a loop in which is a battery and a test-receiving instrument, said contact-points being adapted to be brought into contact with said test-bolts, substantially as and for the purpose set forth.

4. In a telephone system, a telephone-line, two or more switching devices in the circuit of said line, each adapted to open and close said line at its contact-points, and a pair of test-bolts, one of the bolts being connected to the line on one side of the switching devices and the other bolt being connected to the line on the other side of the switching devices, in combination with a test plug or device hav-

ing two contact-points connected by a loop in which is a battery and a test-receiving instrument, said plug contact-points being adapted to be brought into contact with said test-bolts, whereby the operator may determine whether or not the circuit from one test-bolt to the other is opened at some one of the switching devices.

5. In a telephone system, two or more telephone-lines, each having two or more switching devices in its circuit, each switching device being adapted in the operation of the system to open and close its line at its contact-points, and pairs of test-bolts, one pair for each line, one bolt of each pair being connected to its line on one side of its switching devices and the other bolt being connected to its line on the other side of its switching devices, in combination with a testing plug or device having two insulated contact-points connected by a loop in which is a battery and a test-receiving instrument, said plug contact-points being adapted to be brought into contact with any pair of said test-bolts, whereby the operator may determine whether or not either of said lines is in use.

6. In a telephone system, a telephone-line grounded at its two ends, a switching device in the circuit of said line, adapted to open and close said line in the operation of the system at the contact-points, and a pair of test-bolts, one of the bolts being connected to the line on one side of the switching device and the other bolt being connected to the line on the other side of the switching device, in combination with an operator's testing system, consisting of a testing plug or device, with two contact-pieces, a battery, a test-receiving instrument, and a loop, said contact-pieces being connected by the loop and adapted to be brought into contact with said test-bolts, said loop containing said battery and test-receiving instrument, and said battery and test-receiving instrument being so adjusted to each other that the instrument will respond when the testing device is applied to the test-bolts and the circuit between the bolts is closed at the switching device, but will not respond when the circuit is open at the switching device, substantially as and for the purpose set forth.

7. In a telephone exchange system, two or more switch-boards provided with series of switches, one series for each line and one switch of each series arranged on each board, each line passing through each switch of its series and to ground, switch-plugs adapted to be inserted into any of said switches, and when inserted to open the line at the contact-points of the switch and disconnect it from the ground, and series of pairs of test-bolts, one series for each line and one pair of each series on each board, one bolt of each pair being connected to its line before it is connected to any of its switches, and the other bolt being connected to its line after it has passed through its switches and before it is connected to the ground, in combination with operators' test-

ing systems, one system at each board, and each consisting of a testing plug or device, with two contact-points, a battery, a test-receiving instrument, and a loop, said contact-points  
5 being connected to the loop and being adapted to be brought into contact with any pair of the test-bolts at the board, and said loop containing the battery and test-receiving instrument, whereby the operator at any board may by a  
10 preliminary test determine whether any line is in use.

8. The combination of two or more strips of insulating material placed one above the other and each having the metal parts of  
15 spring-jack switches mounted thereon, with rectilinear plug-holes, one for each of said switches and transverse to the front and along one of the edges of its strip, whereby the edge of one strip provides one of the sides of the  
20 holes of another strip, substantially as and for the purpose set forth.

9. In a telephone-exchange system, two subscribers' lines temporarily connected together for conversation, in combination with a calling  
25 generator or battery, a clearing-out annunciator, an operator's telephone, a calling-key, and a switching device, said key and said generator being in a wire or circuit grounded on one side and connected to the circuit of said  
30 lines on the other side, said operator's telephone and said clearing-out annunciator being each in a loop, the two ends of which are connected to the two contact-bolts of a pair of contact-bolts of said switching device, (there  
35 being one pair of contact-bolts for each loop,) said switching device having two contact-pieces, each connected to its side of the circuit of said lines, and the two contact-pieces being adapted to be brought into connection with  
40 either pair of said bolts, whereby at the will of the operator he may loop either the operator's telephone or the clearing-out annunciator into the circuit of the lines so connected together, and may ground said circuit through  
45 the calling-generator, substantially as set forth.

10. In a telephone-exchange system, two subscribers' lines temporarily connected together for conversation, in combination with  
5 a calling generator or battery, a clearing-out annunciator, a calling-key, and a switching device, said key and said generator being in a wire or circuit grounded on one side and connected to the circuit of said lines on the other  
10 side, said clearing-out annunciator being in a loop, the two ends of which are connected to two contact-bolts of said switching device, said switching device having two contact-pieces, each connected to its side of the circuit of said  
15 lines, and said contact-pieces being adapted to be brought into connection with said bolts, whereby at the will of the operator he may loop the clearing-out annunciator in and out of the circuit of the lines so connected together, and may ground said circuit through the call-  
20 ing-generator, substantially as set forth.

11. In an operator's cord system, two cords normally (or when their plugs are not in line-  
switches) grounded, in combination with an operator's telephone, a calling-generator, a  
25 calling-key, and a switching device, said key and said generator being in a wire or circuit grounded on one side and connected to the circuit of said lines on the other side, said tele-  
30 phone being in a loop, the two ends of which are connected to two contact-bolts of said switching device, said switching device having two contact-pieces, either connected to its one of said cords, and said contact-pieces being adapted to be brought into connection with  
35 said bolts, whereby at the will of the operator he may loop said telephone into and out of the circuit of the cords, and may ground said circuit through the calling-generator, substantially as set forth.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,  
WALLACE L. DE WOLF.