

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,358.

Patented Oct. 26, 1897.

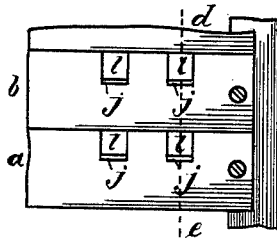


Fig. 1^a

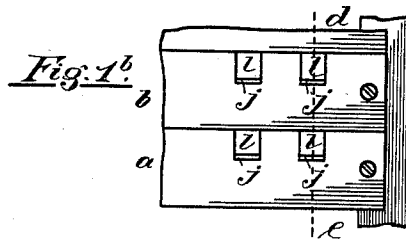


Fig. 1^b

Fig. 2.

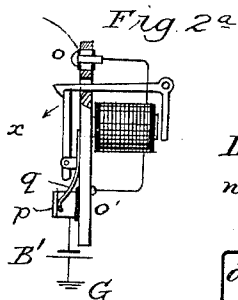
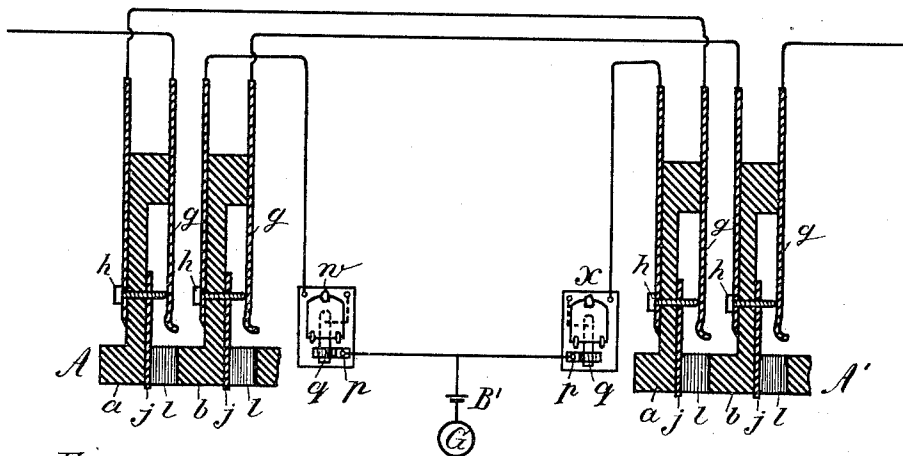


Fig. 2^a

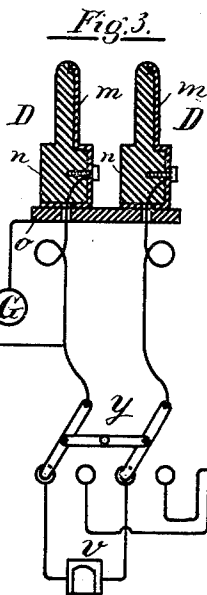
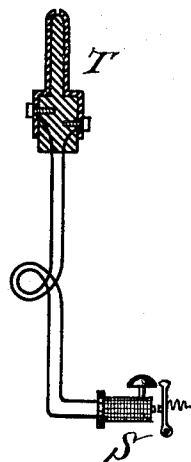


Fig. 3.

Fig. 4.



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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. 592,358, dated October 26, 1897.

Application filed January 9, 1890. Serial No. 336,380. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, temporarily residing at Stuttgart, in the Empire of Germany, 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 a telephone-exchange system in which the lines are single-circuit lines grounded at their outer ends; and it consists in a system of testing the lines to determine whether they are in use.

In the drawings illustrating my invention, Figures 1^a and 1^b represent sections of two multiple switchboards of the exchange to which the same lines are connected. Fig. 2 shows a diagram of the boards, with the main-line apparatus and connections necessary to illustrate my invention. Fig. 2^a is a detail view of one of the line-annunciators. Fig. 3 shows a diagram of an operator's cord system to be used in connection with the boards. Fig. 4 shows an operator's test system to be used at the boards.

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

I place as many boards in the central office as are found necessary or desirable in order to properly operate the exchange. On each board is a spring-jack or other suitable switch for each line. Each switch has a contact-spring which normally connects with an insulated contact-piece and is adapted to receive a loop-plug and, when a plug is inserted, to disconnect the spring from the contact-piece and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively. The switch is also adapted to receive a single-contact switch-plug and, when a plug is inserted, to disconnect the spring from the contact-piece and connect the spring with the contact-piece of the plug. In the construction of the switches as shown and as will hereinafter be described I prefer to have a contact-point electrically connected

with the contact-piece and on which the spring normally bears, as there is less chance of poor connection when the spring bears on a point than when it bears on a surface adapted to be brought into connection with the plug-contacts.

In Fig. 2, *g g* represent the springs of the different switches, *h h* the contact-points on which the springs normally bear, and *j j* the contact-pieces of the switches, connected with the points *h h*. *l l* are the switch-holes. *a b* are the rubber strips on which the metal parts of the switches are mounted, as shown, and through the fronts of which are the switch holes *l l*. The contact-pieces *j j* are so placed along one of the surfaces of the plug-holes as readily to form connection with one of the contact-pieces of the loop-plug.

The holes *l l* are adapted to receive the switch-plugs shown in Fig. 3 and marked D, and when a plug is inserted into a switch it raises the spring *g* from the contact-point *h*, and the spring *g* and contact-piece of the plug are in contact. These holes are also adapted to receive the loop-plug shown in Fig. 4, and when a plug is inserted into a hole it raises the spring of the switch from the contact-point *h*, and the spring *g* and the contact-piece *j* of the switch are in contact with the two contact-pieces of the plug, respectively.

w and *x* are calling-annunciators, one for each of the lines shown. Each annunciator has a pair of contact-points normally (or when the annunciator does not indicate a call) in contact with each other, but which are separated by the annunciator while it indicates a call. The two contact-points of a pair are marked *p* and *q*, respectively. One of them, *q*, is a spring-contact which is pressed by the annunciator-drop when the drop falls away from its corresponding contact-point *p*. The contact-point *p* is represented as an angle-piece which passes over the spring *q* and is in contact with the spring when the spring is not actuated by the annunciator-drop.

The annunciator is shown in detail in Fig. 2^a. The line runs to an insulated bolt *o* at the top of the annunciator-plate *o'*, thence through the annunciator-coil to the plate, and thence normally through spring *q*, which is

in electrical contact with the plate, to the insulated angle-piece *p*, against which spring *q* normally bears, and thence to earth.

B is a test-battery placed in the common ground wire or connection of the lines.

Two lines are shown in the drawings, one marked line No. 1 and the other line No. 2. These lines are ordinary single-circuit lines grounded at their outer ends and having at the subscribers' stations any usual and appropriate subscriber's-station apparatus. Each line passes successively through the pairs of contacts of its switches on the several boards, passing in each case to the spring first. It then passes through its line-annunciator and the pair of contact-points of the annunciator to the common ground wire or connection in which is the battery B'. The circuit of each line shown may thus be traced in Fig. 2.

In the operator's cord system shown in Fig. 3, D D are the switch-plugs of a pair of cords. *nn* are the rubber insulations of the plugs, and *mm* are their contact-pieces. These contact-pieces pass each to the bottom of its plug, and are adapted to rest normally or when the plug is not in use on the metal piece *o*, which then connects it with the ground. Weights, as is usual, or similar devices may be used to bring the contact-pieces of the plugs into contact with the piece *o* and secure a good connection. These plugs are adapted to be inserted into any of the switches at their board, and when a plug is inserted it operates the switch as above described. The plugs should be inserted so that the contact-piece *m* is in contact with the spring *g*. The connections of the lines might have been reversed, so that the lines pass first to the contact-piece *j* of each of their switches, and in that case the plugs should be inserted in such a position that their contact-pieces form connection with the pieces *j* of the switches. Y is the looping-in switch for the pair of cords shown. *k* is the calling-key. *v* is a clearing-out annunciator. *t* is the operator's telephone, and B is her calling generator or battery. The circuits are substantially as shown.

The contact-pieces of the two plugs are connected through flexible switch-conductors to the two levers of the looping-in switch. The contact-bolts of one pair of contact-bolts of this switch are connected together through the operator's telephone and those of the other pair are connected together through the clearing-out annunciator *v*. The lever of the calling-key is connected to one of the cord-circuits and the contact-point of the key is connected through the calling-generator B to ground.

The operation of the system in connection with the switchboards will be apparent to those skilled in the art.

It will readily be apparent that when a line is switched by the insertion of a plug into its switch the line is disconnected from its normal ground at the central office in which is the test-battery B' and is connected into a

circuit with the pair of cords. Only one pair of cords is shown, but the connection of such other pairs, with their accompanying apparatus as the operator may need, will be apparent to those skilled in the art. To each pair of cords with its plugs belong a looping-in switch, a clearing-out annunciator, and a calling-key. One telephone and one calling-generator will answer for her system of cords.

In the operator's test system shown in Fig. 4, T is a loop test-plug adapted to be inserted into any of the switches and when inserted to operate them as heretofore described. S is a test receiving instrument and is connected in a loop which terminates in the two contact-pieces of the plug.

Each operator has one cord system and one test system and they are conveniently mounted and arranged for her work.

The test receiving instruments and battery are so constructed and related to each other that when an instrument is looped into the normal closed circuit with any line (the line being unswitched and not open at some pair of contact-points and therefore the instrument being on closed circuit with the battery) the instrument will sound or respond, but when the circuit is open at any pair of points, either at some board or at the annunciator, the instrument will not sound or respond.

The operation of the test system is as follows: When an operator desires to test a line, she places her test-plug into the switch of the line and by so doing disconnects the pieces *g* and *j* of the switch and connects them with the contact-pieces of the plug. If, then, the line is not switched at any switch and its annunciator does not indicate a call, the instrument and the test-battery B' are on a closed circuit with the line and the instrument will sound or respond, indicating that the line is free to be connected to. This closed circuit is from the subscriber's ground through the circuit of the line to contact-spring *g* of the switch in which the test-plug is placed and from the contact-piece of the test-plug, which is in connection with *g*, through the test receiving instrument to the other contact-piece of the plug to contact-piece *j* of the switch and through the other normally closed pairs of contacts of the line-switches and the normally closed pair of contacts of the line-annunciator to the test-battery and thence to the office ground. If, however, the line-annunciator indicates a call (and the line is not switched) the circuit is open at the pair of annunciator contact-points and the instrument will not sound. If, again, the line is switched at any board when the test is made and the switch in which the test is made is in the cut-off portion of the line or that portion which is between the switch used for switching and the office ground, the test-circuit is open at the pair of contacts *g h* of the switch used for switching and the test receiving instrument will not sound. If, again, the line is switched at any

board and the test-plug is inserted into a switch which is between the one used and the subscriber's station, the test instrument is on closed circuit with the line, but there is no battery in the circuit, as the line is cut off from the common ground wire, in which is the test-battery, and the instrument will not sound. When a test of a line is made and the test receiving instrument sounds or responds, the operator therefore knows that neither the line is switched for use at any board nor its annunciator indicates a call and that she may connect the line with another. When she makes the test and the instrument does not sound, she knows that either the line is switched for use at some board or its annunciator indicates a call and she will not connect it with another line.

By this system of switching and testing a subscriber's line tests "busy" when it is switched and when his annunciator indicates a call. His line is reserved to himself as soon as he has sent in a call and will not be switched with another line before his operator has had time to answer his call, to his confusion and annoyance.

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

1. In a telephone-exchange system, a telephone-line grounded at its outer end and passing normally successively through pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board, and through an annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call to a ground-wire which contains a test-battery, in combination with switching devices at each board to disconnect the pair of contact-points at the board and switch the line for conversation, and a loop test-plug in the two contact-pieces of which terminate the two sides of a loop containing a test receiving instrument, said plug being adapted to be inserted into the switches and when inserted into a switch to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, substantially as set forth.

2. In a telephone-exchange system, a telephone-line normally on closed circuit and passing successively through pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board and thence through an annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call to a common wire which contains a test-battery, in combination with switching devices at each board to disconnect the pair of contact-points at the board and switch the line for conversation, and a loop test-plug in the two contact-points of which terminate the two sides of a loop containing a test receiving instrument, said plug being adapted to be inserted into the switches and when inserted into a switch to

disconnect its pair of contact-points and connect them with the two contact-pieces of the plug, substantially as set forth.

3. In a telephone-exchange system, a telephone-line grounded at its outer end and having in its circuit pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched for use at their board, and thence to a common ground-wire containing a battery through an annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call, in combination with switching devices at each board to disconnect the pair of contact-points at the board and switch the line for conversation, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument and adapted to be inserted into the switch of the line at its board and when inserted to disconnect the pair of contact-points which are normally in contact and connect them with the two contact-pieces of the plug, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards, telephone-lines, each line normally on closed circuit, switches for said lines, one switch on each of the boards for each line, each switch having a pair of contact-points normally in contact and open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switch and thence through an individual annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call to a common wire in which is a test-battery, in combination with pairs of switch-plugs at each board, the contact-pieces of each pair being connected by flexible conductors in the circuit, said plugs being adapted to be inserted into the switches at their board and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the line contact-point of the switch with the plug contact-piece, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends, switches for said lines, one switch on each of the boards for each line, each switch having a pair of contact-points normally in contact but open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switches and thence through an individual annunciator and a

pair of contact-points normally closed but open while the annunciator indicates a call to a ground-wire which contains a test-battery, in combination with pairs of switch-plugs at each board, each pair having their contact-pieces connected by flexible conductors, said plugs being adapted to be inserted into the switches at their board and when a plug is inserted into a switch to disconnect the
 10 contact-points of the switch which are normally in contact and connect the line contact-point with the contact-piece of the plug, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, telephone-lines, each line normally on closed circuit, switches for said
 25 lines, one switch on each of the boards for each line, each switch having a pair of contact-points normally in contact and open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switch and thence through an individual annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call to a common wire in which is a test-battery, in combination with switching devices at each board to disconnect any line from said
 30 common wire and connect it with any other line for conversation, and loop test-plugs, one at each board, each plug having two contact-

pieces in which terminate the two sides of a
 40 loop containing a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of
 45 the plug, substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends, switches for said lines, one switch on each of the boards for each line,
 50 each switch having a pair of contact-points normally in contact but open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switches and thence through
 55 an individual annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call to a ground-wire which contains a test-battery, in combination with switching devices at each board
 60 to disconnect any line from said ground-wire and connect it with any other line for conversation, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a test receiving instrument, each plug being adapted
 65 to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, substantially
 70 as set forth.

In witness whereof I hereunto subscribe my name this 20th day of December, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
 MARGARETHA RIEHL.