(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCHBOARD.

No. 592,313. Patented Oct. 26, 1897.

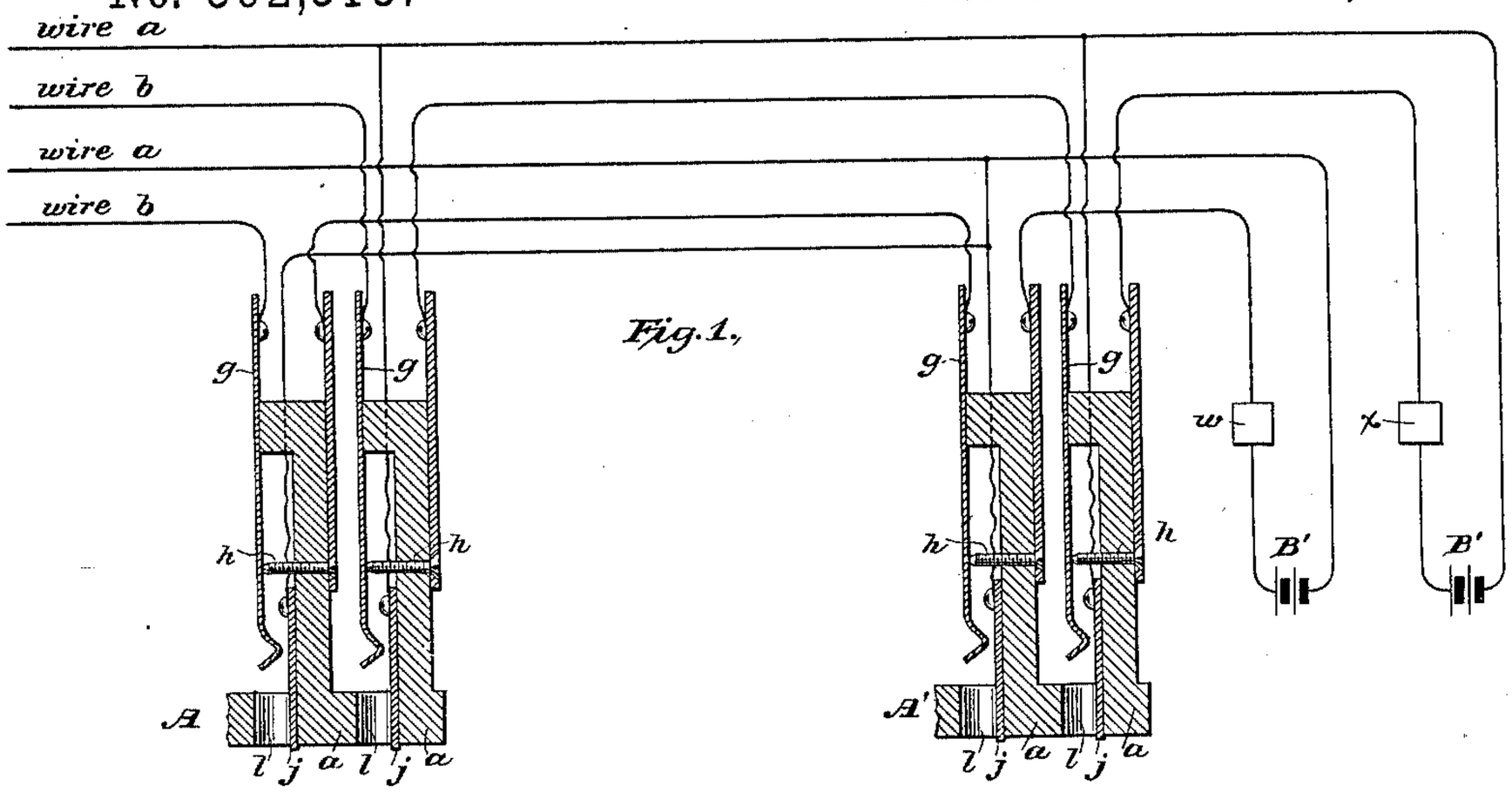

Fig. 1.

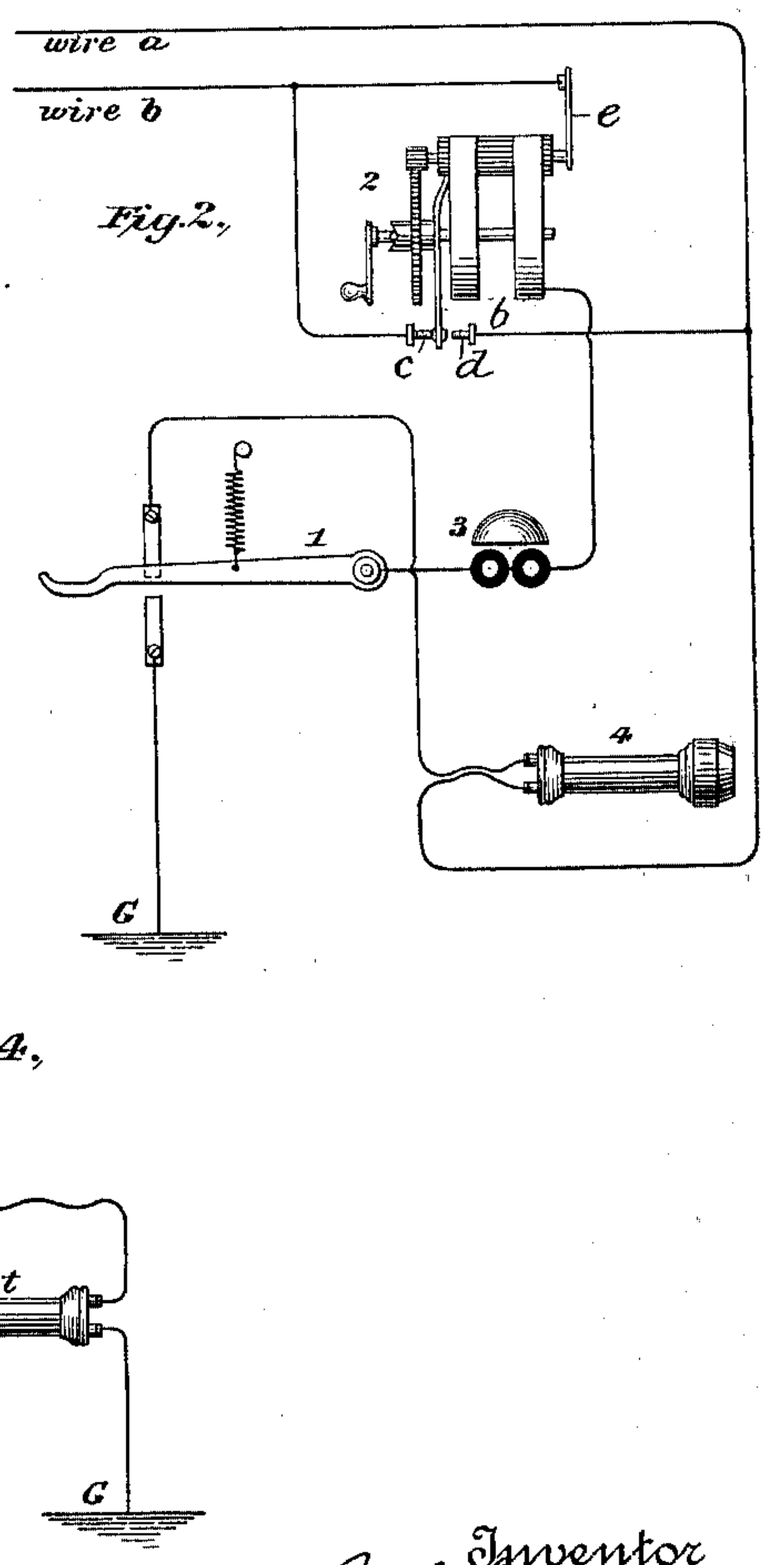

Fig. 2.

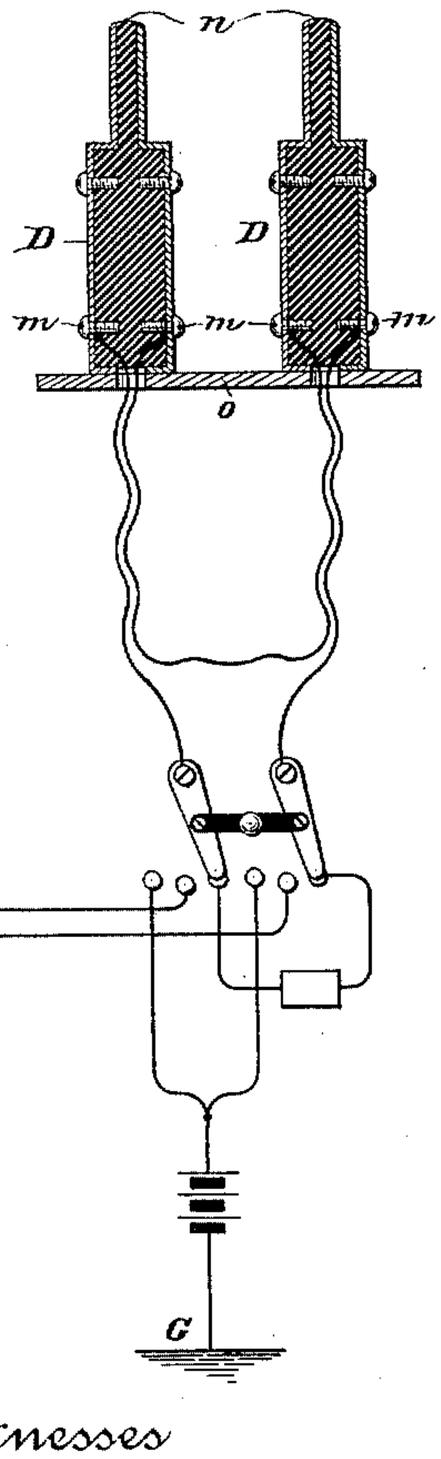

Fig. 3.

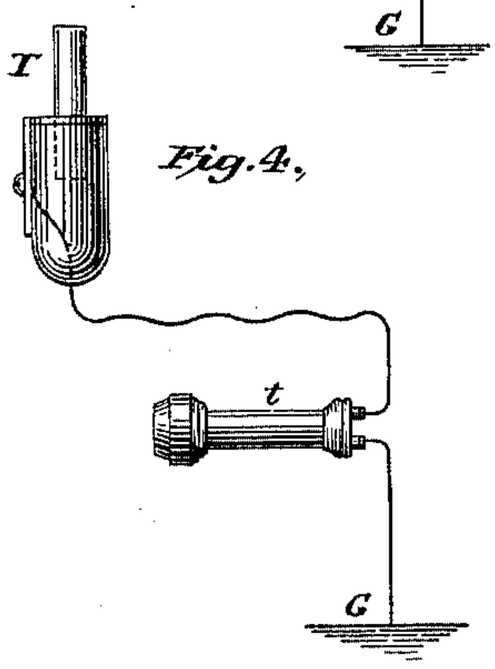

Fig. 4.

Witnesses
Geo. W. Breck.
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. 592,313, dated October 26, 1897.

Application filed November 29, 1889. Serial No. 332,015. (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 a metallic-circuit telephone-exchange system; and it consists in a system of calling, switching, and testing any line to determine whether it is in use.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram illustrating the main-line central-office apparatus and circuits and the test apparatus and circuits connected therewith. Fig. 2 shows a diagram of the subscriber's-station apparatus necessary to illustrate my invention. Fig. 3 shows a diagram of the operator's cord system for receiving and answering calls and clearing out subscribers' lines. Fig. 4 shows an operator's test system including a test-plug with cord, test receiving instrument, and connections.

In Fig. 1, A is a sectional view of a section of one switchboard, and A′ is a sectional view of another switchboard, to which the same lines are connected. I place as many 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 is a spring-jack or similar switch for each line. Each switch has a contact-spring which normally bears 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 loop-switch plug, and when a plug is inserted to disconnect the spring from the contact-point (on which it normally rests) and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively. In the figure, *g g* represent the springs of the different switches, *h h* the contact-points on which the springs normally rest, and *j j* the insulated contact-pieces of the switches. *l l* are the switch-holes. *a a* are the rubber strips on which the switch parts are mounted, as shown, and through the fronts of which are the switch-holes *l l*. These holes are adapted to receive 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. The insulated contact-pieces *j j* should be so placed that a test-plug or similar testing device may be readily connected with them. *w* and *x* are calling-annunciators, one for each line, and B′ B′ are test-batteries, one for each line.

The connection of each main line to the central-office switchboards and apparatus is as follows: One of the branches of the line—say wire *a*, as indicated in the figure—is connected to all the contact-pieces *j j* of its switches on the different boards. The other branch of the line—say wire *b*, as indicated—passes successively through the pairs of contact-points of its switches which are normally in contact, passing in each case to the spring first, as indicated. This wire, after passing from the last contact-point of the switch connnected farthest from the subscriber's station, is connected by a circuit-wire to wire *a* of the subscriber's line. In the circuit-wire thus connecting the two branches of the line I place the line-annunciator and the test-battery of the line.

In the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch. 2 is the calling-generator. 3 is the signal-bell, and 4 is the subscriber's telephone. G is a ground connection. The circuits and contact-points of the apparatus are substantially as shown.

The automatic device shown is a modification of a device very generally used in magneto-generators for telephone-calls, the modification consisting, essentially, in the number of contacts and the arrangement of circuits. The hub of the driving-wheel of the generator has a V-shaped attachment which engages with a pin in the driving or crank shaft. The spring *b* normally or when the generator is not in operation presses against contact-point *c*. When the generator is being operated, the pin, acting on the V arrangement, presses the driving-wheel toward the generator-magnets, and that carries the spring *b* away from point *c* and into contact with point *d*.

e is a contact-spring which remains in contact with an insulated piece on the armature-shaft to which one end of the armature-coil is connected. The other end of the coil and also spring *b* are connected to the frame of the generator. The circuit of one side or branch of a line (marked wire *b*) is to spring *e* and thence through the armature-coil and the frame of the generator to the signal-receiving bell 3 and thence to the lever of the switch 1. Contact-point *c* is connected to wire *b* before the wire passes to the generator-armature. The other side or branch of the line marked wire *a* passes through the telephone to the upper contact-point of the telephone-switch and is connected before it passes to the telephone to contact-point *d* of the generator. The lower contact-point of the telephone-switch is connected to the ground.

It will be seen from the construction of the apparatus as shown and described that when the subscriber's telephone is on the switch and the generator is not being operated the two sides or branches of the line are open to each other at the subscriber's station and wire *b* is grounded through the contact between the lever and lower contact of the switch and has the signal-bell 3 in its circuit. The generator 2 is also in its circuit, but is short-circuited or shunted by the contact between *b* and *c*.

It also will be seen that when the generator is being operated the two sides or branches of the line are connected together by the closing of the contacts *b d*, and the shunt or short circuit of the generator is opened by the opening of the contacts *b c;* also, that when the telephone is removed from the switch the switch-lever will come in contact with the upper contact-point of the switch, removing the ground connection of wire *b* and closing the two sides or branches of the line to each other, with the subscriber's telephone included in their circuit.

Fig. 3 shows an operator's cord system with one pair of loop-switch plugs and their double cords, looping-in switch, and clearing-out annunciator, and her telephone, calling-generator, and the circuits. D D are the switch-plugs. *n n* are their rubber insulations, and *m m* are their contact-pieces. *o* is a metal strip on which the plugs normally rest and which then connects together the two contact-pieces of the plug. G is a ground connection.

The method of operating the system in connection with the switchboards and line apparatus shown will be apparent to those skilled in the art.

It will be noticed that the calling-generator is connected to the ground and that the operator on connecting the generator into a line-circuit establishes a ground connection. If the subscriber's telephone is on its switch, the calling-current will pass through the ground connection at his station, and a complete circuit being established his bell will ring.

The operator's test system shown in Fig. 4 consists, essentially, of a wire with a test receiving instrument in its circuit, said wire being grounded at one end at G and connected at its other end to a flexible conducting-cord with a test-plug attached adapted at the will of the operator to be brought into connection with any switch contact-piece *j* at her board. In the figure, T is the test-plug. *t* is the test receiving instrument, and G is the ground connection.

It will be observed that in the operation of the system, as shown and described, a subscriber on operating his generator sends a current through a closed metallic circuit, in which is the line-annunciator; also that when a line is switched at the central office the portion of the circuit in which is the annunciator and the test-battery is cut out.

Each operator has one cord system (with as many pairs of cords as she may require) and one test system, and they should be so placed and connected at her board that she can readily perform the operations required of her.

The two sides or branches of the line being open to each other at the subscriber's station, as shown and described, when the line is not in use there is no complete circuit on the line through the test-battery, and consequently there will be no consumption of battery. When, however, an operator makes a test of a line by placing her test-plug T on the contact-piece *j* of a switch of the line, and the line is not switched for conversation, and the subscriber's telephone is on its switch, a complete circuit is established, in which is the test-receiving instrument and test-battery, and the instrument will sound, showing that the line is "free." This complete circuit is from the subscriber's ground, through the lower switch contact-point to the line, over the line and through the several pairs of contact-points of its switches, through the test-battery to the contact-piece *j* of the line tested, and thence to ground through the operator's test system. If, when the test is made, the line is in use, either by its being switched at some board and a pair of its switch-points being opened or by a subscriber's telephone being off its switch, there will be no complete circuit established, and the test receiving instrument will not sound. The operator, 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 she will not connect to the line.

In multiple-switchboard systems an operator to whom certain lines are assigned to answer frequently receives several annunciator-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 mean time test the line, and finding it to test "free" may switch it to another line and cause annoyance and

confusion to the subscriber. In my system this 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 my system 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.

The battery should be so adjusted to the apparatus and circuits that the current sent to a line when it is tested will not operate the annunciator or signal-bell, but it should be such as to operate the test receiving instrument through the circuit described.

Since the test-battery B′ of each line gives a constant and not a vibratory current no vibratory current from such source can pass over the circuit of the line to produce induction disturbances in neighboring telephonic circuits. Of course other sources of electricity than galvanic batteries giving constant (not vibratory) currents would be equally advantageous in this respect.

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

1. In a telephone-exchange system, a metallic-circuit line, normally (or when not in use) with its two branches open to each other at the subscriber's station, and one of them grounded at the subscriber's station when the subscriber's telephone is not switched for conversation but not otherwise, a switch at the central office, containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded at the subscriber's station passing through said pair of contact-points and thence, by a circuit-wire, to said third contact-piece, and a battery in said circuit-wire, in combination with a switch-plug adapted to be inserted into said switch and when inserted to disconnect the pair of contact-points which are normally in contact, and a test receiving instrument grounded on one side and connected on its other side to a switch testing plug or device adapted, at the will of the operator, to be brought into connection with said third contact-piece of the switch, substantially as set forth.

2. In a telephone-exchange system, a telephone-line normally (or when the line is not in use) grounded at the subscriber's station, a switch at the central office containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said line passing through said pair of contact-points and thence, by a circuit-wire, to said third contact-piece, and a battery or source of constant current in said circuit-wire, in combination with a switch-plug adapted to be inserted into said switch and when inserted to disconnect the pair of contact-points which are normally in contact, and a test receiving instrument grounded on one side and connected on its other side to a switch testing-plug or device adapted, at the will of the operator, to be brought into connection with said third contact-piece, substantially as set forth.

3. In a telephone-exchange system, a metallic-circuit line, the two branches of which are normally open to each other at the subscriber's station, and one of which is normally grounded at the subscriber's station, and an electric battery in the circuit of the line when it is not switched but not otherwise, in combination with a switch at the subscriber's station with contact-points to remove said ground connection and close said branches to each other when the subscriber's telephone is switched for use, and a test receiving instrument at the central office grounded on one side and connected on its other side to a switch testing plug or device adapted, at the will of the operator, to be brought into connection with the line, with the battery between the point of contact and said normal ground connection at the subscriber's station, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, the two branches of each of which are normally open to each other at the subscriber's station, and one of which is normally grounded at the subscriber's station, and an electric battery in the circuits of each of the lines when it is not switched for use and not otherwise, in combination with switches with contact-points, one switch at each subscriber's station, to disconnect the line from said ground connection and close the two branches of the line to each other when the subscriber's telephone is switched for use, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a switch testing plug or device adapted, at the will of the operator, to be brought into connection with any of said lines, with its battery normally between the point of connection and the normal ground connection at the subscriber's station, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line normally (or when not in use) with its two branches open

to each other at the subscriber's station and one of them grounded at the subscriber's station when the subscriber's telephone is not switched for use but not otherwise, switches, one at each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of each line which is normally grounded at the subscriber's station passing, successively, through the pairs of contact-points on its switches which are normally in contact and thence, by a circuit-wire, to said third contact-pieces of its switches, and an electric battery in said circuit-wire, in combination with switch-plugs adapted to be inserted into said switches, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch which are normally in contact, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a switch testing plug or device, adapted at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, telephone-lines connected to the same, each line normally grounded at the subscriber's station, switches, one at each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said line passing successively through said pairs of contact-points of its switches which are normally in contact and thence, by a circuit-wire, to said third contact-pieces of its switches, and an electric battery or source of constant current in said circuit-wire, in combination with switch-plugs adapted to be inserted into said switches, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch which are normally in contact, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a switch testing plug or device adapted at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

7. In a telephone-exchange system, a metallic-circuit line, one branch of which is normally grounded at the subscriber's station and electric battery or source of constant current at the central office in the circuit of said line, normally, or when it is not switched for use but not otherwise, in combination with a switch at the subscriber's station with contact-points to disconnect the line from the ground when the subscriber's telephone is switched for use, and a test receiving instrument at the central office grounded on one side and connected on its other side to a switch testing plug or device adapted, at the will of the operator, to be brought into connection with said line, with the battery normally between said point of contact and the normal ground connection at the subscriber's station, substantially as set forth.

8. In a telephone-exchange system, multiple switchboards, telephone-lines connected to the same, each normally grounded at the subscriber's station and with an electric battery or source of constant current at the central office in its circuit when it is not switched for conversation, but not otherwise, and switches at each board to connect any two of said lines together for conversation, in combination with test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a switch testing plug or device adapted, at the will of the operator, to be brought into connection with any line, with the battery between the point of connection and the normal ground connection at the subscriber's station, and a switch at the subscriber's station to remove said ground connection when the subscriber's telephone is switched for use, substantially as set forth.

9. In a telephone-exchange system, a metallic-circuit line, the two branches of which are normally open to each other at the subscriber's station and one of which is normally grounded at the subscriber's station, and an electric battery and an annunciator in the circuit of the line when it is not switched for conversation but not otherwise, in combination with a switch at the subscriber's station, with contact-points to remove said ground connection when the subscriber's telephone is switched for use, and a test receiving instrument at the central office grounded on one side and connected on its other side to a switch testing plug or device adapted to be brought into connection with the line, with the battery and annunciator between the point of contact and the subscriber's normal ground and the battery adjusted to the instrument and annunciator to operate the instrument and not the annunciator, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line normally (or when not in use) with its two branches open to each other at the subscriber's station and one of them grounded at the subscriber's station when the subscriber's telephone is not switched for use but not otherwise, switches, one at each board for each line each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of each line which is normally grounded at the subscriber's station passing, successively, through the pairs of contact-points on its switches which are normally in contact and thence, by a circuit-wire, to said third contact-pieces of its switches, and the other side or branch of the line being connected to said third contact-pieces, and

an electric battery in said circuit-wire, in combination with pairs of loop-switch plugs adapted to be inserted into said switches, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch which are normally in contact, and connect the two contact-pieces of the plug respectively with said third contact-piece of the switch connected with one side of the line and said contact-point of the pair connected with the other side of the line, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a switch testing plug or device, adapted at the will of the operator to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line normally (or when not in use) with its two branches open to each other at the subscriber's station and one of them grounded at the subscriber's station when the subscriber's telephone is not switched for use but not otherwise, switches, one at each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of each line which is normally grounded at the subscriber's station passing, successively through the pairs of contact-points on its switches which are normally in contact and thence, by a circuit-wire, to said third contact-pieces of its switches, and the other side or branch of the line being connected to said third contact-pieces, and an electric battery in said circuit-wire, in combination with pairs of loop-switch plugs adapted to be inserted into said switches, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch which are normally in contact, and connect the two contact-pieces of the plug respectively with said third contact-piece of the switch connected with one side of the line and said contact-point of the pair connected with the other side of the line, a switch at the subscriber's station with contact-points to close the sides or branches of the line to each other while the subscriber's telephone is switched for use, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a switch testing plug or device, adapted at the will of the operator to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

12. In a telephone-exchange system, the combination with several telephone-lines connected with multiple switchboards, of an individual test-battery or generator, individual polarized annunciators, one for each line and normally in the circuit of its line, and a test receiving instrument, the battery being so connected in relation to the annunciator as not to operate it when it is included in a closed circuit with it.

13. In a telephone-exchange system, the combination with a telephone-line, of a test-battery and a polarized annunciator, normally in circuit with the line, the battery being so connected in relation to the annunciator as not to operate it when it is included in closed circuit with it.

MILO G. KELLOGG.

Witnesses:
FRANCES D. KELLOGG,
LEROY D. KELLOGG.