

(No Model.)

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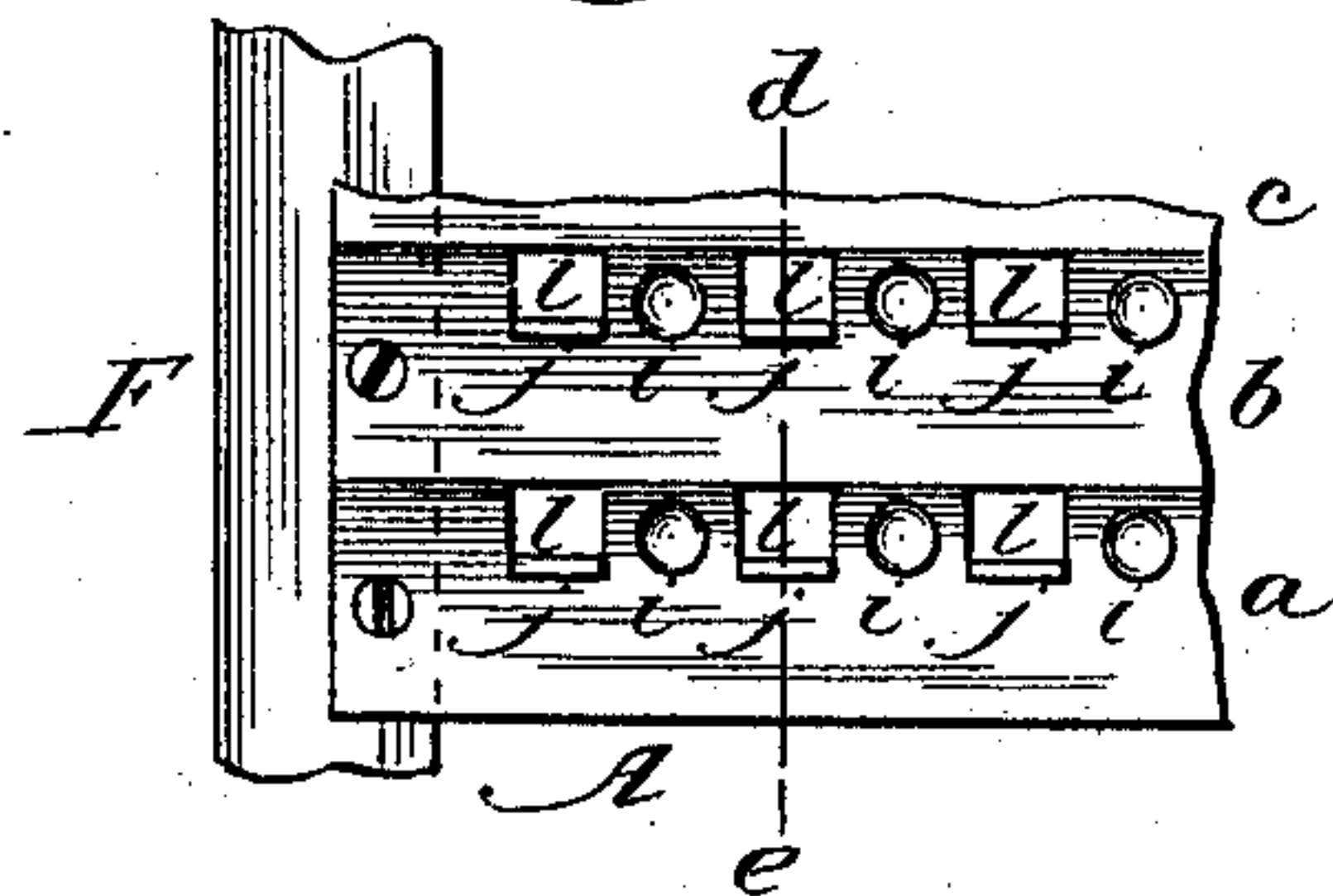
M. G. KELLOGG.

MULTIPLE SWITCH BOARD.

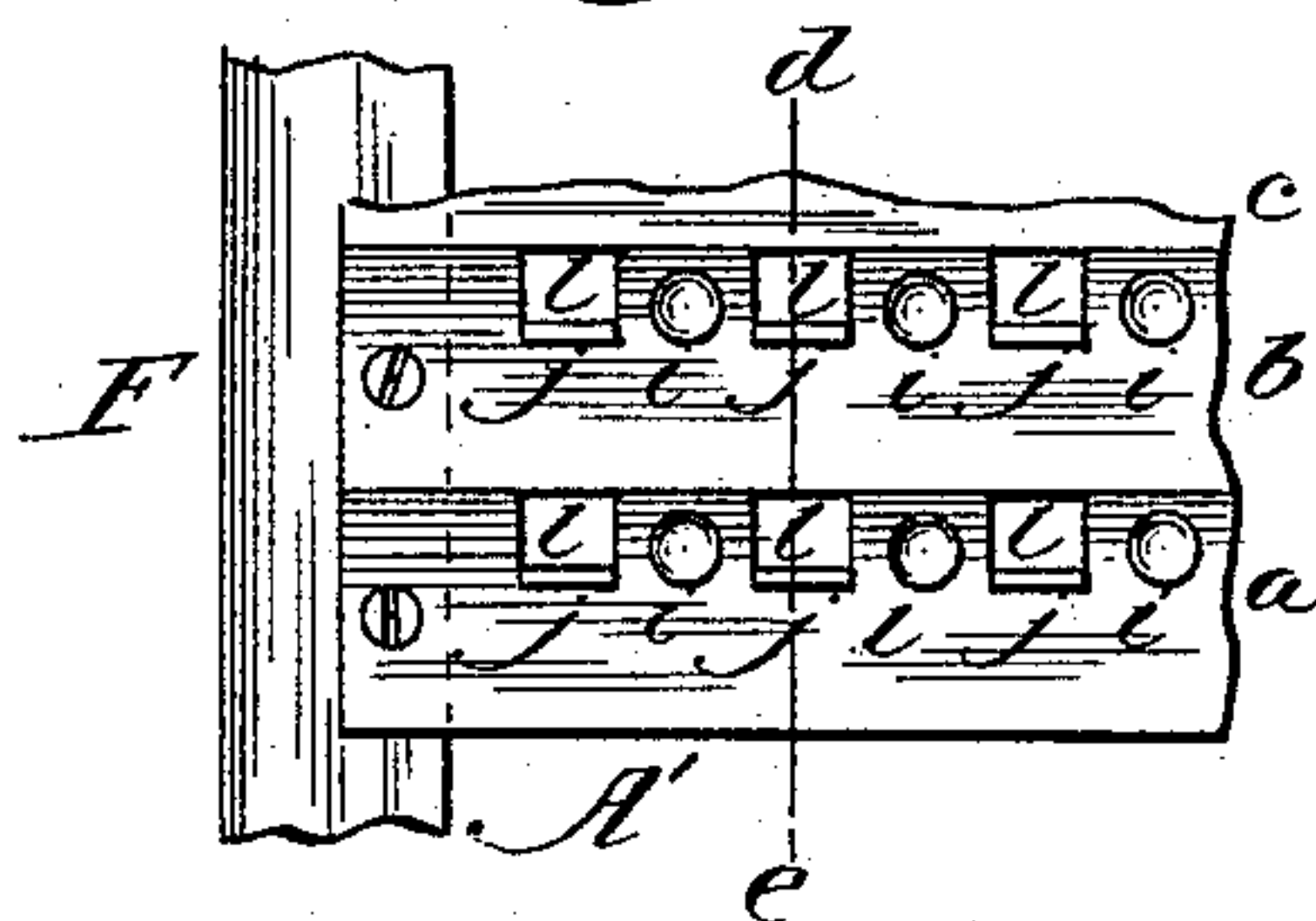
No. 387,645.

Patented Aug. 14, 1888.

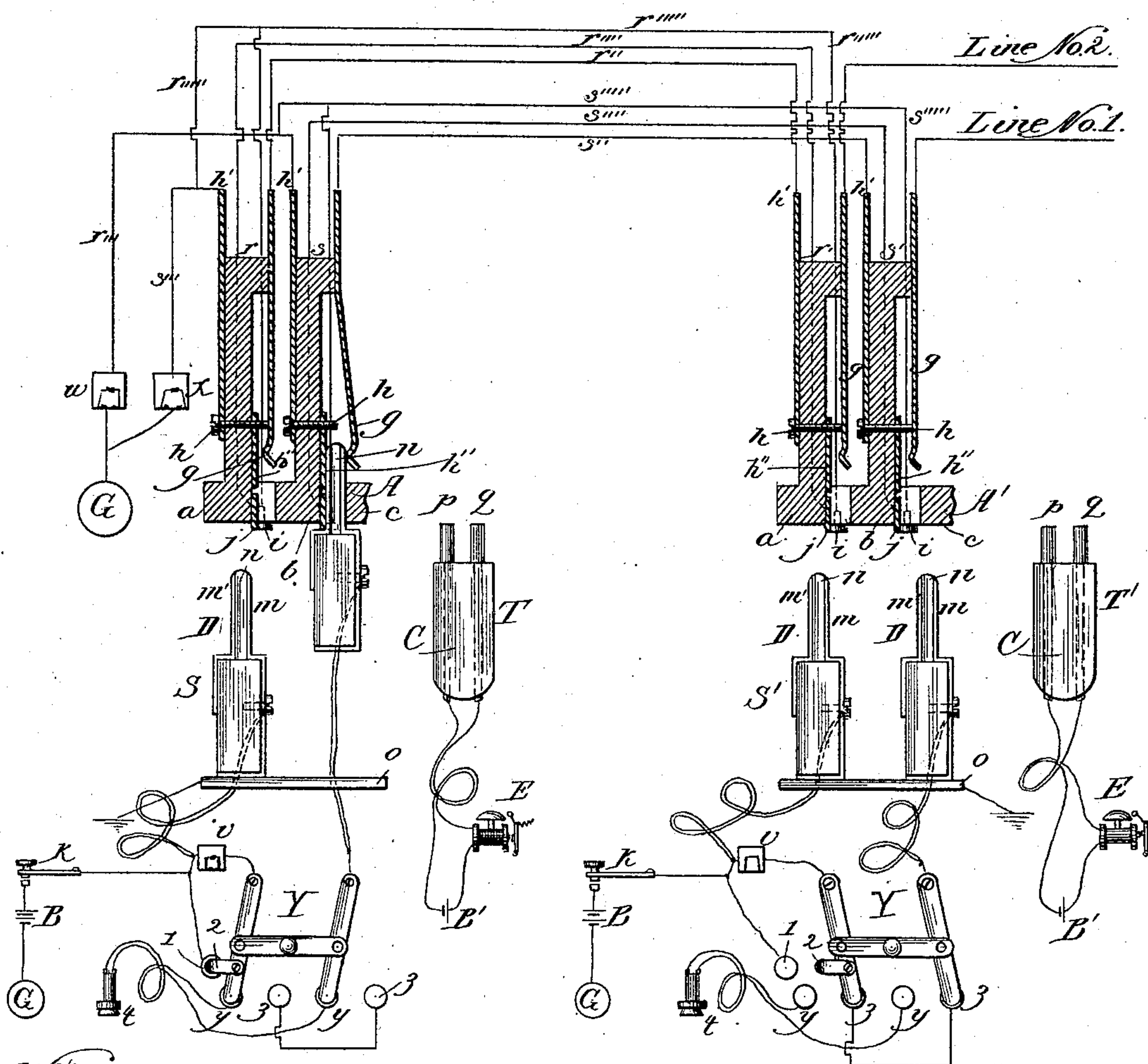
*Fig. 1<sup>a</sup>.*



*Fig. 1b.*



*Fig. 2.*



*Witnesses:*

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*Inventor:*

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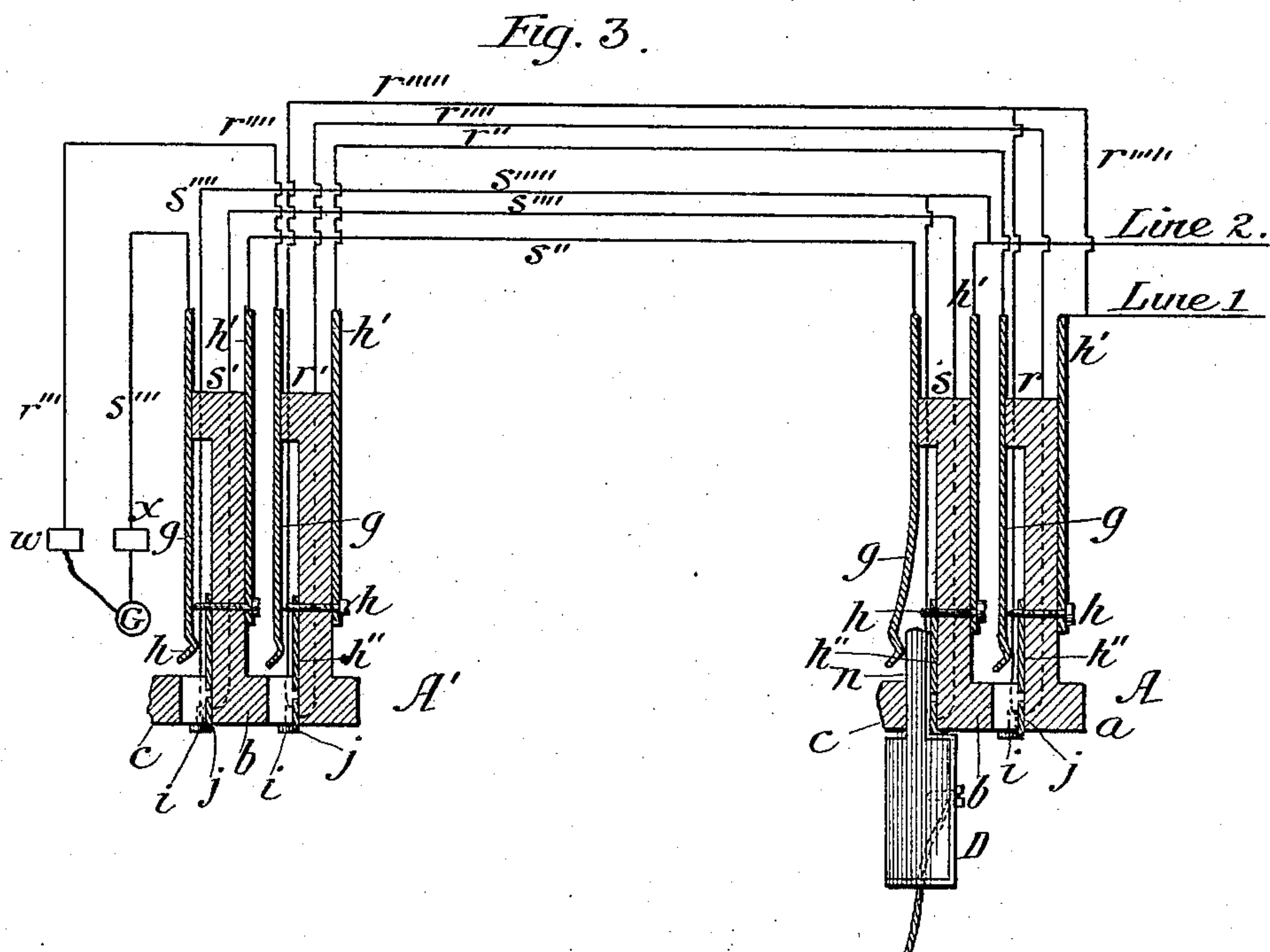
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2 Sheets—Sheet 2.

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Witnesses:  
Frank Blanchard  
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# UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF HYDE PARK, ILLINOIS.

## MULTIPLE SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 387,645, dated August 14, 1888.

Application filed May 26, 1887. Serial No. 239,427. (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 consists in a multiple switch-board system of operating an exchange and testing at any board to determine whether a given line is in use, and in certain apparatus and circuits for operating said system and applicable to other systems of telephone-exchange switch-boards, all of which I shall hereinafter describe, and claim in detail.

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 line which centers at the office a spring-jack or similar switch having three insulated contact-pieces, 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 contact points or pieces which are normally in contact and connect one of them to the flexible conducting-cord of the plug and the other of them to the other contact point or piece of the line, and when the plug is withdrawn to again connect the contact-points which are normally in contact and disconnect the other point from them. I also place on each board for each line a test bolt or piece adjacent to the spring-jack switch of the line. It has as its mate one of the contact-pieces of the switch, which also acts as a test-bolt of the line.

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 lines 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. Fig. 3 shows a modification of the main-line apparatus and circuits applicable to my invention.

In the drawings like parts and apparatus are represented 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 the 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, 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.

*l l*, &c., are rectilinear holes through the fronts and at one of the edges of the strips, adapted to receive the switch-plugs. The contact springs are mounted to the rear of and are parallel to the holes *l l*, to which they belong, as shown. The contact-points *h h*, on which the contact-springs or spring-levers 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 toward the front of the switch-holes, and along their lower faces I place the contact-pieces *j j*, as shown. These pieces *j j* come in proximity to but do not touch the pieces *h'' h''*, and they extend far enough to the front of their respective holes so that the test-plug 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 *h*, on which it normally bears, and its flexible cord is connected to the spring-lever, while the contact-point *h* and the contact-piece *j* are electrically connected through the medium of the piece *m'* of the switch-plug, which then touches both *j* and *h''* of the switch.

Each section of a 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," and the switches of a line on the different boards may be called a "series of switches." 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 shapes and arrangement of the parts used.



*i i* are the test-bolts mentioned above, one for each line, on each board, and placed adjacent to its spring-jack switch, so that the operators may make the tests, as hereinafter described. The test-bolts of a line on the different boards may be called a "series of test-bolts."

Two subscribers' lines are shown. They are marked "line No. 1" and "line No. 2." *s* and *s'* are the spring-jack switches for line No. 1 on the two boards, and *r* and *r'* are the spring-jack switches for line No. 2 on the two boards. The circuits and connections 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 *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 calling-annunciator *w*, and thence to ground. I connect the line, either directly or by branch wire or wires, from between its switches and its annunciator to all the test-bolts *i i* of the line on the different boards. Wire *s''''* and its branches thus connect line No. 1 to all its test-bolts *i i*. The contact-pieces *j j* of switches *s* and *s'* are connected together by wire *s''''* and its branches, as shown. The other lines of the exchange would in like manner be connected to their switches on the different boards, as would also be connected together all the contact-pieces *j j* which belong to a line. Other boards might be added to the exchange, and the connections of the lines and the switches and test-bolts would be similar to the above, and such as will be evident to those skilled in the art.

*s s'*, Fig. 2, are operators' systems of cords, with plugs, keys, switches, clearing-out annunciators, operator's telephone, calling generator or 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 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 and adapted to be inserted in the line-switches. *m m* are the metal pieces of the plugs, adapted to come in contact with the spring-levers *g* of the switches and connect them with the cords of the plugs.

*m' m'* are metal pieces of the plugs, adapted to come in contact with pieces *h''* and *j* of a switch when a plug is inserted and connect them together.

*n n* are the rubber insulations of the plugs. The pieces *m m* extend to the bottom of the plugs, as shown, and are adapted to rest on the metal strip *o*, which is connected to the ground, and normally connect the cords with the ground. Weights, as is usual, or other similar devices may be used to bring the metal pieces *m* of the plugs in normal contact with the strip *o* and form a good connection. The plugs

should be inserted into the switches in such a manner as to make the connections above described. A plug is shown thus inserted in switch *s*.

*S* is a looping-in switch.

*y y* and *z z* are the connecting-bolts, on which the operator at will may place the pairs of switch-levers. The cross-piece between the levers may be of rubber, as is usual, or of other suitable insulating material.

*1* is an insulated contact-bolt, on which a metal lug, (marked 2,) extending from one of the levers of the switch, rests when the levers are on *y y*, as shown. This bolt is connected by a short-circuit wire to the cord-circuit, as shown.

*k* is a calling-key, constructed, connected, and operating as shown. *v* is a clearing-out annunciator.

*t* is the operator's telephone, and *B* is her signaling generator or battery. The letter *G* in each case represents the ground-connection. The circuits are substantially as shown.

*T T'* are the operators' testing systems at the two boards, one at each board. *C* is the rubber handle of the test-plug.

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

*E* is an electric bell or other test-receiving instrument, and *B'* is an electric battery, both being placed in the loop which connects the two contact-pieces *p q*, as shown. The connection between the apparatus *E* and *B'* and the test-plug is by flexible conductors of sufficient length, so that the operator may readily apply the contact-pieces *p q* of her test-plug to the pair of contact bolts or pieces *i j* of any line at her board, as described.

Each operator has one testing system and one cord system. The cords should be of sufficient length and the apparatus should be placed in convenient arrangement at her board, so that she can conveniently operate the exchange system.

The levers of all switches *Y* should normally rest on *z z*; but they are to be moved to *y y* when the operator desires to use her telephone with the pair of cords to which the switch belongs. It will be noticed that when the levers of a switch are on *z z* the clearing-out annunciator is in circuit with its cords; but when the levers are on *y y*, so that the operator's telephone is looped into circuit with the cords, the clearing-out annunciator is shunted by a wire of low resistance.

The method of operating the exchange system at either board, including answering calls, making connections, sending signals, clearing out connections, &c., are such as will be apparent on an examination of the apparatus and circuits shown. For convenience, I call the contact-piece *j* and the contact-bolt *i*, which is its mate, a pair of "test-bolts." The pairs



of test-bolts of a line on the different boards may be called a "series of pairs of test-bolts."

It will be seen that when there is no switch-plug in any switch of a line none of the test-bolts  $i$  of the line are in electric connection with the corresponding test-bolts  $j$ , and if a test-plug is applied, as above, to any pair of test-bolts of a line in such a condition there is not a complete circuit established through the bell and battery of the plug and the bell will not ring. If, on the other hand, there is a switch-plug in any switch of a line, an electric connection exists between any test-bolt  $i$  of the line and its corresponding test-bolt  $j$ , and if a test-plug is then applied to any pair of test-bolts of the line the bell will ring. Consequently an operator may at any time find out whether a given line is in use at some other board by applying her test-plug, as above, to the pair of test-bolts of the line, and if her test-bell rings she knows that one of the switches of the line has a plug in it, and if it does not ring she knows that none of the switches of the line have plugs in them.

The testing system would be equally applicable if the test-bolts  $i$  of a line were connected to the line-circuit, instead of the ground-circuit, and the arrangement of switches were such that the contact-pieces  $j$  of a line were connected to the line-circuit when a plug was inserted into any switch of the line. Fig. 3 shows an arrangement of the apparatus and circuits by which this result may be accomplished.

The operators' systems for connecting and for testing (shown in Fig. 2 and marked Y and T, respectively) may be used with the apparatus shown in Fig. 3. The switch-plugs should be inserted in this case for switching, so that the metal pieces  $m$  of the plugs bear on the contact-pieces  $h$  and their mates.

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

1. The combination, with a pair of flexible conducting-cords and their plugs for connecting two subscribers' lines, of an operator's telephone, a clearing-out annunciator, and a switch, said annunciator being in the circuit of said cords and said switch having contact-points to switch said telephone in and out of the circuit of the cords, and other contact-points to shunt said annunciator by a circuit of small resistance, of which the telephone is not a part, when said telephone is switched into the circuit of the cords, substantially as set forth.

2. The combination, with two telephone-lines connected together for conversation, of an operator's telephone, a clearing-out annunciator, and a switch, said annunciator being in the circuit of the lines and said switch having contact-points to switch said telephone in and out of the circuit of the lines, and other contact-points to shunt said annunciator by a circuit of small resistance, of which the telephone is not a part, when said telephone is

switched into the circuit of the lines, substantially as set forth.

3. The combination, with telephone-lines radiating from the central office and a loop provided with means for connecting it at opposite ends with any two of said lines, of an operator's telephone, a signal-receiving device, and a switch, said signal-receiving device being in the circuit of said loop and said switch having contact-points to switch said telephone in and out of said loop, and other contact-points to shunt said signal-receiving device by a circuit of small resistance, of which the telephone is not a part, when said telephone is switched into the circuit of the loop, substantially as set forth.

4. The combination, with a telephone-line and a line-switch, of two test-bolts, one of which is connected by a branch connection to the circuit of the line on one side of the pair of switch-points and the other of which is normally insulated from the line and is adjacent to one of the switch-points and is crossed with said point by the plug on its insertion, said point being that point of the switch which is connected to the same side of the line as said branch connection is, substantially as set forth.

5. The combination, with a telephone-line, of two or more switches for said line, one on each of two or more switch-boards, and two or more pairs of test-bolts, one pair on each of said switch-boards, one bolt of each pair being connected by a branch connection to the circuit of the line outside of and to one side of the switches, and the other bolts being normally insulated from the line and connected together by a circuit-connection, each bolt being adjacent to one of the switch-points at its board and crossed with it by the plug on its insertion, said point being that point of the switch which is connected to the same side of the line as said branch connection is, substantially as set forth.

6. The combination, with a telephone-line and two or more switch-boards, at each of which said line may be switched for conversation, of two or more pairs of test-bolts for said line, one pair on each of said boards, one bolt of each pair being connected by a branch connection to the circuit of the line outside of and on one side of the switches, and the other bolts of the pairs being connected together and each adjacent to one of the switch-points at its board, said point being that point of the switch which is connected to the same side of the line as said branch connection is, substantially as set forth.

7. The combination, with a telephone-line, of two or more switches for said line, one on each of two or more boards, and two or more pairs of test-bolts for said line, one pair on each of said boards, one bolt of each pair being connected by a circuit-connection to the circuit of the line between its switches and the office ground, and the other bolt of each pair being connected with its corresponding



bolts on the other boards adjacent to the contact-point of the line-switch at its board, which is connected with the office ground and crossed with said point by the plug on its insertion, substantially as set forth.

8. The combination, with telephone-lines and two or more switch-boards, at each of which said lines may be switched for conversation, of pairs of test-bolts for each of said lines, one pair on each of said boards, one bolt of each pair being connected to the circuit of the line between the switches and the office ground, the other bolt of each pair being connected with its corresponding bolts on the other boards adjacent to the ground contact-point of the line switch at its board and crossed with said point by the switch-plug on its insertion, and sets of testing apparatus, one set at each board, each set consisting of a double testing plug or device, with a double flexible cord, the two contact-pieces of each plug being adapted to be brought into contact with any pair of test-bolts at its board, and a test-receiving instrument and a battery in a loop, which connects the two conductors of said flexible cord, substantially as set forth.

9. The combination, with telephone-lines and two or more switch-boards, at each of which said lines may be switched for conversation, of pairs of test-bolts for each of said lines, one pair on each of said boards, one bolt of each pair being connected to the circuit of the line outside of and on one side of its line-switches, the other bolt of each pair being connected with its corresponding bolts on the other boards adjacent to the point of the switch of its line at its board, connected to said first-mentioned bolt and crossed with said point by the switch-plug on its insertion, and sets of testing apparatus, one set at each board, each set consisting of a test-receiving instrument and a battery in a loop, and means for connecting the two sides of the loop to the two test-bolts of any pair of test-bolts at its board, substantially as set forth.

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Witnesses:

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