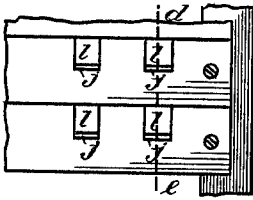


(No Model.)

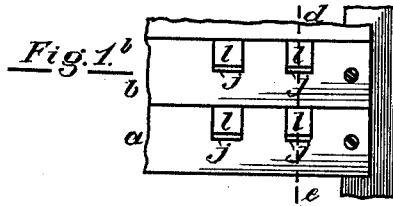
M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,337.

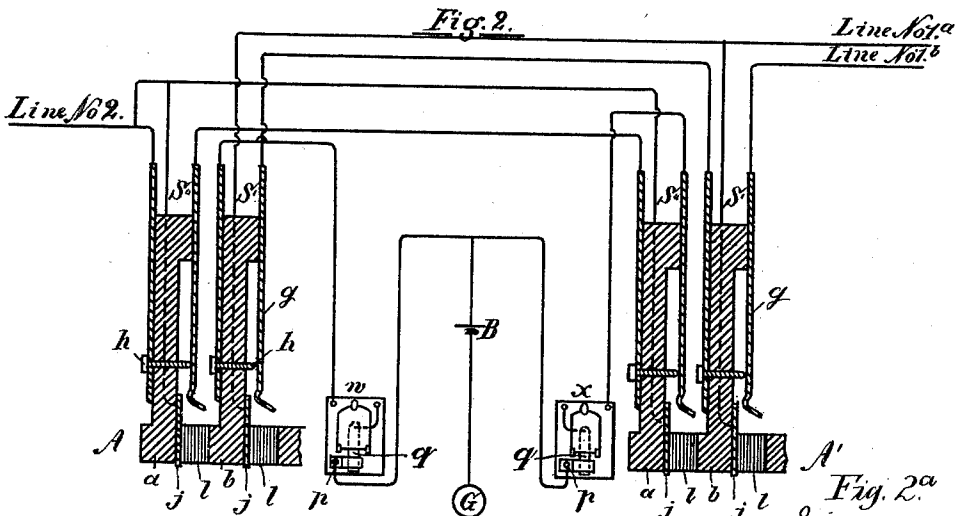
Patented Oct. 26, 1897.



*Fig. 1^a*

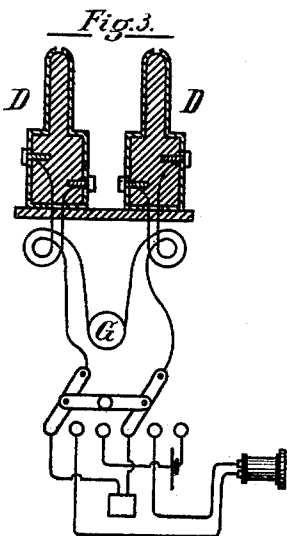


*Fig. 1^b*



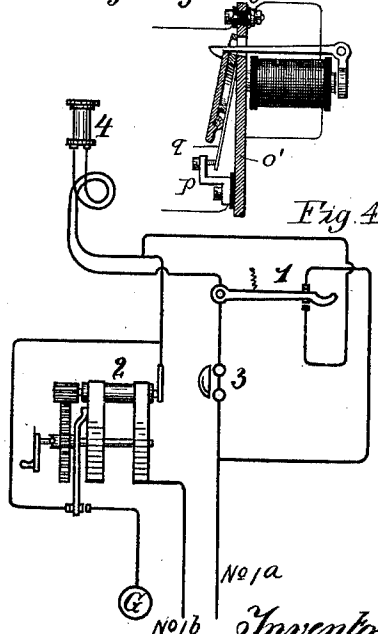
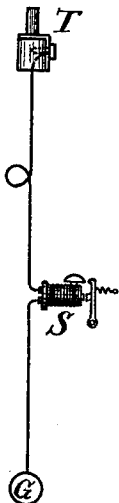
*Fig. 2.*

*Line No. 1^a*  
*Line No. 1^b*



*Fig. 3.*

*Fig. 5.*



*Fig. 4.*

Witnesses:  
G. Gross.  
G. C. Dietz.

Inventor:  
Milo G. Kellogg

# 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. 592,337, dated October 26, 1897.

Application filed December 20, 1889. Serial No. 334,354. (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, after passing to the switchboards, normally unite in a common wire in which is a battery and are disconnected from the common wire when switched for conversation, and the test is applied to the circuit of the line before the line passes to the contact-points which make such disconnection. The lines may be single or metallic circuit lines, or both. Such a system is shown in my application for patent, Serial No. 262,664, filed February 1, 1888.

The invention consists in an attachment or arrangement of contact-points of the line-annunciators, by which while a line-annunciator indicates a call its line is automatically disconnected from its normal connection with the common wire in which is the battery. By so doing the line tests "busy" when the annunciator indicates a call whether the line has been switched for use or not, and the operator will not connect the line with another line when the subscriber has sent in a call and the call has not been answered. A subscriber's line is therefore reserved to himself as soon as he sends his call in, and the operation of the exchange system will be more satisfactory to him.

In the accompanying drawings, illustrating my invention, Figures 1<sup>a</sup> and 1<sup>b</sup> 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 line connections and apparatus necessary to illustrate my invention. Fig. 2<sup>a</sup> is a detail view of one of the line-annunciators. Fig. 3 shows an operator's cord system to be used with the boards. Fig. 4 shows a subscriber's station apparatus to be used on metallic-cir-

cuit lines. Fig. 5 shows an operator's test system to be used at a board.

In the drawings like parts and apparatus are indicated 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<sup>a</sup>, and A' is a sectional view of the switchboard shown in Fig. 1<sup>b</sup>, 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 answer the calls and make the necessary connections and disconnections. 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 and connect the two contact-pieces of the plug with the spring and with said switch contact-piece, respectively.

In Fig. 2, *g g* represent the springs of the switches, *h h* the contact-points on which the springs normally bear, and *j j* the insulated contact-pieces of the switches. *l l* are the switch-holes. *a b* are the rubber strips on which the contact-pieces are mounted, as shown, and through the fronts of which are the holes *l l*.

The insulated contact-pieces *j j* of the switches are so placed that a test-plug or similar device may readily be applied to them. When a switch-plug (shown in Fig. 3) is inserted into a switch-hole *l*, it separates the pieces *g h* of the switch, and one of the contact-pieces of the plug is in contact with the piece *j* and the other piece is in contact with the spring *g*.

The switches for the single-circuit lines are marked S'', and those for the metallic-circuit lines are marked S'.

B is a battery or other source of electricity. *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<sup>a</sup>. The line runs to a bolt  $o$ , mounted on and insulated from the plate  $o'$ , and from thence is connected with one terminal of the annunciator-coil, the other terminal of which is connected to the plate  $o'$ . The contact-spring  $q$  is mounted upon and is in electrical connection with the plate  $o'$ , while the bracket piece or contact  $q$ , with which the spring is normally in contact, is insulated from the plate. The ground connection through the battery  $B$  is connected with the contact  $p$ . When the drop falls, the projection at its bottom comes in contact with the spring  $q$  and presses it away from the contact-piece  $p$ .

Two lines are shown in Fig. 2, one a metallic-circuit line, the two sides or branches of which are marked line No. 1<sup>a</sup> and line No. 1<sup>b</sup>, respectively, and one a single-circuit line (to be grounded at its outer end) marked line No. 2.

The circuit of the single-circuit line is as follows: From the subscriber's ground, through his station apparatus, (which may be of the usual form of apparatus,) through the line and the pairs of contact-points  $g h$  successively of its switches on the several boards, going in each case to the point  $h$  first, thence through its line-annunciator to the common wire of the lines in which is the battery. This wire is grounded, with the battery between the ground connection and the connection of the lines with it. All the contact-pieces  $j j$  of a single-circuit line are connected together and to their line between its switches and the subscriber's station.

The two contact-points of the line-annunciator  $p q$  are placed in the circuit of its line between the several pairs of contact-points of the line-switches and the point where the line unites with said common wire in which is the battery.

The circuit of each line through its annunciator and annunciator contact-points is as follows and as shown: The line passes through the annunciator-magnet and thence to spring  $q$  and normally through the contact between  $q$  to the angle-piece  $p$  and thence to the common wire.

The circuit of a metallic-circuit line is as follows: One side or branch of the line, say line No. 1<sup>a</sup>, as shown, is connected with all the contact-pieces  $j j$  of its switches on the boards. The other branch of the line, say

line No. 1<sup>b</sup>, passes, successively, through the pairs of contact-points  $g h$  of its switches on the several boards, going in each case to the spring first. It then passes through the line-annunciator and thence to the common wire in which is the battery.

The two contact-points of the line-annunciator  $p q$  are placed in the circuit of its line between the several pairs of contact-points of the line-switches and the point where the line unites with said common wire in which is the battery.

In the operator's cord system shown in Fig. 3,  $D D$  are two loop-plugs, the two contact-points of which are connected by double flexible cords to their loop-switch clearing-out annunciator and the operator's telephone and calling-generator, substantially as shown. Only one pair of plugs, with their cords and apparatus, is shown, but other pairs may be added in a way which will be apparent to those skilled in the art.

In the subscriber's station apparatus for metallic-circuit lines shown in Fig. 4, 1 is the telephone-switch, 2 is the calling-generator, 3 is the signal-receiving bell, and 4 is the subscriber's telephone. These parts may be the usual forms of apparatus, and are connected, as shown or in other ways, so as to produce the required results. The generator, however, is modified and is as shown. When it is not in operation, the subscriber's line is open to the ground at his station. While it is being operated the line is automatically grounded, with the armature-coil between said ground connection and the normal ground connection of the line at the central office.

The generator has an automatic device which is a modification of the automatic device very generally used in telephone-generators. The modification consists, essentially, in the arrangement and number of the contacts. One side or branch of the line, say line No. 1<sup>a</sup>, as shown, is connected with the insulated spring of the generator, which is maintained in contact with an insulated end of the armature-coil. The other end of the armature-coil is connected with the metal frame of the generator, as is also the other side or branch of the line (line No. 1<sup>b</sup>) and the contact-spring of the automatic device. When the generator is operated, the contact-spring is forced away from the contact-point on which it normally rests, thereby removing the normal shunt of the generator and into connection with the point which is connected with the ground, thereby grounding the circuit with the armature-coil between such ground connection and the normal ground connection of the line at the central office.

In the operator's test system shown in Fig. 5,  $T$  is the test-plug connected by a flexible conductor to the test receiving instrument  $S$ , and thence to the ground.

Each operator has a cord system and a test

system, and they are conveniently mounted and arranged for her work.

When a line is tested by placing a test-plug on a contact-piece *j* of the line and the line is not switched at any board and the line-annunciator does not indicate a call, there is a complete circuit from the ground through the test receiving instrument, the circuit of the line, the pairs of switch contact-points of the line, the annunciator contact-points, and the battery to the ground, and the test receiving instrument will sound or respond, indicating to the operator that the line is free to be connected to. Should, however, the line be switched at any board, this circuit is open and the instrument will not sound or respond. Should, again, the line-annunciator indicate a call, this circuit is open at the pair of contact-points of the annunciator and the instrument will not sound or respond. When the instrument on a test being made does not respond, the operator knows, therefore, that either the line is switched for use or its annunciator indicates a call, and she will not then connect it with another line. The test receiving instruments and the battery should be such that when closed in the circuits the instrument will respond. The parts should, however, be so related to the line-annunciators that on a test of a line being made it will not operate the annunciator. For this purpose the annunciators may be such as will be operated only when one polarity of current passes through them, and the batteries may be so connected to the circuit as not to operate the annunciators.

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

1. In a telephone-exchange system, a common ground-wire to which the lines are normally connected, containing a battery, in combination with an annunciator normally in the circuit of the line, a pair of contact-points operated by the annunciator to disconnect the line from said common ground-wire while the annunciator indicates a call, a pair of switch contact-points which disconnect said line from said common ground-wire, while the line is switched by a switch which controls them and a test receiving instrument grounded on one side (but not through the battery) and connected on its other side to a test plug or device adapted to be brought for testing into connection with the line, substantially as set forth.

2. In a telephone-exchange system, a common wire containing a battery to which the lines are normally connected on one side of the battery, in combination with an annunciator normally in the circuit of a line, a pair of contact-points operated by the annunciator which disconnect the line from said common wire while the annunciator indicates a call, a pair of switch contact-points which disconnect said line from said common wire while the line is switched by a switch which controls them and a test receiving instrument

connected on one side to the common wire on the other side of said battery and connected on its other side to a test plug or device adapted to be brought for testing into connection with said wire whether the wire is connected to the battery or not, substantially as set forth.

3. In a telephone-exchange system, a common wire containing a battery, to which the lines are normally connected on one side of the battery, in combination with an annunciator normally in the circuit of a line, a pair of contact-points operated by the annunciator which disconnect said line from said common wire while the annunciator indicates a call, a pair of switch contact-points which disconnect said line from said common wire while the line is switched at a switch which controls them, and a test wire or circuit containing a test receiving instrument, connected at one end to said common wire on the other side of the battery and connected at its other end to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected to the battery or not, substantially as set forth.

4. In a telephone-exchange system, a common ground-wire, containing a battery, to which the lines are normally connected, in combination with a subscriber's line, a series of pairs of contact-points for the line, one pair on each of several boards each pair normally in contact but open while the line is switched at their board, said line passing normally, successively, through said pairs of contact-pieces and being thence connected to said common wire, an annunciator normally in the circuit of the line, a pair of contact-points operated by the annunciator which break the connection of the line with said common wire while the annunciator indicates a call, and a test wire or circuit, containing a test receiving instrument, grounded at one end, but not through the battery, and connected at its other end to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected to the battery or not, substantially as set forth.

5. In a telephone-exchange system, a common wire, containing a battery, to which the lines are normally connected, in combination with a subscriber's line, a series of pairs of contact-points for the line, one pair on each of several boards, each pair normally in contact but open while the line is switched at their board, said line passing normally, successively, through said pairs of contact-points and being thence connected to said common wire on one side of the battery, an annunciator normally in the circuit of the line, a pair of contact-points operated by the annunciator which break the connection of the line with said common wire, while the annunciator indicates a call and a test receiving instrument connected on one side to the other side of said battery and on its other side to a test plug or device adapted to be brought for testing into connection with said line whether the line is

connected to the battery or not, substantially as set forth.

6. In a telephone-exchange system, a telephone-line normally 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 to a common ground-wire for the lines in which is a battery, in combination with an annunciator normally in the circuit of the line, a pair of contact-points operated by the annunciator which disconnect said line from said common wire while the annunciator indicates a call, and a test receiving instrument grounded on one side (but not through the battery) and connected on the other side to a test plug or device adapted to be brought for testing into connection with the line between the pairs of switch and annunciator contact-points on the one hand and the subscriber's station on the other hand, substantially as set forth.

7. In a telephone-exchange system, a telephone-line normally passing, successively, through pairs of switch contact-points, one pair on each of several boards, each pair normally in contact but open while the line is switched at their board and thence to a common wire for the lines connected to one side of a battery, in combination with an annunciator normally in the circuit of the line, a pair of contact-points operated by the annunciator which disconnect said line from the battery while the annunciator indicates a call, and a test receiving instrument connected on one side to the other side of said battery and on its other side to a test plug or device adapted to be brought for testing into connection with the line between said pairs of switch and annunciator contacts on the one hand and the subscriber's station on the other hand, substantially as set forth.

8. In a telephone-exchange system, a metallic-circuit line, one of whose sides or branches normally passes successively, through pairs of 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 to one side of a battery common to the lines, in combination with an annunciator normally in the circuit of that branch of the line, a pair of contact-points controlled by the annunciator which disconnect the line from the battery, while the annunciator indicates a call and a test receiving instrument connected on one side to the other side of said battery and on its other side to a test plug or device adapted to be brought for testing into connection with the other side or branch of the line, substantially as set forth.

9. In a telephone-exchange system, a battery normally connected on one side, to a subscriber's line, switching devices to disconnect the line from said normal connection with the battery, an annunciator normally in the circuit of the line, and a pair of contact-points operated by the annunciator which disconnect

the line from said normal connection with the battery while the annunciator indicates a call, in combination with a test receiving instrument connected on one side to the other side of said battery, and on its other side to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected to the battery or not, substantially as set forth.

10. In a telephone-exchange system, a battery connected on one side to the ground and on its other side normally connected to a telephone-line, switching devices to disconnect the line from the battery while the line is switched for use, an annunciator normally in the circuit of the line, and a pair of contact-points operated by the annunciator which disconnect the line from the battery while the annunciator indicates a call, in combination with a test wire or circuit grounded at one end (but not through the battery), connected on its other end to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected to the battery or not, and a test receiving instrument in said test wire or circuit, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, a telephone-line, a battery connected on one side to the ground and on its other side normally connected to the line, switching devices at each board to disconnect the line from its normal connection with the battery and switch it with any other line for conversation, an annunciator normally in the circuit of the line, and a pair of contact-points operated by the annunciator which disconnect the line from its normal connection with the battery while the annunciator indicates a call, in combination with test receiving instruments, one at each board each grounded on one side (but not through the battery) and connected on its other side to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected with the battery or not, substantially as set forth.

12. In a telephone-exchange system, multiple switchboards, a telephone-line, a battery normally connected on one side to the line, switching devices at each board to disconnect the line from its normal connection with the battery and switch it with another line for conversation, an annunciator normally in the circuit of the line, and a pair of contact-points operated by the annunciator which disconnect the line from its normal connection with the battery while the annunciator indicates a call, in combination with test receiving instruments, one at each board, each instrument connected on one side to the other side of the battery and on its other side to a test plug or device adapted to be brought for testing into connection with the line whether the line is connected with the battery or not, substantially as set forth.

13. In a telephone-exchange system, a me-

tallic-circuit line, one of whose sides or  
branches normally passes successively  
through pairs of contact-points, one pair on  
each of several boards each pair normally  
5 closed but open while the line is switched at  
their board, and thence to a ground connection  
common to the lines, in combination with  
an annunciator normally in the circuit of that  
branch of the line, a pair of contact-points  
10 controlled by the annunciator which disconnect  
the line from the ground while the annunciator  
indicates a call, a test receiving in-

strument connected on one side to the ground  
and on its other side to a plug or device adapted  
to be brought for testing into connection 15  
with the other side or branch of the line and  
a battery in the circuit thereby established  
on testing, substantially as set forth.

In witness whereof I hereunto subscribe my  
name this 29th day of November, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,  
MARGARETHA RIEHL.