(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCH BOARD.

No. 387,889. Patented Aug. 14, 1888.

Fig. 1a.

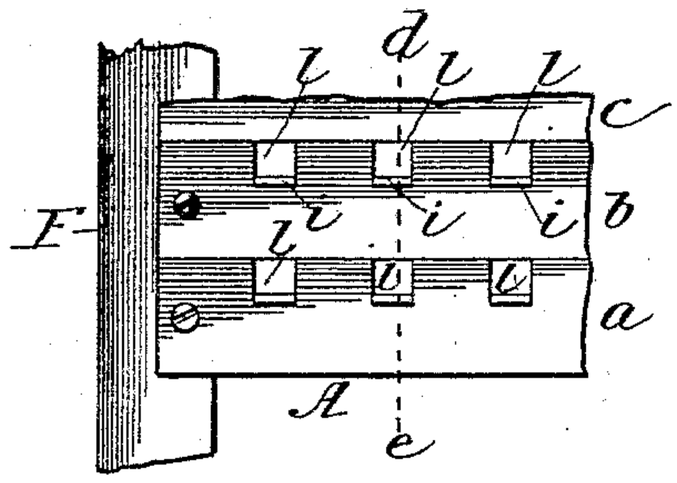

Fig. 1b.

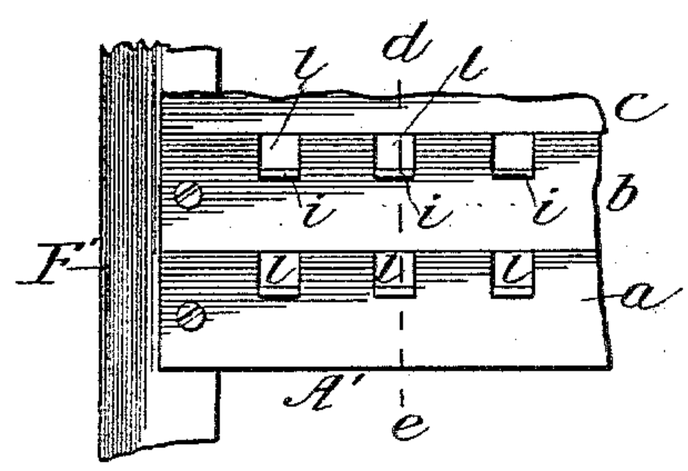

Fig. 2.

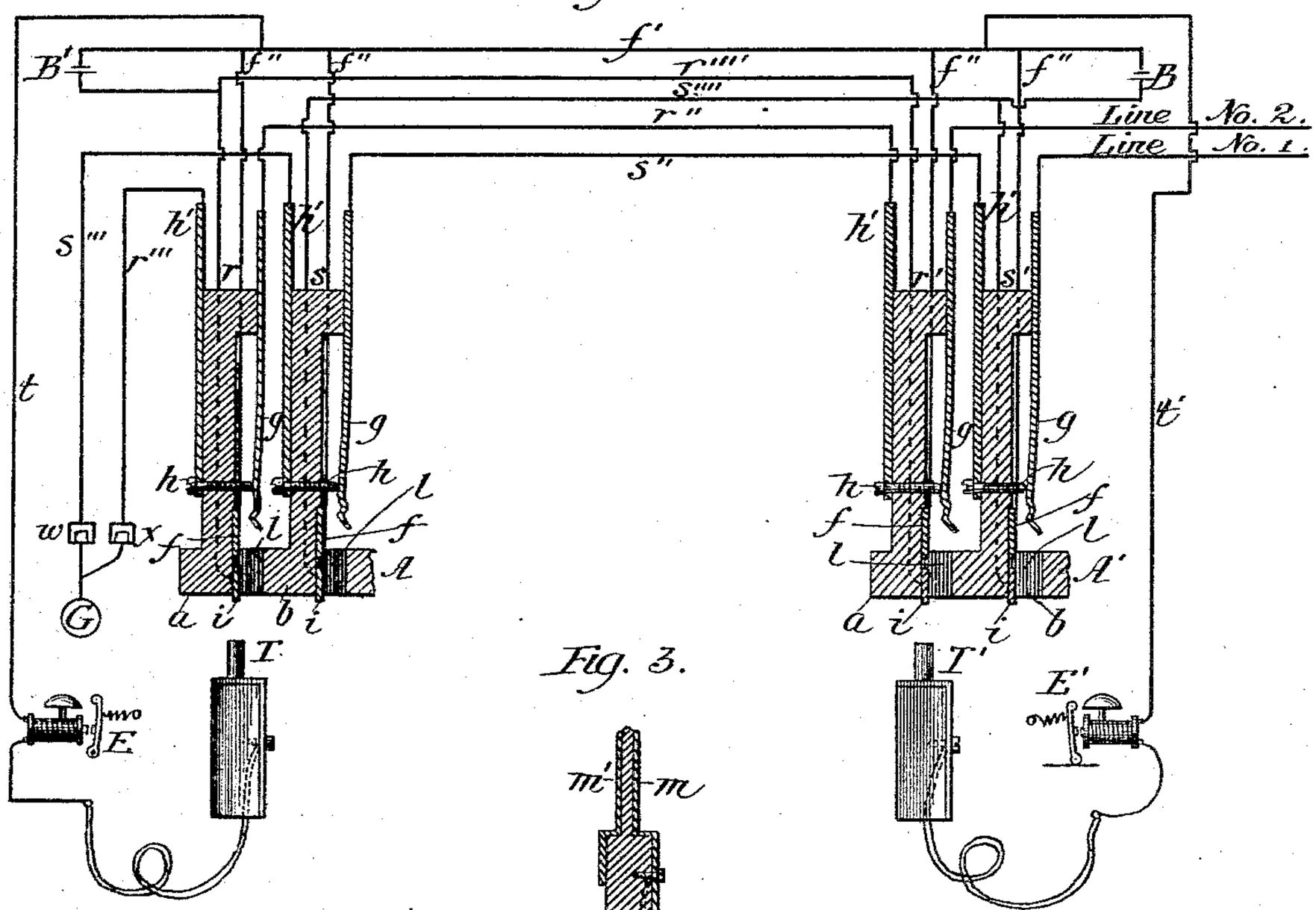

Fig. 3.

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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. 387,889, dated August 14, 1888.

Application filed June 6, 1887. Serial No. 240,418. (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 is designed to facilitate the work of switching at the central office of a telephone-exchange system; and it consists in multiple switch-boards for the exchange and independent local circuits and electric apparatus, whereby an operator at any board may readily determine whether the line of a subscriber called for is in use at either of the other boards, and is adapted to any of the known methods or combination of methods of sending in the calls or connecting the terminal stations with or through the central office.

In my 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 enters the office a switching device or devices adapted to make the necessary connections and disconnections of the line and to make the necessary connections and disconnections of the local-test system, which I shall hereinafter describe.

In the drawings I have shown spring-jack switches adapted to closed-circuit lines. Other forms of switches may be used which will practically accomplish the same purpose. My testing system is also applicable to open-circuit lines, and in this case it is not necessary to have the switches adapted to remove a ground-connection from a line when the line is switched for conversation.

Figures 1ª and 1ᵇ 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 my test system.

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. 1ª, as indicated by line *d e*, and A′ is a sectional view of the switch-board shown in Fig. 1ᵇ, as indicated by line *d e*.

a b represent rubber strips on which the metal parts of the spring-jack parts 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 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 *l l* 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′*, as shown. A contact-spring, *g*, and its contact-point *h* form the main-line contact-points of a switch. Toward the front of the switch-holes and along their lower faces I place the contact-pieces *i i*, as shown. These pieces extend far enough to the front of the holes so that a test-plug or similar device may be applied to any of them by the operator at the board. In the rear of the contact-pieces *i i*, and also along the lower faces of the switch-holes, I place the contact-pieces *f f*, as shown. These pieces are normally insulated from all other parts of their switches. The contact-piece *i* and the contact-piece *f* of a switch form a pair of local contact-points, and the contact-piece *i* also acts as a test-plate or test-bolt of its line.

Fig. 3 shows a switch-plug adapted for use with the switches described above. *n* is the rubber handle and insulation of the plug. *m* is the main-line contact-piece of the plug, to which is connected the flexible conducting-cord. *m′* is a local contact-piece and is insulated from *m*. When a plug is inserted into a switch-hole, the piece *m* presses on the lever *g* and raises it from the contact-point *h*, and consequently connection is broken between *g* and *h* and is made between *g* and *m*. At the same time the piece *m′* of the plug bears on the pieces *i* and *f* of the switch and electrically connects them.

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 "spring-jack 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 arrangement adapted to the shapes and arrangement of the parts used.

Two subscribers' lines are shown in the drawings. They are marked line No. 1 and line No. 2. *s s'* are the spring-jack switches for line No. 1 on the two boards, and *r r'* are the spring-jack switches of line No. 2 on the two boards. The circuits and connections are as follows for the main lines: 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. Line No. 2, as would be every other line of the exchange, is connected in a similar manner through its series of switches.

G represents the ground-connection.

E is an electric bell or other test-receiving instrument.

T is a test-plug with a flexible conducting-cord, and *t* is a branch test-wire for switch-board A, and E' is a test-receiving instrument. T' is a test-plug with a flexible conducting-cord, and *t'* is a branch test-wire for switch-board A'.

B is an electric battery for the local test-circuit of line No. 1, and B' is a battery for the local test-circuit of line No. 2.

The local test-circuits and connections are as follows: All the contact-pieces *f f* of all of the switches of the system are connected together. Switches *s*, *s'*, *r*, and *r'* are thus shown as having their contact-pieces *f f* connected together by the wire *f'* and its branches *f'' f''*, &c. All contact-pieces *i i*, &c., of the switches of a given line are connected together. The contact-pieces *i* and *i* of switches *s* and *s'* are shown as connected by wire *s''''*, and the contact-pieces *i* and *i* of switches *r* and *r'* are shown as connected by wire *r''''*.

The wire *f'* and its branches may be called the "common test-wire," and the wires *s''''* and its branches, *r''''* and its branches, &c., may be called "individual test-wires" of their lines. The test-battery of a line is placed in a loop or wire which connects the common test-wire with the individual test-wire of the line. This wire may be considered as a part of the individual test-wire, and the wires to the pieces *i i* of its switches should not branch off between the battery and the common test-wire.

The branch test-wire of a switch-board branches off from the common test-wire, as shown, and in it is placed the test-receiving instrument. It terminates in the test-plug T or T', with its flexible cord adapted to be brought at will into connection with any contact-piece *i* of its board. These branch wires may terminate in or be connected to any other suitable switching device or devices, whereby the operator may at pleasure connect it to any contact-piece *i* of her board.

The method of operation of the testing system is as follows: If the operator at any board desires to test a line to see whether it is switched at another board, she places her test-plug on the contact-piece *i* of the switch of the line. If the line is not switched at another board, her test-bell will ring, there being an electric circuit from her test-plug through her test-bell, thence through the common test-wire to the individual test-wire of the line and the battery, and thence to the contact-piece *i*—thus forming a closed circuit in which is the bell and the battery. If, however, the line is switched at another board, the bell will not ring, because the battery is short-circuited by a circuit of very much smaller resistance through the contact-piece *m'* of the switch-plug which is used to switch the line and the circuits, as shown and described. The operator will thus know on testing whether or not the line is switched for use at another board.

I have only shown two switch-boards in use and two test-bells—one test-bell for each board. Other switch-boards and other test-bells might be added to the system and the connections of the lines and switches and test-circuits would be similar to the above, and such as will be evident to those skilled in the art.

I have not shown in detail the method of answering calls and making connections at the central office. Well-known forms of apparatus and connections may be used for this purpose.

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

1. In a telephone-exchange system, two or more multiple switch-boards to which the same telephone-lines are connected, local test-circuits having a pair of contact-points or test-bolts at the switches, one test-circuit for each line, each test-circuit containing a battery and connected to each board on each side of the battery, and said battery being normally open, and a switch-plug having insulated contacts crossing the test-bolts at the connected switches for automatically shunting the test-circuit around a tested switch through a line of less resistance when the main line is switched for conversation at another switch, in combination with a test-receiving instrument connected on one side to each test-circuit at one side of the battery, and a test-plug whereby the operator may at will connect the test-receiving instrument on its other side to any test-circuit at the other side of the battery, substantially as and for the purpose set forth.

2. In a telephone-exchange system, the combination of two or more multiple switch-boards for telephone-lines with series of switches, one switch for each telephone-line, and one switch of each series being on each board, circuit-closers, one circuit-closer for each switch, each circuit-closer being closed automatically by the insertion of a plug in its switch, local test-

circuits, each test-circuit containing a test-battery and two contact-pieces and connected on the two sides of its battery to the two contact-pieces, respectively, of each of its circuit-closers on the several boards, a test-receiving instrument at each board, and switch-testing devices whereby the operator at any board may at will connect her test-receiving instrument into circuit with either of said test-circuits, the connection with said circuit being on the two sides of its test-battery, substantially as and for the purpose set forth.

3. In a telephone-line switch, the combination of the main-line contacts *g* and *h*, a pair of contact-points which are closed on the insertion of a switch-plug and opened on its withdrawal, said contact-points being mounted on one of the inner faces of the plug-hole and insulated from the contacts *g* and *h*, and one of said contact-points being also a test-plate for the line to which a test-plug may be applied, substantially as set forth.

4. A spring-jack switch containing within the plug-hole two main-line contact points or pieces which are normally in contact with each other, in combination with a pair of test-bolts arranged within the plug-hole on one of the inner faces of the plug-hole and insulated from each other and from the main-line contact-pieces, and a switch-plug having two parallel insulated contact-pieces, said plug being adapted, when inserted into the switch, to disconnect the main-line contact-pieces from each other and connect one of them to one of the contact-pieces on the plug and to cross the two test-bolts through the other contact-piece of the plug, substantially as set forth.

5. In a telephone-exchange system, multiple switch-boards provided with series of switches, one switch for each telephone-line, and one switch for each series arranged on each board, local-circuit closers, one circuit-closer for each switch, and each comprising separate contacts, whereby it is closed automatically by the insertion of a switch-plug into its switch, test-plates arranged one for each switch, each test-plate being one of the contact-points of the circuit-closer of its switch, or connected thereto, local test-circuits, one for each line, each test-circuit containing a test-battery and connected on the two sides of its battery to the two contact-pieces, respectively, of each of its circuit-closers on the several boards, a test-receiving instrument at each board, and a plug for each test-receiving instrument, said plug being connected with a flexible conducting-cord to one side of the test-receiving instrument and adapted at the will of the operator to be brought into connection with any of the test-plates at her board, and the test-receiving instruments being connected on their other side with said local test-circuits with their batteries between the instruments and their test-plates, substantially as and for the purpose set forth.

6. In a telephone-exchange system, the combination of two or more switch-boards, the main lines and main-line circuits between the boards, the test-circuits, one for each line, including all the boards, a battery in every test-circuit, a common test-wire connected with all the test-circuits, test devices connected with said common test-wire, and test-bolts at each switch included in the test-circuits, substantially as set forth.

7. In a telephone-exchange system, the combination of test-circuits, the test-bolts at each switch connected with the test-circuit, a test-plug connected with a signaling device and with all the test-circuits at one end and adapted to close a circuit through the signaling device when the line is not switched, and circuit-connections of comparatively low resistance between the test-circuits at one board with the test-bolts at the other boards, whereby the test-circuit at the tested board is short-circuited when the line is switched at another board.

8. In a telephone-exchange system, the combination of the contact-pieces *f f* at the several switches, the common test-wire *f'* and branches f^2, which connect them, the contact-pieces *i* at the several switches, electrical connections between all the pieces *i* in a given line, a battery in each test-circuit, and a test plug and signal, substantially as set forth.

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