(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCH BOARD.

No. 382,476. Patented May 8, 1888.

Fig. 1.

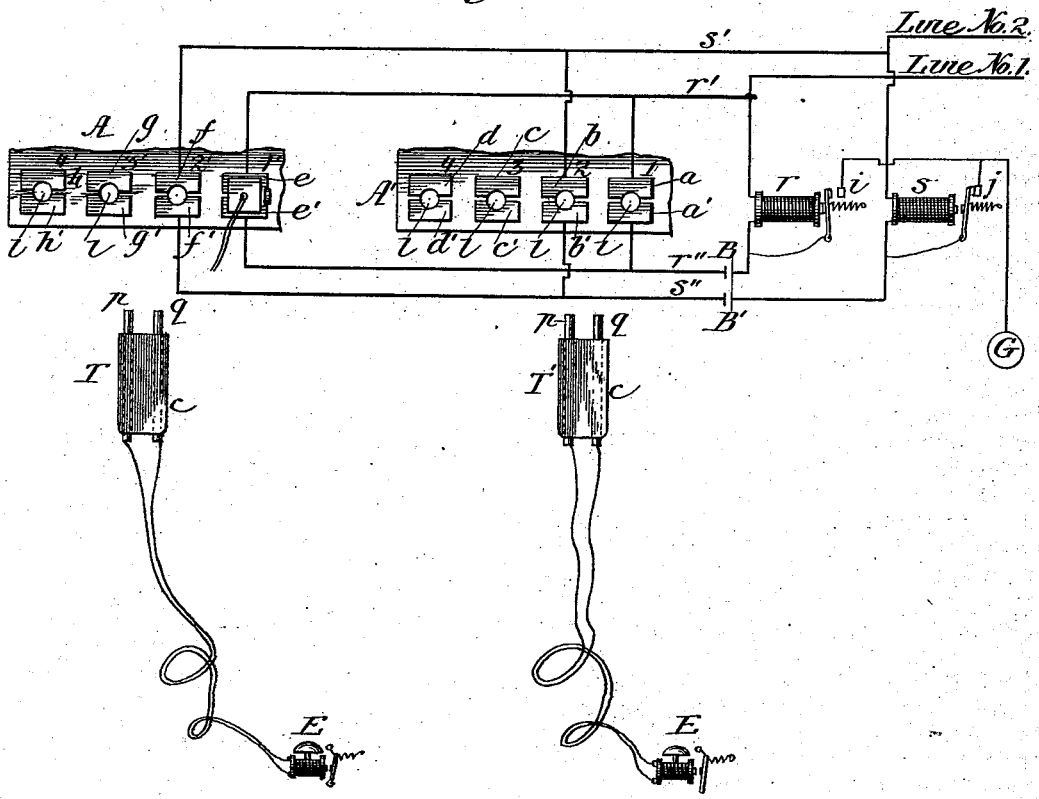

Fig. 2.

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MULTIPLE SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 382,476, dated May 8, 1888.

Application filed June 3, 1887. Serial No. 240,114. (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 normally grounded at the central office.

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

It consists, secondly, of apparatus and circuits for disconnecting temporarily any line from the ground at the central office when it is switched for conversation, 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 answer the calls and connect and disconnect the subscribers' lines. On each board I place, for each line which centers at the office, a switching device having two insulated contact-pieces and adapted to receive a switch-plug, and when the plug is inserted to connect the pieces with each other and with the flexible cord of the plug. The two insulated pieces are also placed and adapted so that the two contact-pieces of a double test-plug may, at the will of the operator, be brought into contact with them.

In my system I use relays for temporarily disconnecting the lines from the ground when they are switched for conversation. There is a relay for each line, and it is connected to the circuit of its line and to the switching apparatus, as will hereinafter be described. There is also a battery for each line at the central office, which is used to operate the relay of the line and to indicate the test of the line, in a manner which will hereinafter be described.

Figure 1 of the drawings shows the various apparatus and connections necessary to operate and illustrate my invention.

A and A′ are sections of two multiple switch-boards, to which the same wires are connected.

a a′, *b b′*, *c c′*, and *d d′* are the metal parts of the four line-switches shown on board A′, and *e e′*, *f f′*, *g g′*, and *h h′* are the metal parts of the four line-switches shown on board A′. The switches are marked 1 2 3 4 and 1′ 2′ 3′ 4′, as shown. Two lines are shown as entering the office and connected to their switches on the two boards, and they are marked line No. 1 and line No. 2. To line No. 1 belong the switches 1 and 1′, and to line No. 2 belong the switches 2 and 2′. To line No. 1 also belong the relay *r*, with its back-contact points *i*, and the battery B, and to line No. 2 belong the relay *s*, with its back-contact points *j*, and the battery B′. The lines are connected to their relays, batteries, and switches, as shown. For instance, line No. 1, after entering the office, separates into two branches, (marked *r′* and *r″*.) The contact-pieces *a* and *e* of its switches on the two boards are connected to *r′*, and the contact-pieces *a′* and *e′* of the switches are connected to *r″*. The relay *r* and the battery B are connected in these branches before the branches are connected to any of the switch parts, and provided they are thus connected it does not matter in what points of the branches they are placed. Line No. 2 is shown as connected to its apparatus in a manner similar to line No. 1. Every other line of the exchange would be connected in like manner to its apparatus.

One of the contact-points of each relay is connected to the line to which the relay belongs, and the other contact-point is connected to the ground, as shown.

l l, &c., are the plug-holes of the switches, adapted to receive the metal part of the switch-plug, and, when the plug is inserted, to cross or connect the contact-points of the switch. A plug is shown as inserted in switch 1′. Fig. 2 shows a plug in detail.

It will be seen from an examination of the apparatus and circuits that when a switch-plug is inserted into any switch of a line the battery and relay of the line are on closed circuit, and the armature of the relay will be attracted to the magnet and the line will be disconnected from the ground. If two plugs connected together by a flexible cord are placed in the two switches of two lines at a board, the lines are disconnected from the ground and are connected together for conversation.

T T' are two operators' test systems, one at each board and intended for one operator. Each test system consists of a double test-plug, a double flexible cord attached to the two contact-pieces of the plug, a loop connecting the two conductors of the cord, and an electric bell or other test-receiving instrument in the circuit of the loop.

C is the rubber handle of the test-plug.

p and *q* are the two contact-pieces of the plug.

E is the electric bell.

The parts of the plug and apparatus are so made, shaped, arranged, and adjusted that the two contact-pieces *p q* of the plug can be at will connected to the two contact-pieces of any switch at the board—that is, *p* can be connected to one of the contact-pieces, while *q* is connected to the other. The switch-cord should be long enough to allow these connections.

When a test-plug is connected, as above described, to any pair of contact-pieces of a switch, the test-bell will ring if the line is not switched for conversation at another board, for there will be a circuit through the loop of the test system and the branch wires of the line, and the battery will be in this circuit and will send through it enough current to actuate the bell. If, however, the line is in use at another board when the test is made, the bell will not ring, because the battery is short-circuited by the very small resistance through the circuit of the plug. The operator can therefore tell whether or not the line is in use at another board.

Only two boards are shown in the drawings. Others can be added and the lines connected to them in a way which will be apparent.

I have not shown apparatus for receiving and answering calls and for the general conduct of the business. Usual forms of apparatus can be used for this purpose in the usual manner.

The test-pieces to which the test-plug is applied may be different from the switch contact-pieces, providing they are in suitable electric connection.

The system may be modified so as to have the loop in which is the battery and the relay disconnected from the line-circuit. In that case at least three contact-points would be required for each switch—one for the line and two for the loop.

The relays used and described are what are known as "back-contact relays," the relay-points being so arranged that they are closed when there is no current through the relay-magnets.

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

1. In a telephone-exchange system, the combination of a telephone-line entering the central office and separated into two branches, with a line-switch containing two normally-insulated metal parts, said parts being adapted to be brought temporarily into contact when said line is switched for conversation, and one of said parts being connected to one of said branches and the other of said parts being connected to the other of said branches, a back-contact relay and a battery, both in the circuit of said branches, as described, and a ground-wire, said line being connected to one of the contact-points of said relay, and said ground-wire being connected to the other contact-point of said relay, substantially as and for the purpose set forth.

2. In a telephone-exchange system, two or more switch-boards at the central office, in combination with a telephone-line, line-switches, one switch on each of said boards for said line, each switch being adapted to receive a switch-plug and having two normally-insulated metal parts, said parts of each switch being adapted to be temporarily brought into connection when a plug is inserted into the switch, said line being separated into two branches, one of said branches being connected to one of said metal parts of each of said switches, and the other of said branches being connected to the other of said metal parts of each of said switches, a ground wire or connection, a back-contact relay in the circuit of one of said branches before the branch is connected to any of said switch parts, one of the contact-points of said relay being connected to the line and the other contact-point being connected to the ground wire or connection, and an electric battery in the circuit of one of said branches before the branch is connected to any of said switch parts, whereby when the switch-plug is placed in the switch of the line at either board the line is temporarily disconnected from the ground.

3. In a telephone-exchange system, the combination of two or more switch-boards at the central office, a telephone-line, the two branches of said line, the two-part switches of the line, one switch on each board, the switch-plugs, the back-contact relay, the battery, and the ground wire or connection, all connected and operating substantially as and for the purpose set forth.

4. In a telephone exchange system, the combination of two or more switch-boards at the central office, a telephone-line, the two branches of said line, the two-part switches of the line, one switch on each board, the switch-plugs, the battery, the relay, and the operators' test-systems, one system at each board, each containing a double test-plug, a test-receiving instrument, and a loop, all connected and operating substantially as set forth, whereby when a switch-plug is inserted into either switch the battery is closed to the relay and is short-circuited to the test-receiving instrument if the test is applied at either board.

5. In a telephone-exchange system, two or more switch-boards, a telephone-line adapted to be switched at either board, a test-circuit for the line, said test-circuit being a loop in

which is a battery, two or more pairs of contact-points, one pair at each board, each pair being normally open and adapted to be closed or connected at a board when the line is switched for conversation at the board, one point of each of said pairs of contact-points being connected to said test-circuit on one side of said battery, and the other point of each of said pairs being connected to the test-circuit on the other side of the battery, in combination with operators' test-receiving instruments, one at each board, and switching devices or means whereby the operator at either board may at will connect the two sides of her test-receiving instrument to said loop or test-circuit on the two sides of the battery and determine whether or not said line is switched for use.

6. In a telephone-exchange system, a line-switch adapted to receive a switch-plug and containing two contact-points, said points being normally open at the switch and connected by a loop in which is a battery and a back-contact relay, one point of said back-contact relay being connected with the ground and the other point being connected with the loop, in combination with a telephone-line also connected with the loop, and a switch-plug with a flexible conducting-cord attached to its metal part, said plug being adapted to be inserted into the switch, and when connected to connect or cross the two contact-points of the switch, whereby when the plug is inserted the line is disconnected from the ground and is connected with the flexible conducting-cord.

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