

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,403.

Patented Oct. 26, 1897.

Fig. 1.

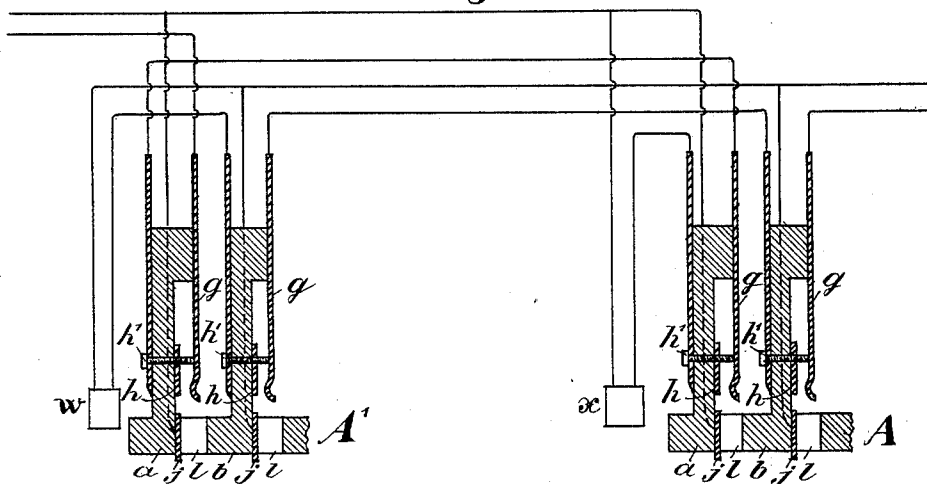


Fig. 2.

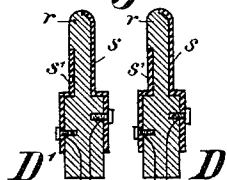


Fig. 3.

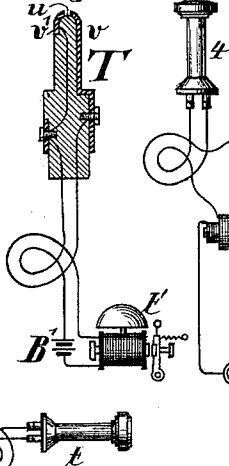
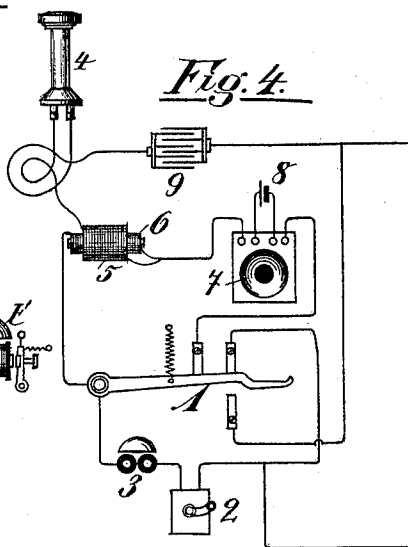


Fig. 4.



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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. 592,403, dated October 26, 1897.

Application filed May 19, 1891. Serial No. 393,274. (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, have invented certain new and useful
5 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.

10 My invention relates to a telephone-exchange system in which the lines are metallic-circuit lines and in which the necessary switching between the lines is accomplished by means of pairs of double or loop plugs connected together by double flexible conductors.

15 It consists of a system of testing the lines at any board to determine whether or not they are in use.

In the accompanying drawings, illustrating
20 my invention, Figure 1 represents sectional views of sections of two multiple switchboards and the main-line central-office connections and apparatus of the two lines connected to the switchboards. Fig. 2 represents
25 a diagram of an operator's cord system and apparatus necessary to illustrate my invention. Fig. 3 represents an operator's test system. Fig. 4 represents a subscriber's-station apparatus necessary to illustrate my invention.

30 I place as many switchboards in the central office as are found necessary or desirable in order to properly operate the exchange. On each board is a spring-jack switch for each
35 line. Each switch has a contact-spring which normally connects with a contact-point and is separated from the point while a plug is inserted into the switch and has a contact-piece insulated from the rest except by the
40 circuit connections. To the contact-point is attached an extension-piece or connection along the surface of the switch-hole, by means of which one of the contact-pieces of the loop test-plug (hereinafter described) forms con-
45 nection with the contact-point when the plug is inserted, as hereinafter described. The insulated contact-piece mentioned above is also placed along the surface of the switch-hole and preferably in front of said extension-
50 piece to the contact-point and is so placed that one of the contact-pieces of the loop-

switch plugs, hereinafter described, forms connections with said contact-piece when the plug is inserted. Said plugs are so constructed and said contact-pieces and extension-pieces
55 of the switches are so placed that when the test-plug is inserted into a switch the contact-piece of the plug does not come into contact with said contact-piece and, when a switch-plug is inserted into a switch, the con-
60 tact-piece of the plug does not come into contact with the extension-piece or point of the switch.

In Fig. 1, A A' are sectional views of sections of the two switchboards shown. *g g* represent the springs of the different switches,
65 *h' h'* the contact-points of the switches on which the springs normally bear, and *h h* the extension-pieces of the points placed along the surface of the holes of the switches in front of the points. *j j* are the insulated contact-pieces of the switches, also placed along the holes of their respective switches, preferably in front of the extension-pieces. *a b*
70 are rubber strips on which the metal parts of the switches are mounted and through the fronts of which are the switch-holes *l l*. These holes are rectilinear holes and are adapted to receive the loop-plugs mentioned above and to cause them to operate the
80 switches, as described.

w and *x* are calling-annunciators, one for each board shown.

Two metallic-circuit lines are shown in the figure, and they are connected to their re-
85 spective boards as follows and as shown: One side or branch of the line is connected to the contact-pieces *j j* of its switches on its several boards. The other side or branch of the line passes successively through the pairs of con-
90 tacts *g h* of its switches on the several boards, passing in each case to the spring first, and is then connected to the other side or branch of the line, (to which the contact-pieces *j j* are connected.) The annunciator of the line is
95 placed in the circuit between the two sides or branches of the line. The two branches of the line may be normally on closed circuit at the subscriber's station and may be provided with any usual and appropriate subscriber's-
100 station apparatus.

In the operator's cord system shown in Fig.

2, D D' are a pair of loop-switch plugs adapted to use with the switches shown in Fig. 1. *r r* are the rubber insulations of the plugs. *s s'* are the two contact-pieces of the plug.
 5 The plugs are constructed and the contact-pieces are arranged so that when a plug is inserted into a switch the spring is pressed away from the contact-point, the contact-piece *s* forms connection with the spring *g*, the contact-piece *s'* forms connection with the contact-piece *j* of the switch, and the contact-point *h'* is insulated from the contact-pieces of the plug. The plugs should be inserted into the switches in such a direction that they
 10 form the connections as above described.

Y is the looping-in switch for the pair of cords shown. *c* is the clearing-out annunciator. *t* is the operator's telephone, and *B* is her calling-generator. The looping-in switch has two
 20 levers and three pairs of contact-points, on which the levers may alternately be placed at the will of the operator. One pair of the contact-points are marked *m m'*, and they are connected by a loop which contains the operator's telephone. The pair adjoining them
 25 are marked *n n'*, and they are connected by a loop which contains the operator's calling-generator. The next pair are marked *p p'*, and they are connected by a loop which contains the clearing-out annunciator. When the levers pass from *m m'* to *p p'*, they rest on
 30 *n n'*.

The connection of the different parts are substantially as shown.

35 Only one pair of switch-plugs, with their cords and looping-in switch, are shown. Other pairs, as are found desirable, may be added to the operator's system in a way which will be apparent to those skilled in the art.
 40 She needs but one telephone and calling-generator.

The lever of the looping-in switch normally rests on the contact-points *m m'*.

45 *o o'* are a pair of contact-points, of which *o* is a stationary point and is connected by a circuit-wire to the cord-circuit which connects the two contact-pieces of the plugs which are not directly connected to the switch-levers, and *o'* is a contact-point which is connected to one of the levers, as shown, and moves with the lever. The contact-points
 50 *o o'* are in contact when the switch-levers are on the contact-points *m m'* and are out of contact when the levers are moved to the other points of the switch. The contact *o'* should be so placed that it will not make contact with *m* or *n* when the switch-levers are moved from their normal position.

55 In the operator's test system shown in Fig. 3, *T* is the loop test-plug. *t'* is the test receiving instrument, and *B'* is the test-battery. *u* is the rubber insulation of the plug, and *v v'* are its contact-pieces. The plug is constructed and the pieces are arranged so that
 60 when the plug is inserted into any switch the spring is pressed away from its contact-point, the contact-piece *v* forms connection with the

spring *g*, the contact-piece *v'* forms connection with the extension-piece *h*, and the contact-piece *j* of the switch is not in contact
 70 with the contact-pieces of the plug. The plug should be inserted into the switches in such a direction that they form the connections as above described. The two contact-pieces *v v'* of the plug are connected by a
 75 flexible conducting-loop in which is the test receiving instrument and battery.

Each operator has a cord system and a test system, and they are conveniently mounted at her board for her work. The conducting-cords of the plugs should be long enough,
 80 so that she can connect any plug with any switch at her board.

In the subscriber's station apparatus shown in Fig. 4, 1 is the telephone-switch. 2 is the
 85 calling-generator. 3 is the signal-receiving bell. 4 is the subscriber's telephone. 5 is the secondary, and 6 the primary, of the induction-coil. 7 is the transmitter. 8 is the transmitter-battery. 9 is a condenser. These
 90 parts may be of usual forms of apparatus and are connected as shown or in other ways, so as to perform practically the operations required and the operations hereinafter described.

95 When the subscriber's telephone is on its switch, the signal-receiving bell is in the circuit of the line, and the telephone, the secondary of the induction-coil, and the condenser are shunted by a wire of small resistance, so as to be practically out of the circuit.
 100 When the telephone is off the switch, the telephone, the secondary of the induction-coil, and the condenser are in the circuit, and the signal bell is practically out of the circuit.

105 The test receiving instruments and test-batteries should be so constructed and adjusted to each other and the circuits that the instrument will sound or respond when it and the battery are looped into the closed circuit
 110 of any single line and the subscriber's telephone is not off its switch for use, but will not respond if the circuit is open at any point, or if the subscriber's telephone is off its switch and the condenser at the subscriber's
 115 station is included in the circuit, or the line is switched with another line and thereby has its test-circuit open or is included in circuit with another line, as will hereinafter be indicated.

120 The general features of the operation of the switch system as shown and described will be readily understood by those skilled in the art.

125 The operation of the test system is as follows: When an operator desires to test a line, she places her test-plug into the switch of the line and by so doing disconnects the points *g* and *h* of the switch and connects them with the contact-pieces of the plug. If, then, the
 130 line is not switched at any board and the subscriber's telephone is on its switch, the test receiving instrument will sound or respond, indicating that the line is free to be switched

to. If, however, the subscriber has taken his telephone from the switch for use, the instrument will not sound, as the condenser in the circuit will prevent it from doing so. If, again, the line is switched at some board and the test is made in the cut-off portion of the line—that is, that portion which is between the switch used for switching and the office ground—the instrument will not sound, because the test-circuit is open at the pair of contact-points of the switch used for switching.

If, again, the line is switched at any board with another line and the test is made in some switch between the one used for switching and the subscriber's station, the instrument will not sound on account of the condenser being in the circuit in which the test receiving instrument is included and on account of the extra resistance of the other line.

When a test of a line is made and the test receiving instrument sounds, the operator knows that neither the line is switched for use nor the subscriber's telephone is switched for use, and when the instrument does not sound she knows that either the subscriber's telephone is switched for use or the line is switched for use, and she will not connect the line with any other line.

By this system a subscriber's line is reserved to himself from the time he takes down his telephone for use or the line is switched for use.

In multiple-switchboard systems an operator to whom certain lines are assigned to answer frequently receives several calls at practically the same moment, and it may require some time before she can switch to a certain line and answer its call. In systems in which the test depends only on the line being switched at some board another operator may in the meantime test the line and finding it to test "free" may switch it with another line and cause annoyance and confusion to the subscriber. This cannot occur in this system of testing, 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 arises 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 with another line. Lines in this condition are technically called "tied up." This, again, cannot occur in this system, because the line will test "busy" until it is disconnected at the central office whether or not the subscriber's telephone is on its switch. The system therefore combines the

advantages and obviates the disadvantages of the two general systems of testing outlined above.

I claim as my invention—

1. In a telephone-exchange system, multiple switchboards, and metallic-circuit lines each normally on closed circuit, switches for said lines one on each board, each switch having a pair of contacts through which in series one side of the line passes and each switch having a contact-piece to which the other side or return limb of the line is connected in combination with switch apparatus by which each line may be switched with any other line, a condenser at the subscriber's station and a switch with contacts to switch the condenser into the circuit of the line when the subscriber's telephone is switched for use, a test receiving instrument and battery in a loop and switch apparatus by which said loop may be switched into the normal circuit of the line, said instrument and battery being so adjusted to each other and the line that the instrument sounds when they are included in the normal closed circuit of the line but does not sound when on open circuit or on closed circuit with the line with the condenser in the line-circuit or on closed circuit with the line and another line, substantially as set forth.

2. In a telephone-exchange system, multiple switchboards and metallic-circuit lines one side or branch of each of which passes through a pair of switch contact-points to the other side or branch of the line, the same being to contacts of the spring-jacks of the line on the several boards, in combination with switch apparatus by which when the two sides of the line are connected through such switch with the two sides or branches of any other metallic-circuit line said pair of contact-points is open, a condenser at the subscriber's station and a switch with contacts to switch the condenser into the line-circuit when the subscriber's telephone is switched for use, a test receiving instrument and battery in a loop and switch apparatus by which said loop may be switched into the normal circuit of the line, said instrument and battery being so adjusted to each other and the line that the instrument sounds when they are included in the normal closed circuit of the line but does not sound when on open circuit, or on closed circuit with the line with the condenser in the line-circuit, or on closed circuit with the line and another line, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

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C. M. BROOKE.