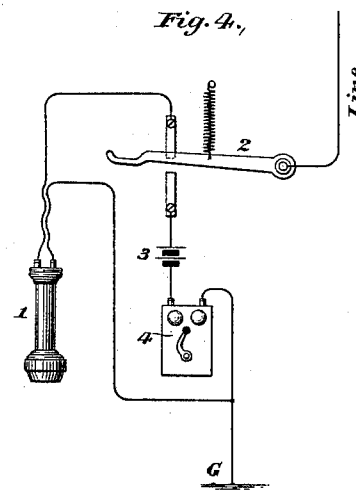
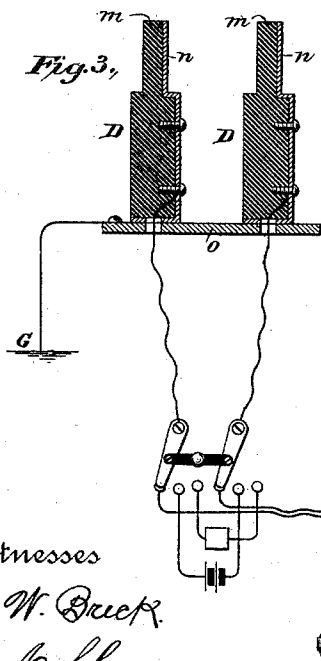
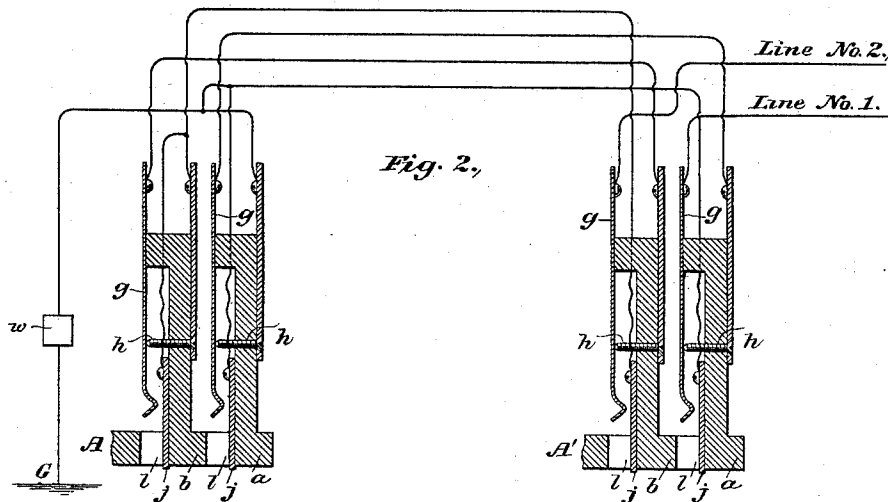
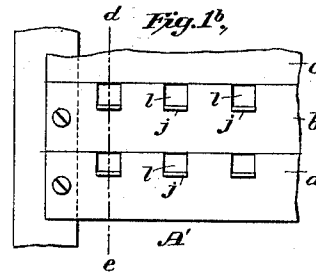
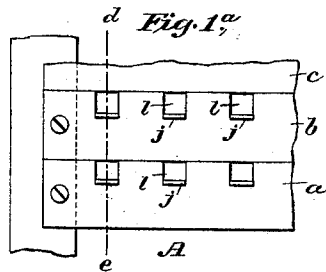


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,319.

Patented Oct. 26, 1897.



Witnesses
Geo. W. Dyer.
C. E. Ashley

Inventor
Milo G. Kellogg,
By his Attorneys
Baldwin, Davidson & Wright

UNITED STATES PATENT OFFICE.

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. 592,319, dated October 26, 1897.

Application filed November 29, 1889. Serial No. 332,022. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, 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 single-circuit telephone-lines; and it consists in a system of switching and testing such lines to determine whether they are in use.

In the accompanying drawings, illustrating my invention, Figures 1^a and 1^b are front views of sections of two multiple switchboards to which the same lines are connected. Fig. 2 is a diagram illustrating the main-line switchboard's apparatus and connections necessary to illustrate my invention. Fig. 3 is a diagram of an operator's cord system to be used in connection with said system. Fig. 4 is a diagram of a subscriber's station apparatus necessary to illustrate my invention.

In the figures like parts and apparatus are represented by the same letters and figures of reference.

G in each case represents a ground connection.

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*.

There are as many boards in the exchange as are necessary to answer the calls and make the connections. On each board is a spring-jack or similar switch for each line. Each switch has a contact-spring which normally rests on an insulated contact-point and has a contact-piece insulated from the rest (except by the circuit connections) and is adapted to receive a switch-plug, and when a plug is inserted to disconnect the spring from the contact-point and form connection between the spring and the contact-piece of the plug.

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 insulated contact-pieces of the switches. *ll* 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 *ll*. These holes are adapted to receive the switch-plugs, (shown in Fig. 3 and marked D D,) and when a plug is inserted into a switch it operates it as above described. *w* is a calling-annunciator.

The insulated contact-pieces *j j* should be so placed that a test-plug may be readily applied to them. Their function in this system is to form test-pieces for their lines, and they may be placed as shown or in any convenient position on their respective boards.

The connection of each line to the switchboards is as follows and as shown: A line normally grounded at the central office passes successively through the pairs of contact-points of its switches on the several boards, passing in each case to the spring first. It then passes through its line-annunciator to ground. The insulated contact-piece *j j* of each line is connected to the circuit of the line, the connection being between the pairs of contact-points of its switches on the one hand and the annunciator on the other hand. Instead of the annunciator, which also constitutes one resistance-coil, any suitable resistance may be placed in the ground connection.

In lines which are normally open to the ground at the central office the ground connection is left off and the line after passing through its pairs of contact-points, as described above, is connected to the contact-pieces *j j* of its switches. For such lines the calls are generally sent to the central office on independent calling-circuits, as in the Law and American district systems.

In Fig. 2 line No. 1 shows a line normally grounded, and line No. 2 a line normally open at the central office.

Fig. 3 shows an operator's cord system with one pair of cords and their plugs, looping-in switch, clearing-out annunciator, and the operator's telephone and calling-generator. The plugs D D are constructed as shown, *m* being the rubber insulation and *n* the contact-piece, and they should be inserted into the switches in such a position that the contact-piece of the plug is in connection with

the switch-spring and is not in connection with the switch contact-piece *j*. *o* is a metal strip on which the bases of the plugs normally rest and which then connects their contact-pieces with the ground. The circuits are as shown. The method of connecting other pairs of cords with their accompanying apparatus to the system, as well as the method of operating the system in connection with the switchboards, will be apparent to those skilled in the art. Each operator has one cord system with as many pairs of cords as she may require, and the parts are conveniently mounted and arranged at her board to operate the system.

In the subscriber's station apparatus shown in Fig. 4, 1 is the subscriber's telephone. 2 is the telephone-switch. 3 is a station-battery, and 4 is the signal-bell and calling-generator. The contact-points and circuits are substantially as shown or otherwise arranged, so as to perform the switching operation, as hereinafter pointed out. The battery is switched into the circuit with the line when the subscriber's telephone is on its switch and is out of the circuit of the line when the telephone is not on the switch. On lines in which the calling is done by the subscriber on an independent circuit the calling-generator may be left out of the subscriber's apparatus.

The system of testing is as follows: An operator on testing places the levers of her looping-in switch so that her telephone is in circuit with a pair of her cords. She then places the contact-piece of one of the plugs into connection with the contact-piece *j* of the line to be tested, the other plug being in its normal position on plate *o* or connected to another line whose telephone is switched for use. If, when she does this, the line is not switched at any board, a complete circuit is established which comprises her telephone and the line tested, and if the subscriber's telephone is on its switch, his station-battery is in that circuit and the operator will hear a click, indicating to her that the line is free.

This test-circuit may be traced as follows: Assuming that one of the plugs *D* is on the ground-plate *o*, from ground through test-telephone to the contact-piece of the other plug *D*, test-contact *j*, say of line No. 1 on either board, through all the pairs of contacts *g h* of that line to the subscriber's station and through test-battery 3 to ground. The annunciator *w* or other resistance at the central office prevents the short-circuiting of the test-circuit above traced. If the test be made on a test-contact of line 2, the circuit is the same. If a plug *D* be plugged to a switch, the test-circuit is then from ground at subscriber's station on that line through test-telephone and other plug *D* to ground at the subscriber's station on the line tested. If, however, when she makes the test the line is switched at some other board, this circuit is open at the pair of contacts of the switch used and she will hear no click. If, again,

the line is not switched at the central office, but the subscriber's telephone is off its switch for use, his battery will not be in circuit and the operator will not hear a click. When an operator tests a line and gets no test response, she therefore knows that either the line is switched for use at the central office or that the subscriber's telephone is switched for use, and thereby that the line is "busy," and she will not connect it with another line.

The station-batteries should be such as to operate the test receiving instruments over the circuits when the tests are made.

In multiple-switchboard systems an operator to whom certain lines are assigned to answer frequently receives several calls at practically the same moment, and it may require some time before she can switch to a certain line and answer its call. In systems in which the test depends only on the switching of the line at some other board another operator may in the meantime test the line, and finding it to test "free" may switch it to another line and cause annoyance and confusion to the subscriber. In this system the trouble is obviated, because as soon as the subscriber takes his telephone from its switch the line will test "busy," whether or not it is switched at the central office. Again, in systems of testing which depend only on the subscriber's telephone being on or off its switch, confusion frequently occurs from the fact that a subscriber places his telephone on its switch when he is through conversation without sending in a clearing-out signal and his line tests "free" and is "connected to" when it is already switched at the central office with some other line. Lines in this condition are technically called "tied up." In this system, again, this trouble is obviated, because the line will test "busy" until it is disconnected at the central office, whether or not the subscriber's telephone is on its switch. The system therefore combines the advantages and obviates the disadvantages of the two general systems of testing outlined above.

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

1. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the subscriber's station and extending from the office ground through a test-receiving instrument and a pair of switch contact-points in the central office, normally closed but open while the line is switched for use, and through the circuit of the line to the subscriber's ground, a pair of test-contacts in such circuit, normally open but closed by the operator on testing, and a battery normally in said circuit between said pair of test-contacts and the subscriber's ground, substantially as set forth.

2. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the subscriber's station and extending from the office ground, through a test receiving instrument and a series of pairs of switch contact-

points, one pair on each of several boards and each pair open while the line is switched at their board, and through the circuit of the line to the subscriber's ground, a pair of test
5 contact-points in such circuit, normally open but closed by the operator on testing, and a battery in said circuit at the subscriber's station while his telephone is not switched for conversation but not otherwise, substantially
10 as set forth.

3. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the subscriber's station and extending from his ground through the circuit of the line, and a
15 series of pairs of switch contact-points, one pair on each of several boards and each pair normally closed but open while the line is switched at their board, and thence to ground through a series of branch or derived circuits,
20 one for each board, and each containing a test receiving instrument and a pair of test-contacts, normally open but closed by the operator at the board on testing, and a battery at the subscriber's station in the circuit, while
25 his telephone is not switched for conversation, but not otherwise, substantially as set forth.

4. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the
30 subscriber's station and extending from the office ground through a test receiving instrument and a pair of switch contact-points in the central office, normally closed but open while the line is switched for use, and through
35 the circuit of the line to the subscriber's ground, a pair of test-contacts in such circuit, normally open but closed by the operator on testing, and a battery in said circuit when the subscriber's telephone is not switched for
40 use, but not otherwise, in combination with a resistance grounded on one side and connected on its other side to said circuit between said switch contact-points on the one
45 hand and said test contact-points on the other hand, substantially as set forth.

5. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the subscriber's station and extending from the office ground, through a test receiving instrument and a series of pairs of switch contact-points, one pair on each of several boards and each pair open while the line is switched at their board, and through the circuit of the line to the subscriber's ground, a pair of test
50 contact-points in such circuit, normally open but closed by the operator on testing, and a battery in said circuit at the subscriber's station while his telephone is not switched for conversation but not otherwise, in combination
60 with a resistance grounded on one side and connected on its other side to said circuit between said switch contact-points on the one hand and said test contact-points on the other hand, substantially as set forth.

6. A test-circuit for a subscriber's line, said test-circuit being permanently closed at the subscriber's station and extending from his

ground through the circuit of the line, and a series of pairs of switch contact-points, one pair on each of several boards and each pair
70 normally closed but open while the line is switched at their board, and thence to ground through a series of branch or derived circuits, one for each board, and each containing a test receiving instrument and a pair of
75 test-contacts, normally open but closed by the operator at the board on testing, and a battery at the subscriber's station in the circuit, while his telephone is not switched for conversation, but not otherwise, in combination
80 with a resistance grounded on one side and connected on its other side to said circuit between said switch contact-points on the one hand, and said test contact-points on the other hand, substantially as set forth. 85

7. In a telephone-exchange system, a subscriber's line permanently grounded at its outer end and containing at its subscriber's station a battery in its circuit when his telephone is not switched for use but not otherwise,
90 a switch at the central office containing a pair of contact-points normally in contact but separated by a switch-plug on its insertion, and a test contact-piece insulated from the rest (except by the circuit connections),
95 said line passing through said pair of contact-points and thence to said test contact-piece, in combination with a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted,
100 at the will of the operator, to be brought into connection with said test contact-piece, substantially as set forth.

8. In a telephone-exchange system, a subscriber's line permanently grounded at its
105 outer end and containing at the subscriber's station a battery in its circuit when his telephone is not switched for use but not otherwise, and at the central office a switch containing a pair of contact-points normally in
110 contact and separated by a switch-plug on its insertion, a test contact-piece insulated from the rest (except by the circuit connections), and a resistance-coil, said line passing through the pair of contact-points and thence to
115 ground through the resistance-coil, and said test contact-piece being connected to the circuit of the line between the pair of contact-points and the resistance-coil, in combination with a test receiving instrument grounded on
120 one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with said test contact-piece, substantially as set forth. 125

9. In a telephone-exchange system, a subscriber's line permanently grounded at its outer end, and at his station a battery and a switch with contact-points to switch the battery into the circuit of the line while his telephone is not switched for use and to switch
130 the battery from the circuit while the telephone is switched for use, in combination with a test contact-piece at the central office

normally connected to said line, a switch with contact-points to disconnect said contact-piece from the line while the line is switched for use, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with said test contact-piece, substantially as set forth.

10 10. In a telephone-exchange system, a subscriber's line permanently grounded at its outer end, and at his station a battery and a switch with contact-points to switch the battery into the circuit of the line when his telephone is not switched for use and to switch the battery from the circuit when the line is switched for use, in combination with a test contact-piece at the central office normally connected to said line, a switch with contact-points to disconnect said contact-piece from the line when the line is switched for use, a resistance-coil grounded on one side and connected to the circuit of the line between the contact-points and the contact-piece, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with said contact-piece, substantially as set forth.

30 11. In a telephone-exchange system, multiple switchboards and telephone-lines connected to the same, each line being permanently grounded at its outer end and having at its subscriber's station a battery and a switch with contact-points to switch the battery into the circuit of the line while the subscriber's telephone is not switched for use and to switch it from the line while the telephone is switched for use, in combination with test contact-pieces, one for each line on each board, the contact-pieces of the line being normally

connected to it, switches at the several boards with contact-points to disconnect a line from its test contact-pieces while the line is switched for use, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a test plug or device adapted, at the will of an operator, to be brought into connection with any test contact-piece at its board, substantially as set forth.

12. In a telephone-exchange system, multiple switchboards and telephone-lines connected to the same, each line being permanently grounded at its outer end and having at its subscriber's station a battery and a switch with contact-points to switch the battery into the circuit of the line while the subscriber's telephone is not switched for use and to switch it from the line while the telephone is switched for use, in combination with test contact-pieces, one for each line on each board, and each normally connected to its line, switches on the several boards with contact-points to disconnect a line from its test contact-pieces while the line is switched for use, resistance-coils one for each line grounded on one side and connected on its other side to the line between its switch contact-points and its test contact-pieces, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of the test contact-pieces at its board, substantially as set forth.

In witness whereof I hereunto subscribe my name this 16th day of October, 1889.

MILO G. KELLOGG.

Witnesses:

FRANCES D. KELLOGG,
MARGARETHA RIEHL.