

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,345.

Patented Oct. 26, 1897.

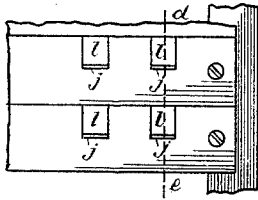


Fig. 1^a

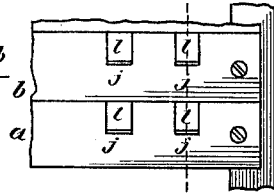


Fig. 1^b

Fig. 2.

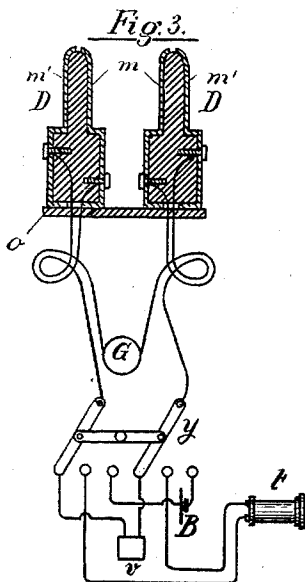
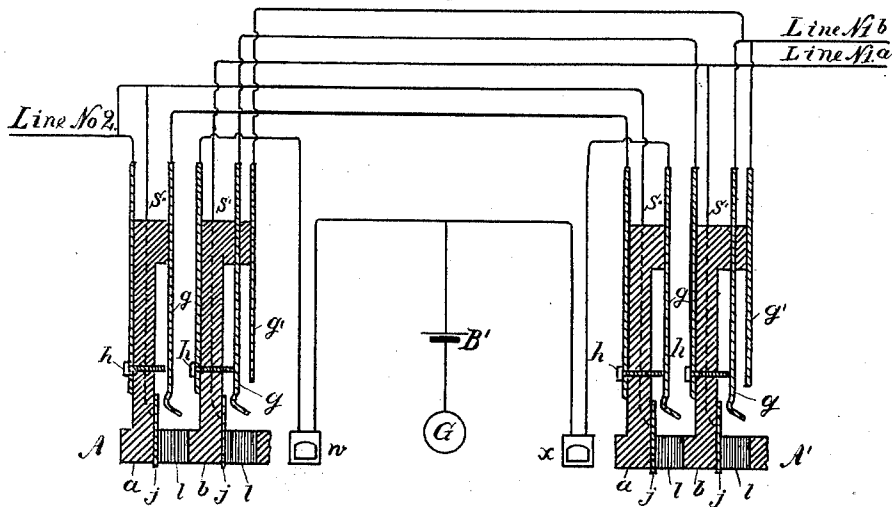


Fig. 3.

Fig. 5.

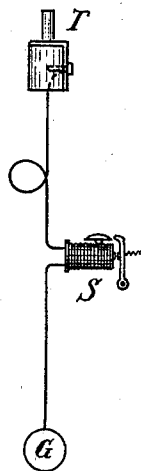
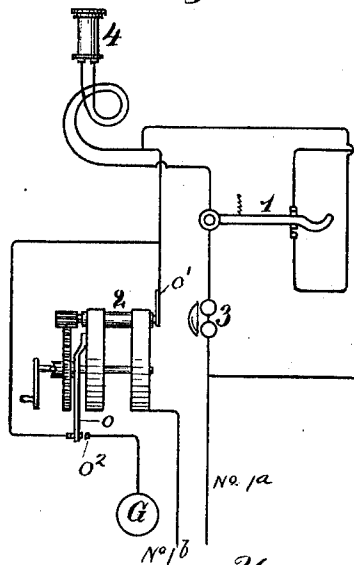


Fig. 4.



Witnesses:

G. G. Dietz.
S. Gross.

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. 592,345, dated October 26, 1897.

Application filed December 23, 1889. Serial No. 334,698. (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 part of the lines are metallic-circuit lines and part of them are single-circuit lines; and it consists of apparatus for and a system of switching such lines of the exchange in the operation of the exchange system and 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. 3 shows a diagram of an operator's cord system to be used in connection with the boards. Fig. 4 shows a subscriber's-station apparatus for use on metallic-circuit lines. Fig. 5 shows an operator's test system.

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 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 bears) and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively.

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. *ab* 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*. The contact-pieces *j j* are so placed that a test-plug or similar device may readily be applied to them. The holes *ll* 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 raises the spring *g* from the contact-point *h* and the spring *g* and contact-piece *j* are in contact with the two contact-pieces, respectively, of the plug.

For a spring-jack switch which is to be used for metallic-circuit lines I provide still another contact-piece from those mentioned above, which is normally (or when a plug is not in a switch) disconnected from the line contact-points, but when a plug is inserted into a switch this piece is in contact with the spring-lever of the switch. I have shown this contact-piece as a spring also, and it is marked *g'*. When a plug is inserted into a switch, it raises the lever *g* of the switch so that it comes in contact with the spring *g'*.

The switches for single-circuit lines are marked *s''* and those for metallic-circuit lines are marked *s'*.

B' is a battery or other source of electricity. *w* and *x* are the line-annunciators for the two lines shown.

Two lines are shown in Fig. 2, one of them a metallic-circuit line, the two sides or branches of which are marked line No. 1^a and line No. 1^b, respectively, and the other a single-circuit line 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 the usual form of apparatus,) thence through the line and the pairs of switch contact-points *g h* of the switches, successively, of its switches on the several boards, going in each case to the point *h* first, thence through the line-annunciator to the common wire of the lines in which is the battery. This common wire is grounded with the battery between the ground and the connections of the lines with it. All the contact-pieces *j j* of the

switches of the line are connected together and to the line, the connection being between the switch contact-points and the subscriber's station.

5 The circuit of a metallic-circuit line is as follows: One side or branch of the line, say line No. 1^a, as shown, is connected with all the contact-pieces $j j$ of its switches on the board. The other branch of the line, say
10 line No. 1^b, passes successively through the pairs of contact-points $g h$ of its switches on the several boards, passing in each case to the spring first. It then passes through its annunciator to the common wire in which is
15 the battery. This branch of the line is also permanently connected with the contact-pieces $g' g'$ of its switches, the point of connection being between the switch-contacts on the one hand and the subscriber's station on
20 the other hand.

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
25 subscriber's telephone. These parts may be the usual forms of apparatus and may be connected as shown or in other ways so as to produce the required results. The generator, however, is modified and is as shown.

30 The modification consists, essentially, in the number and arrangement of the contact-points of the automatic device. The automatic device shown is a modification of a form very generally used. It consists in a V-
35 shaped attachment to the hub of the driving-wheel, a pin in the shaft, which engages in this V-shaped arrangement, and a spring which presses against the wheel and brings the pin normally in the center of the V
40 arrangement. The contact-points and circuits are substantially as shown. One side or branch of the line connects with the frame of the generator, as does also one end of the armature-coil and the spring o of the auto-
45 matic device. The other side or branch of the line connects to the insulated spring o' , which bears on an insulated piece on the armature-shaft to which the other end of the armature-coil is connected. The contact-
50 point o'' , with which the spring of the automatic device is pressed into contact when the generator is operated, is connected to the ground. The side or branch of the line which
55 is grounded at the central office is the one connected to said insulated spring of the generator.

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 auto-
60 matically grounded, with the armature-coil between said ground connection and the normal ground connection of the line at the central office.

65 In the operator's cord system shown in Fig. 3, $D D$ are two loop-plugs. Y is a looping-in switch for the plugs; v , a clearing-out annunciator. t is the operator's telephone,

and B is her calling-generator. $m m'$ are the two contact-pieces of the plug. They extend to the bottom of the plug, as shown, and normally rest on the metal piece o , which then
70 brings them into electrical connection. The contact-pieces $m' m'$ of the two plugs are connected to the two levers of the switch Y by flexible conductors, as shown. The other
75 contact-pieces of the plugs $m m$ are connected to the ground through flexible conductors, as shown. Only one pair of plugs, with their cords, switch, and clearing-out annunciator, is shown. Other pairs may be added to the
80 system in a manner which will be apparent to those skilled in the art.

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
85 t , and thence to the ground.

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

The switching between the various lines of
90 the exchange is as follows: When an operator receives a call on a single-circuit line assigned to her board, she places one of the plugs of her system into the switch of the line so that the piece m' is in contact with
95 the switch-piece j , and, placing the levers of the switch Y so that her telephone is in circuit, finds out by conversation what line is wanted. The circuit is from the subscriber's station ground through the circuit of the line
100 to the switch in which the plug is placed, thence through the cord connected to the plug, the levers of the looping-in switch, the telephone, and the other cord of the pair to
105 the other plug of the pair. The circuit of the line is complete to the ground through the connection between the contact-pieces of the other plug by means of the piece o , on which they rest. When she finds out what
110 line is wanted, she tests it, as will hereinafter be described, and if she finds it to test "free" she places the other plug of the pair in its switch so that the contact-piece m' of
115 the plug is in connection with the contact-piece j of the switch. If the second line is a single-circuit line also, the circuit is complete between the two lines from the subscriber's
120 ground of one line through the switch-cords connected to the plug-contacts $m' m'$ to subscriber's ground of the other line.

If the second line is a metallic-circuit line, there is a complete circuit as follows: from the ground of the single-circuit line, through the circuit of the line, the contact-pieces m'
125 m' of the plugs used, and the cords connecting them together, through the circuit of the metallic-circuit line to the contact-piece m of the plug which is in its switch, and thence to the ground through the cord conductor which is connected with the piece. When an operator
130 receives a call on a metallic-circuit line assigned to her board, she places one of the plugs of her system into the switch of the line, and, placing the levers of the switch Y

so that her telephone is in the circuit, finds out by conversation what line is wanted. The circuit is from the ground at the central office through a conductor of the plug-cord to the line and through the circuit of the line and the other conductor of the cord to the switch-lever connected with it, thence through the telephone and the other lever to the ground through the cord conductor connected to it. The circuit of the line is complete when the plug is in the switch, because the two contact-pieces of the other plug of the pair are connected or bridged by means of the metal piece *o*, on which they rest. When she finds out what line is wanted, she tests it to see whether it is busy or not, and if it is not busy she places the other plug of the pair into its switch at her board. If the line which she connects to is a single-circuit line, she places the plug in its switch so that the contact-piece *m'* is in connection with the piece *j* of the switch. There is a complete circuit of the two lines from the subscriber's ground, the contact-pieces *m' m'* of the two plugs, and the cord connecting them together, thence through the circuit of the metallic-circuit line to the contact-piece *m* of the plug which is inserted into its switch, and thence to the ground through the cord which is connected with the piece. If the line which she connects to is also a metallic-circuit line, the lines are connected into a complete circuit as follows: from the ground through one contact-piece *m* to one line, thence through the circuit of the line, the contact-pieces *m' m'*, and the cords which connect them to the other line, thence through the circuit of the other line and the contact-piece *m* of the plug connected with it back to the ground.

When a metallic-circuit line is switched by the insertion of a plug into one of its switches, there is a circuit to the line from the plug-contact not only through the pairs of contact-points which intervene between the switch and the branch of the line in which these points are, but there is a circuit from the contact of the plug to the branch of the line by means of the contact between the springs *g* and *g'*, which shunts said pairs of contact-points. Any poor contact which may exist at any pair of the contact-points will therefore not impede the telephone-current.

In each case where a plug is inserted into the switch of a single-circuit line it is so inserted that the contact-piece *m'* is in connection with the contact-piece *j* of the switch. The other contact-piece of the plug is then connected with the ground, but it does not affect the operation of the system.

When any line in the system, whether single or metallic circuit, is not switched for use, there is a complete circuit from its contact-pieces *j j* and the switch contact-points *g h* of the line to the battery and thence to the ground; but when the line is switched at any board the circuit to the battery and ground is interrupted at the pair of contact-points *g h*

used. In the case of metallic-circuit lines the circuit is that of the line by way of the subscriber's station. It follows that when the operator applies her test-plug and the instrument responds that the line is not switched at any board and when it does not respond that the line is switched at some board. The operator can therefore determine, on testing, whether or not a line is switched.

It will be seen from the description of the system of switching and testing, as above described, that the operators can make all the necessary connections and testing for a telephone system with combined single and metallic circuit lines and that the operations they go through with for each connection are the same whether the lines switched be single-circuit or metallic-circuit lines.

It will also be seen that when any two lines are connected together for conversation the circuit does not depend on passing through successive pairs of switch contact-points on other boards of the exchange, but for each line, whether single or metallic circuit, there is a solid connection to the line from the switch used which shunts the pairs of contact-points of the switches which intervene.

The confusion and trouble which would arise from two systems of switching and testing and uncertain connection while conversation is going on, which in other systems exists from having many pairs of contact-points in the talking-circuit, is avoided in this system.

In the case of the single-circuit lines the solid connection between the switch used in switching a line and the line is secured by the circuit-wire which connects contact-piece *j* of the switch with the line.

I do not, of course, limit my invention to the specific style or form of switch shown, since it is obvious that other styles of switches might be used. Without departing from what is perfectly well known in the art I may refer to modifications of mere details in the construction of the switches and connections of the lines as follows: It is evident that other forms of switches may be used in which there is a contact on each board for each side or branch of the line to which said side or branch of the line is permanently connected, with which respectively the two contacts of a loop-switch plug form electric connection when the plug is inserted and in which there is a pair of contacts normally closed through the cut-off portion of the line passing to the annunciator, but opened on the insertion of the plug. For instance, the construction of the switches and plugs may be such that the plug on its insertion, while opening the normally closed contacts, forms direct contact between its two contact-pieces and the two contact-pieces of the switch which are permanently connected to the two sides or branches of the line; also, the circuit of the line after passing through the normally closed pairs of contacts of the switches through the annunciator may pass to the contacts *j j* of the switches in the

usual way for metallic-circuit lines which are normally on closed circuit instead of passing to the ground in the central office.

The advantages of my system would be substantially obtained in the modifications of the details I have mentioned, and my invention is broad enough to include such modifications.

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

1. In a telephone-exchange system, a telephone-line in combination with switches for said line, one switch on each of several boards, each switch having a pair of contact-points normally in contact, but separated by a switch-plug on its insertion into the switch and a third contact-piece connected permanently to the line and normally otherwise insulated from the other switch contact-pieces, said line normally passing, successively, through said pairs of contact-points, and said plug on its insertion into a switch pressing the line contact-piece of its pair of contact-pieces into connection with said third contact-piece of the switch, substantially as set forth.

2. In a telephone-exchange system, a telephone-line normally connected with the ground at the central office, in combination with switches for said line, one switch on each of several boards, each switch having a pair of contact-points normally in contact but separated by a switch-plug on its insertion into the switch and a third contact-piece permanently connected to the line and normally otherwise insulated from the other contact-pieces of the switches, said line normally passing, successively, through said pairs of contact-points and thence to the ground, and said plug on its insertion into a switch pressing the line contact-piece of its pair of contact-pieces into connection with said third contact-piece of the switch substantially as set forth.

3. In a telephone-exchange system, a telephone-line, in combination with switches for said line, one switch on each of several boards, each switch having a pair of contact-points normally in contact but separated by a switch-plug on its insertion and a third contact-piece connected permanently to the line and normally otherwise insulated from the other contact-pieces of the switches, said line normally passing, successively, through said pairs of contact-points of its switches and said plug on its insertion into a switch forming connection between its cord and the line contact-piece of the pair of contact-pieces of the switch and pressing said line contact-piece into connection with said third contact-piece of the switch, substantially as set forth.

4. In a telephone-exchange system, a telephone-line normally connected with the ground at the central office, in combination with switches for said line, one switch on each of several boards, each switch having a pair of contact-points normally in contact, but separated by a switch-plug on its insertion

into the switch and a third contact-piece permanently connected to the line and normally otherwise insulated from the other contact-pieces of the switches, said line normally passing, successively, through said pairs of contact-points and thence to the ground, and said plug on its insertion forming connection between its cord and the line contact-piece of the pair of contact-pieces of the switch and pressing said line contact-piece into connection with said third contact-piece of the switch, substantially as set forth.

5. In a telephone-exchange system, a telephone-line in combination with a switch having a pair of contact-points normally in contact and through which the line normally passes and a third contact-piece permanently connected with the line but otherwise insulated from the other contact-pieces of the switch, said switch being adapted to receive a switch-plug and when the plug is inserted to disconnect said pair of contact-pieces and press that contact-piece of the pair which is then connected with the line into connection with said third contact-piece, substantially as set forth.

6. In a telephone-exchange system, a telephone-line and a switch having a pair of contact pieces or points normally in contact and through which the line normally passes and a third contact-piece permanently connected with the line but otherwise insulated from the other contact-pieces of the switch in combination with a switch-plug with flexible cord adapted to be inserted into the switch and when inserted to disconnect the pair of contact-points, connect that point of the pair which is then connected with the line with its cord and press the point into connection with said third contact-piece, substantially as set forth.

7. In a telephone-exchange system, a subscriber's line grounded at its outer end, a switch for the line containing a pair of contact-points normally in contact, through which the line passes to a battery and thence to ground, and a third contact-piece permanently connected with the line, a metallic-circuit line, a switch for the line containing a pair of contact-points normally in contact, through which one side or branch of the line normally passes to a battery and thence to ground, and a third contact-piece permanently connected to the other side of the line, in combination with a pair of switch-plugs adapted to be inserted into the switches of said lines to switch them together and when inserted, to disconnect the pairs of contact-points which are normally in contact, and a test wire or circuit containing a test receiving instrument, grounded at one end and connected on its other end to a switch plug or device adapted to be brought for testing into connection with either of said third contact-pieces substantially as set forth.

8. In a telephone-exchange system, a subscriber's line grounded at its outer end,

switches for the line, one switch on each of several boards, each switch containing a pair of contact-points normally in contact and a third contact-piece, said line passing, successively, through said pairs of contact-points and thence to ground through a battery, and said third contact-pieces being connected permanently to the line, a metallic-circuit line, switches for the line, one switch on each of the boards, each switch containing a pair of contact-points normally in contact and a third contact-piece, one side or branch of the line passing successively, through the pairs of contact-points and thence to ground through a battery, the other branch of the line being connected to said third contact-pieces of its switches, in combination with a pair of double or loop-switch plugs at each board, one of the contact-pieces of each of which is connected by flexible conductors to one of the contact-pieces of the other, and the other contact-pieces of which are connected to the ground through flexible conductors, said plugs being adapted to be inserted into the switches at their board, respectively, and when inserted to disconnect the pairs of contact-points which are normally in contact, and connect the two contact-pieces of one plug with the two sides of the metallic-circuit line and the ungrounded contact-piece of the other plug with the other line, a test receiving instrument at each board, grounded on one side and connected on its other side to a test plug or device adapted to be brought for testing into connection with said third contact-pieces at its board, substantially as set forth.

9. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, and switches for said lines, one switch for each line on each board, each switch having a contact-piece permanently connected with one side or branch of the line and another contact-piece permanently connected with the other side or branch of the line, and each switch having also pairs of normally closed contacts, through which successively one side or branch of the line passes to the line-annunciator, in combination with loop-switch plugs at each board each adapted to be inserted into each switch at its board and when inserted to open the pair of normally closed contacts of the switch and form electrical connection within the switch between its two contact-pieces and the two contacts respectively of the switch which are permanently connected with the two sides or branches of the line.

10. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, and switches for said lines, one for each line on each board, two line contacts or terminals in each switch to which the two sides or branches

of its line are respectively permanently connected, and a pair of contacts in each switch normally closed but automatically opened by a switch-plug on its insertion.

11. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, and switches for said lines, one for each line on each board, two line contacts or terminals in each switch to which the two sides or branches of its line are respectively connected, and a pair of contacts in each switch, each contact being other than either of said line contacts or terminals, normally closed, but automatically opened by a switch-plug on its insertion.

12. In a telephone-exchange system, multiple switchboards, telephone-lines, and switches for said lines, one switch for each line on each board, each switch having a contact-piece permanently connected with one side or branch of the line and another contact-piece permanently connected with the other side or branch of the line, and each switch having also pairs of normally closed contacts, through which successively one side or branch of the line passes to the line-annunciator, in combination with loop-switch plugs at each board, each adapted to be inserted into each switch at its board and when inserted to open the pair of normally closed contacts of the switch and form electrical connection within the switch between its two contact-pieces and the two contacts respectively of the switch which are permanently connected with the two sides or branches of the line.

13. In a telephone-exchange system, multiple switchboards, telephone-lines, and switches for said lines, one for each line on each board, two line contacts or terminals in each switch to which the two sides or branches of its line are respectively permanently connected, and a pair of contacts in each switch normally closed but automatically opened by a switch-plug on its insertion.

14. In a telephone-exchange system, multiple switchboards, telephone-lines, and switches for said lines, one for each line on each board, two line contacts or terminals in each switch to which the two sides or branches of its line are respectively connected, and a pair of contacts in each switch, each contact being other than either of said line contacts or terminals, normally closed, but automatically opened by a switch-plug on its insertion.

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

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
MARGARETHA RIEHL.