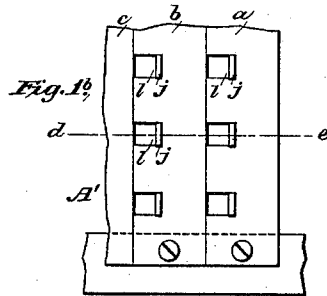
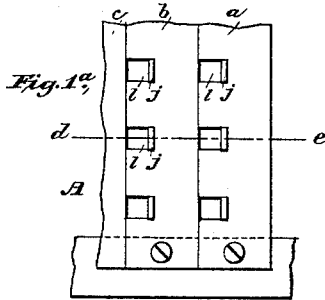


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,335.

Patented Oct. 26, 1897.



Line No. 2<sup>b</sup>  
Line No. 2<sup>a</sup>  
Line No. 1<sup>b</sup>  
Line No. 1<sup>a</sup>

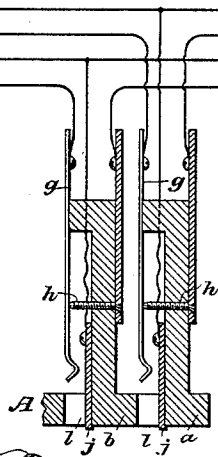


Fig. 2.

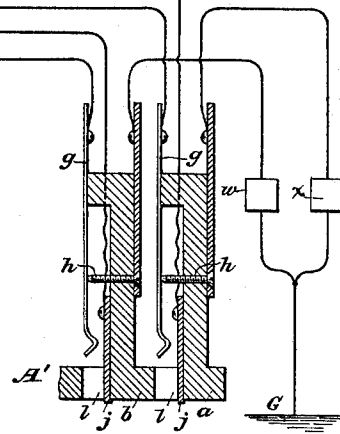


Fig. 4.

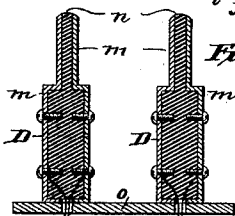
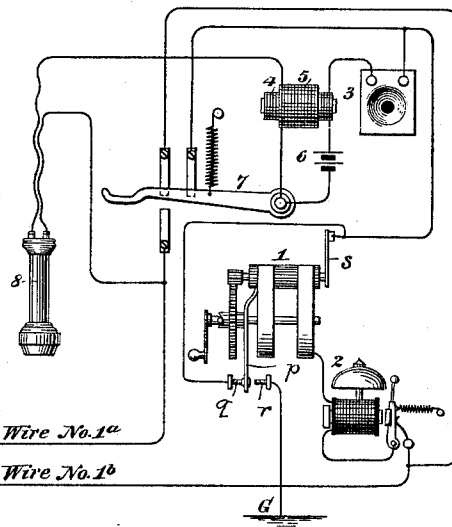


Fig. 3.



Fig. 5.



Wire No. 1<sup>a</sup>

Wire No. 1<sup>b</sup>

Witnesses

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# 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. 592,335, dated October 26, 1897.

Application filed December 12, 1889. Serial No. 333,538. (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 telephone-exchange system in which the subscribers' lines are metallic-circuit lines; and it consists in a system of calling, switching, and testing such lines which I shall describe and claim.

I place as many switchboards in the central office as are found necessary in order to properly operate the exchange. On each board for each line is a spring-jack or similar switch having two contact-points which are normally in contact and a third contact-piece insulated from the rest, (except by the circuit connections,) said switch being adapted to receive a loop-switch plug and, when a plug is inserted, to disconnect the contact-points which are normally in contact and connect one of them with one contact-piece of the plug and the other contact-piece of the plug with the third contact-piece of the switch mentioned above. These third contact-pieces are also so placed and arranged that a test-plug may readily be applied to them.

Figures 1<sup>a</sup> and 1<sup>b</sup> of the drawings are sections of two multiple switchboards to which the same lines are connected. Fig. 2 is a diagram of the boards and the circuits and connections to them necessary to illustrate my invention. Fig. 3 is an operator's cord system adapted for use with the boards. Fig. 4 is a diagram of the subscriber's-station apparatus necessary to illustrate my invention. Fig. 5 shows an operator's test system.

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*. *a b* repre-

sent rubber strips on which the metal parts of the switches are mounted, as shown. *l l* are square holes through the fronts of the strips, adapted to receive and guide the switch-plugs. The contact-springs *g g* are mounted to the rear of the holes and normally bear on their corresponding contact-points *h h*. *j j* are the contact-pieces of the switches, insulated from the rest, (except by the circuit connections.) The switch-plugs are shown in Fig. 3 and marked D D. When a plug is inserted into a switch, it disconnects the spring *g* of the switch from its corresponding contact-point *h* and the two contact-pieces of the plug form connection with the spring and with the contact-piece *j*, respectively. Each section of a rubber strip, with its contact spring, point, and insulated piece and the hole, all arranged and operating as above, may be considered as a spring-jack switch.

*w* and *x* in Fig. 2 are calling-annunciators for the lines. Two lines are shown in the figure as connected to the boards. The two branches of one line are marked line No. 1<sup>a</sup> and line No. 1<sup>b</sup>, respectively, and the two branches of the other line are marked line No. 2<sup>a</sup> and line No. 2<sup>b</sup>. The circuit of a line may be traced as follows: One branch, starting out from the subscriber's station, passes to the central office and through the pairs of contact-points *g h* of its switches, passing in each case to the spring first. It then passes through its line-annunciator and thence to the ground. The other branch of the line is connected to all the contact-pieces *j j* of its switches.

In the operator's cord system shown in Fig. 3, D D represent a pair of loop-switch plugs. *n n* is the rubber insulation, and *m m* are the contact-pieces of the plug. They extend to the bottom of the plug, as shown, and are adapted to rest normally on the metal strip *o*, which thereby temporarily connects them together.

Y is the looping-in switch for the pair of cords, having three pairs of contact-bolts, on which the operator may at will place the levers of the switch. *v* is the clearing-out annunciator of the pair of cords. B is the operator's calling generator or battery, and *t* is her telephone. The circuits and connec-

tions are substantially as shown. Each operator should have a cord system with as many pairs of cords and plugs and their switches and annunciators as she may need. She will need only one calling-generator and one telephone, and their connections with the other parts, as well as the method of operating the system in connection with the boards, will be apparent to those skilled in the art.

In the subscriber's-station apparatus shown in Fig. 4, 1 is the calling-generator. 2 is the signal-bell. 3 is the transmitter. 4 is the primary, and 5 is the secondary, of the induction-coil. 6 is the transmitter-battery. 7 is the telephone-switch, and 8 is the hand-telephone. These parts may be usual forms of apparatus and are connected as shown or in other ways to produce the required results.

The signal-bell is an ordinary vibrating bell, (having an automatic circuit-breaker,) as shown, and of the resistance suitable to the circuit.

The calling-generator has a modified construction and is as follows: It has an automatic device, shown in the drawings, by which, when the crank is not in motion, the wire of the armature is shunted and the line is disconnected from the ground at the subscriber's station, and when the crank is in motion the shunt is taken from the armature and the line is temporarily connected with the ground at the subscriber's station.

The automatic device shown is a modification of a form very generally used, the modification being substantially in the arrangement of the contact-points. It consists in a V-shaped attachment to the hub of the driving-wheel, a pin in the shaft which engages in the V-shaped arrangement, and a spring which presses against the wheel and brings the pin normally in the center of the V-shaped arrangement. The contact-points are substantially as shown. The spring is marked *p*, one of the contact-points *q*, and the other point *r*. When the generator is not operated, the spring bears on point *q*. When the generator is being operated, the pin in its shaft presses on one of the sides of the V-shaped arrangement and presses the driving-wheel in the spring and carries the spring away from contact-point *q* and into connection with point *r*. Point *r* is connected with the ground. The spring is connected to the metal frame of the generator. One side of the armature-coil and one side or branch, as wire No. 1<sup>b</sup>, of the metallic circuit are connected to the metal frame. The other side of the armature-coil is connected to an insulated piece on the armature-shaft, against which the insulated contact-spring, marked *s*, bears. This spring is connected to the other side or branch of the line, marked wire No. 1<sup>a</sup>, and is also connected to the point *q*. The armature-coil is therefore shunted by a circuit, while the generator is not operated, and when it is operated this shunt connection is open by the opening of points *p q*. The line is normally disconnected with

the ground at the subscriber's station, but when the generator is operated it is temporarily grounded there by the closing of points *p r*, with the armature-coil between such connection and the ground connection of the line at the central office.

I have represented in the subscriber's-station apparatus the gravity telephone-switch ordinarily used. The contacts and circuits are such that when the hand-telephone is on the switch the telephone is switched or shunted from the direct circuit of the line and the signal-bell is in the direct circuit, and when the telephone is off from the switch it is in the direct circuit of the line and the signal-bell is not in the direct circuit.

In the drawings, Fig. 4, wire No. 1<sup>a</sup> and wire No. 1<sup>b</sup> represent the two sides or branches of a line, and *G* is the ground connection. The generator should be so connected into the circuit that the temporary connection made between the line and the ground is between the normally open end of the line and the armature-coil. When the subscriber's telephone is on his switch, the vibrating bell 2 is in the direct circuit of the line, the circuit being as follows: from wire No. 1<sup>b</sup> through bell, shunt around generator, transmitter, battery 6, and telephone-switch to the side No. 1<sup>a</sup> of the line. When the telephone is off its switch, the bell is shunted by a wire of low resistance running from the side of the line No. 1<sup>b</sup> to one of the upper contact-points of the telephone-switch, thence through the secondary of the transmitter induction-coil and telephone to side No. 1<sup>a</sup> of the line.

In the operator's test system shown in Fig. 5, *T* is a test-plug adapted to be brought into connection with any contact-piece *j* at its board, *t'* is a test receiving instrument, and *B'* is a test-battery. The connections are substantially as shown. Each operator has a test system and it is conveniently mounted and arranged for her work.

The operation of the test system is as follows: When an operator tests a line by placing her test-plug into contact with the contact-piece *j* of the line, and the line is not switched at any board and the subscriber's telephone is not taken from its switch for use, the signal-bell (which is then in the circuit) will vibrate and the operator will hear the make and break in her instrument, and she thereby knows that the line is "free" and may be connected to. Should, however, the line be switched at any board and the ground connection of the line at the central office removed by the separation of the contacts *g h*, or should the subscriber's telephone be off its switch for use and the vibrating bell be thereby switched or shunted from the direct circuit, she will not hear the make and break and will know that the line is not "free." In this system, therefore, the line tests "busy" whether it is switched at any board or whether the subscriber's telephone is switched for use. In some multiple-test sys-

tems the line tests "busy" only when it is switched at some board, and it may test "free" and be connected to when the subscriber has already sent in his call and taken his telephone for use and cause him annoyance and confusion. In other systems the line tests only when the subscriber's telephone is switched for use, and it may test "free" and be connected to when his telephone is on its switch, but the line is still in connection with another line, causing annoyance and confusion to the subscribers and to the office. My system obviates both these sources of dissatisfaction in the operation of an exchange system.

The circuits in Fig. 4 show the bell 2 when the telephone is off the switch in one branch of a circuit containing two branches, one of which contains the transmitter 3, the primary of the induction-coil, and the subscriber's battery 6, and the other of which is a circuit-wire of small resistance, which is practically a short circuit to the bell. The battery should be merely sufficient to operate the transmitter, and the bell should be of a resistance of considerable size, suitable for the main-line circuit in which it is to be operated, and, being shunted as described, the bell would not be operated when thus connected with the subscriber's battery even when the test-battery at the central office is connected to the line.

The test-batteries should be strong enough to operate the circuit-breakers and test receiving instruments through the test-circuits, as described. When the test-current passes through the line-annunciators, it should, however, be such as not to operate them. The annunciators may be polarized annunciators constructed to be operated by only one polarity of current, and they and the test-batteries may be connected into the circuits so that the polarity of the batteries is not such as to operate the annunciators.

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

1. A test-circuit for a metallic-circuit line, from the ground, through a test receiving instrument to a test plug or device, thence to one side or branch of the line when the test is applied, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched for use by the switch which controls them, to the ground, in combination with a circuit-breaker at the subscriber's station normally included in said test-circuit a subscriber's telephone its switch-contacts and circuit connection controlled thereby whereby when the telephone is not switched for use the circuit-breaker is included in the circuit, and when the telephone is switched for use the circuit-breaker is switched or shunted from the direct circuit, and a battery in said circuit, substantially as set forth.

2. A test-circuit for a metallic-circuit line, from the ground, through a test receiving instrument to a test plug or device, thence to

one side or branch of the line when the test is applied, thence through the circuit of the line and 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, to the ground, in combination with a circuit-breaker at the subscriber's station normally included in said test-circuit, a subscriber's telephone, its switch-contacts and circuit connections controlled thereby whereby when the telephone is not switched for use the circuit-breaker is included in the circuit and when the telephone is switched for use the circuit-breaker is switched or shunted from the direct circuit, and a battery in said circuit, substantially as set forth.

3. A test-circuit for a metallic-circuit line, from one side or branch of the line, through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched for use by the switch which controls them, to one side of each of several test receiving instruments in multiple or parallel circuit, said instruments being placed, one at each of several boards and each having on its other side a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a circuit-breaker at the subscriber's station, a switch with contact-points which switch the circuit-breaker into his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, and a battery in any test-circuit established, substantially as set forth.

4. A test-circuit for a subscriber's line, from one side or branch of the line, through the circuit of the line and 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, to one side of each of several test receiving instruments in multiple or parallel circuit, said instruments being placed one at each of the boards and each having on its other side a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a circuit-breaker at the subscriber's station, a switch with contact-points which switch the circuit-breaker into his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, and a battery in any test-circuit established, substantially as set forth.

5. A test-circuit for a metallic-circuit line, from the ground, through a battery and a test receiving instrument to a test plug or device, thence to one side or branch of the line while the test is applied, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched by a switch which controls them, in combination with a circuit-breaker at the subscriber's station, and a switch with contact-points which switch the circuit-breaker into

the circuit of his line while his telephone is not switched for use and out of the circuit while it is switched for use, substantially as set forth.

5 6. A test-circuit for a metallic-circuit line, from one side or branch of the line, through the circuit of the line and a pair of switch contact-points normally in contact but open  
10 while the line is switched by a switch which controls them, thence to one side of a test receiving instrument and through it to a test plug or device adapted to be brought for testing into connection with said side or branch of the line, a battery in the circuit between said  
15 pair of contact-points and said switch-plug, a circuit-breaker at the subscriber's station and a switch with contact-points which switch the circuit-breaker into his line-circuit while his telephone is not switched for use and out  
20 of the circuit while it is switched for use, substantially as set forth.

7. A test-circuit for a metallic-circuit line containing a test-battery from the ground, through a test receiving instrument to a test  
25 plug or device, thence to one side or branch of the line when the test is applied, thence through the circuit of the line, a pair of switch contact-points normally in contact but open while the line is switched by a switch  
30 which controls them, and an annunciator, to the ground, in combination with a circuit-breaker at the subscriber's station normally in the test-circuit a subscriber's telephone its switch and contact-points and connections  
35 controlled thereby, whereby the circuit-breaker is included in the direct circuit when the telephone is not switched for use but not otherwise, said test battery and instruments being so constructed and connected that when  
40 a test is applied it will not operate said annunciator but will operate said test receiving instrument when it is in closed circuit with the circuit-breaker, substantially as set forth.

8. A test-circuit for a metallic-circuit line  
45 containing a test-battery from one side or branch of the line, through the circuit of the line, a pair of switch contact-points normally in contact but open while the line is switched by a switch which controls them and an annunciator,  
50 to one side of a test receiving instrument and through it to a test plug or device adapted to be brought for testing into connection with said side or branch of the line, in combination with a circuit-breaker  
55 normally in said circuit, and a switch with contact-points which switch the circuit-breaker at the subscriber's station into the line while the subscriber's telephone is not switched for use and out of the direct circuit  
60 of the line while the telephone is switched for use, said battery and instruments being so constructed and connected that when a test is applied it will not operate said annunciator but will operate said test receiving instrument  
65 when in closed circuit with the circuit-breaker, substantially as set forth.

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

tallic-circuit line normally passing, on one of its sides, successively, through pairs of contact-points, one pair on each of several switch-  
70 boards, each pair normally in contact but open while the line is switched at their board, and thence to the ground, in combination with a test wire or circuit grounded on one end, containing a test receiving instrument  
75 and battery and connected on its other end to a test plug or device adapted to be brought for testing into connection with the other side of the line, and a circuit-breaker at the subscriber's station in the circuit of his line while  
80 his telephone is not switched for use but not otherwise, substantially as set forth.

10. In a telephone-exchange system, a metallic-circuit line normally passing on one side, successively, through pairs of contact-  
85 points normally in contact but open while the line is switched at their board, and thence to the ground, in combination with test receiving instruments, one at each board where a pair of said contact-points is located, each  
90 instrument being grounded on one side and connected on the other side to a test plug or device adapted to be brought for testing into connection with the other side of the line, a battery in circuit with each instrument be-  
95 tween the switch contact-points and its test-plug, a circuit-breaker at the subscriber's station and a switch with contact-points which switch the circuit-breaker into the circuit of the line while his telephone is not  
100 switched for use and out of the circuit while it is switched for use, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, a metallic line connected to  
105 the same and one of its sides or branches normally grounded at the central office, and switching devices to connect said line at any board with another line for conversation and when thus connected to disconnect it from the  
110 ground, in combination with test receiving instruments, one at each board, grounded on one side and connected on the other side to a test plug or device adapted to be brought for testing into connection with the other  
115 side of said line, a battery in the test-circuit thereby established, and a circuit-breaker at the subscriber's station in the circuit of the line while his telephone is not switched for use but not otherwise, substantially as set  
120 forth.

12. In a telephone-exchange system, metallic-circuit lines, multiple switchboards and switches for said lines, one on each board for each line, each switch having a pair of con-  
125 tact-points normally in contact but open while the line is switched at their board, one side of each line passing, successively, through the pairs of contact-points of its switches and thence to ground, in combination with  
130 test receiving instruments, one for 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

the other side of the line, a battery in the circuit between the switch contact-points and each test-plug, and a circuit-breaker in the circuit at the subscriber's station when his telephone is not switched for use but not otherwise, substantially as set forth.

13. In a telephone-exchange system, multiple switchboards, a metallic-circuit line connected to the same and one of its sides or branches normally grounded at the central office through an annunciator, and switching devices to connect said line with another line for conversation and when thus connected to disconnect it from the ground and the annunciator, in combination with test receiving instruments, one at each board and each grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with the other

side of the line for testing, a battery in the test-circuit thereby established a circuit-breaker at the subscriber's station in the direct circuit of the line while the line is not in use, the subscriber's telephone, its switch and contacts and connections controlled thereby whereby the circuit-breaker is switched or shunted from the direct circuit of the line when the telephone is switched for use but not otherwise, said battery and instruments being so constructed and connected that when a test is applied it will not operate said annunciator but will operate said test receiving instrument when in closed circuit with the circuit-breaker, substantially as set forth.

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