

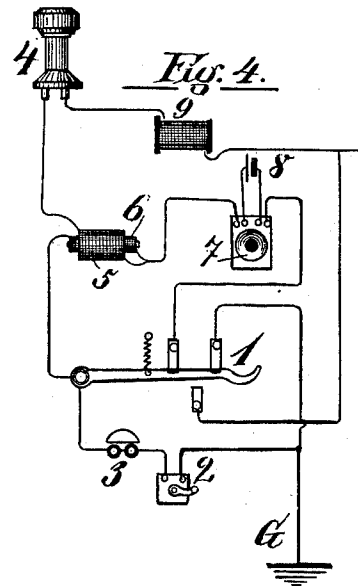
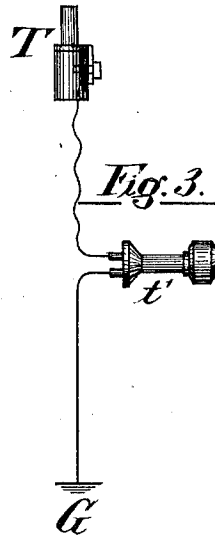
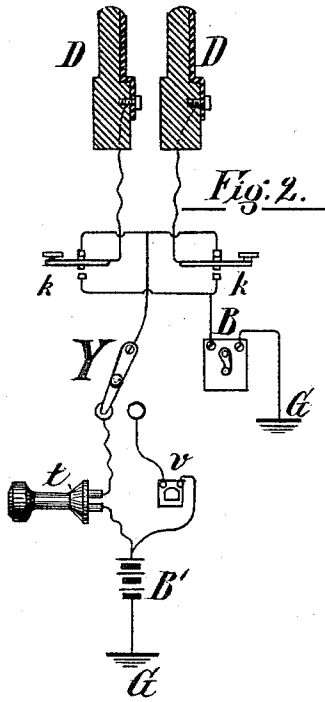
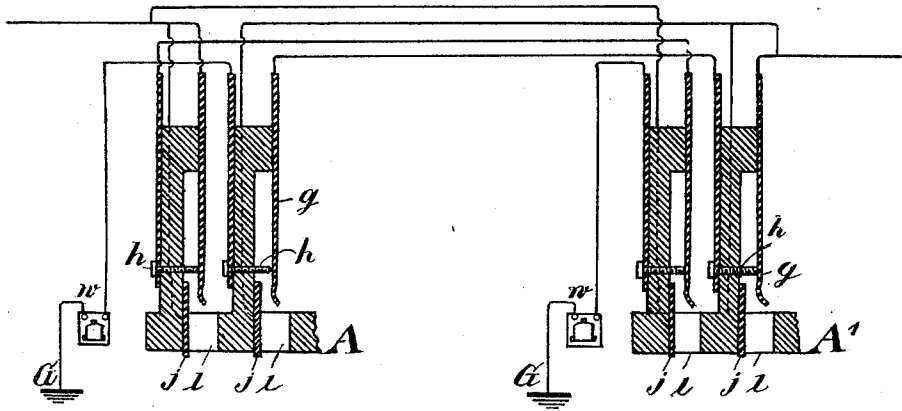
(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,415.

Patented Oct. 26, 1897.

Fig. 1.



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. 592,415, dated October 26, 1897.

Application filed November 30, 1891. Serial No. 413,607. (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 in Geneva, in the Republic of Switzerland, 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 are grounded at their outer ends; and it consists in a system of answering calls, testing, and clearing-out connections which I shall describe and claim in detail.

In the drawings illustrating my invention, Figure 1 represents sectional views of sections of two switchboards and two lines connected to the boards, with their switches, line-annunciators, and central-office connections. Fig. 2 shows an operator's cord system to be used at each board. Fig. 3 shows an operator's test system to be used at each board, and Fig. 4 is a diagram of a subscriber's station apparatus for each line.

In Fig. 1, A A' are the two sections of the switchboards. Each board has a switch for each line of the exchange. Each switch has a contact-spring and a contact-point with which the spring is normally in contact and a contact-piece placed along the switch-hole. The metal parts are mounted on a rubber strip of suitable shape, through the front of which is the switch-hole. *gg* are the contact-springs; *h h*, the contact-points, on which the springs normally bear. *ll* are the switch-holes, and *jj* the contact-pieces along the switch-holes. *aa* are the rubber strips, on which the metal parts are mounted. The parts are so constructed and arranged that when a switch-plug (shown in Fig. 2 and marked D D) is inserted into the switch-hole it presses the contact-spring *g* away from the point *h* and the contact-piece of the plug forms connection with the spring, or it may form connection with the contact-piece *j* of the switch, as will hereinafter be indicated.

ww are the line-annunciators, one for each line.

Each line passes successively through the contacts *g h* of its switches on the several boards, passing in each case to the spring *g* first and from the last contact *h* through its annunciator to the ground. The contact-pieces *jj* of the switches of the line are connected with the line before it passes to any contacts *g h* of its switches.

In Fig. 2, D D are a pair of switch-plugs, each adapted to be inserted into the switch-holes at its board and to operate the switches, as described. *k k* are two calling-keys, one for each plug. Each key has a lever to which the contact-piece of its plug is connected through a flexible switch conductor and a contact-point with which the lever is normally in contact. This contact-point is connected with the corresponding point of the other key. Each key has also another contact-point, which is normally out of contact with the lever. When the lever is depressed or operated, it is pressed out of contact with the first-mentioned point of the key and into contact with the other point. Y is a switch, and *v a* a clearing-out annunciator, one switch and one annunciator for each pair of plugs. *t* is the operator's telephone, B a calling-generator, and B' a battery which may be used both in testing and in clearing-out signaling, as will be indicated. One calling-generator and one battery B' will answer for the exchange.

The lever of the switch Y is connected with the circuit which connects the two contacts of the keys of the pair of plugs normally in contact with the levers. One side of the battery B' is grounded. One of the switch-bolts, on which the lever of the switch Y may be placed by the operator, is connected, through the operator's telephone, to the other side of the battery and the other switch-bolt is connected with the same side of the battery through the clearing-out annunciator. The generator is grounded on one side and connected on its other side to each of the points normally out of contact with the key-levers.

Other pairs of plugs with their special apparatus may be connected to the operator's cord system, substantially as shown and as will be evident to those skilled in the art.

In the operator's test system shown in Fig. 3, T is the test-plug, which is adapted to be

brought for testing into connection with any contact-piece j at its board. t' is the test receiving instrument. The plug is connected, through the test receiving instrument, with the ground.

Each operator has one cord system and one test system located at the board where she operates.

In the subscriber's - station apparatus shown in Fig. 4, 1 is the telephone-switch. 2 is the calling-generator. 3 is the signal-receiving bell. 4 is the subscriber's telephone. 5 is the secondary, and 6 is the primary, of the induction-coil. 7 is the transmitter. 8 is the transmitter-battery. 9 is a resistance-coil of suitable resistance to operate as hereinafter described. These 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.

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 resistance-coil are shunted by a wire of small resistance, so as to be practically out of the circuit. When the telephone is off the switch, the telephone, the secondary of the induction-coil, and the resistance-coil are in the circuit and the signal-bell is practically out of the circuit.

The resistance of the telephone and secondary of the induction-coil combined aggregate in well-constructed apparatus about four hundred ohms and the resistance of the signal-bell is about one hundred ohms. The resistance of the line-circuit when the telephone is off its switch for use is therefore much greater than is the resistance while the telephone is on the switch. I utilize this difference in resistance to send the clearing-out signals, as will hereinafter appear. If the difference in resistance when the telephone is off the switch for use and when it is in its normal position on the switch is not sufficient to secure an easy adjustment of the clearing-out system, such additional resistance as is required may be placed in the resistance-coil 9. Whether this artificial resistance is used and its amount if used will depend on the apparatus and circuits to which the system may be applied.

The operation of the system is as follows:

When a subscriber wishes a connection, he operates his generator and the call is indicated on the line-annunciator. The operator who sees the call places one of her switch-plugs into the switch of the line and thereby disconnects the line from the ground connection through the annunciator. She then places the switch Y, which belongs to the plug, in such position that it is grounded through her telephone and the battery B', and her telephone then being on closed circuit with the line she finds out by conversation what line is wanted. She then tests the

line wanted, as will hereinafter be indicated, and if it tests "free" or "unswitched" she places the plug which is the mate to the other one used into the switch of the line wanted, which disconnects this line also from its ground connection through its line-annunciator and leaves the two lines connected together. She then presses or operates the key whose lever is connected with the line wanted and by so doing disconnects the line from the other line and sends a calling-current over it. She then releases the key-lever and the lines are again in circuit with each other. She then moves the lever of the switch Y so that the circuit is grounded through the clearing-out annunciator v and the battery B'. She may if she wishes signal to the subscriber who made the call that the connection is complete by pressing on the other key.

The battery B' should be of such strength with reference to the annunciator and circuits that when two subscribers are thus connected and carrying on conversation with their telephones off their switches the battery is not strong enough to operate the annunciator, but when the telephones are placed on their switches after conversation, thereby greatly decreasing the resistance of their respective circuits, as heretofore indicated, the current from the battery operates the annunciator. The mere act of replacing the telephones on the switches after conversation therefore automatically sends a clearing-out signal to the operator in the central office and the subscribers are not under the necessity of sending in a clearing-out signal from their calling-generators in order to have their connections promptly disconnected after they are through conversation. This is of great advantage in a telephone-exchange, as the subscribers frequently place their telephones on their switches after they are through conversation and forget to send any clearing-out signals from their generators. The result is that the lines are frequently left connected after conversation has ceased and any other operator testing the line will not be able to make any desired connection with it and also that when the subscriber sends a new call it is indicated on the clearing-out annunciator and the operator, thinking it is a clearing-out signal, merely disconnects the line and does not connect her telephone to it to answer a call.

When an operator desires to listen to the circuit of two lines connected together for conversation, she places the switch Y, connected with their circuit, so that her telephone is connected to it and part of any telephone-current passing over the circuit will go to ground through her telephone.

The clearing-out annunciators should preferably be of high resistance and of considerable retardation, so that an undue amount of any telephone-current passing over a circuit will not go to ground through the annunciator-coils. The annunciators therefore act as

retardation or retarding coils to the ground connections at the central office, although special retardation-coils may be used.

The test system is as follows: When a line is switched for conversation, its circuit is grounded through the battery B'. If when it is in that condition a test-plug is applied to the contact-piece *j* of the line at any board, a complete circuit is established which contains the battery and the operator's test receiving instrument, and the instrument will sound, indicating that the line is already switched for use. This complete circuit is from the ground through the battery to the line where the line is switched, and from the line to the contact-piece *j* where the test is made, and thence through the operator's test receiving instrument to the ground. When a line is tested which is not thus switched for use, no circuit is established on testing it which contains a battery and the test receiving instrument.

When the calling-generator B is connected to a line-circuit and the line is tested, there will be a current from the generator through the test receiving instrument which will give a test indication in the instrument. In any case, therefore, the line will test "busy" when a switch-plug is in one of its switches.

The circuit of each test system from its plug to the ground should be of sufficiently high resistance so that when connected to any line which is switched for conversation the test will not cause enough extra current to pass through the clearing-out annunciator connected to the line to operate it. With a telephone for the test receiving instrument the test will be operative with a sufficiently high resistance in the circuit to accomplish this purpose. Special resistance-coils may be placed in the test systems to furnish such desired resistance.

The levers of the switches Y may be left normally so as to connect the operator's telephone with her several switch-plugs. The operations in answering a call will then be, first, to place one of her switch-plugs in the switch of the calling-line; second, test the line wanted; third, place the mate of said plug in the switch of the line wanted; fourth, operate the calling-key connected with the second plug, and, fifth, move the lever of the switch Y to its other position. In disconnecting a connection the operator merely takes the plugs from the switches and moves the lever of the switch Y to its normal position.

I claim as my invention—

1. In a telephone-exchange system, the multiple switchboards of the exchange to which the same telephone-lines are connected, two of said lines temporarily connected together at either of said boards for conversation, and an electric battery at the central office as long as the lines are thus connected in a circuit connection from the circuit of said lines to the ground, in combination with test receiving instruments, one at each board, each

instrument being grounded on one side and connected on its other side to its switch testing device, and test-bolts or contact-pieces, one for each line on each board, to each of which said test device at its board may be applied, each of said test-bolts or contact-pieces being connected to the circuit of its line between the line-switches and the subscriber's station, substantially as set forth.

2. In a telephone-exchange system, the multiple switchboards of the exchange to which the same telephone-lines are connected, two of said lines temporarily connected together at either of said boards for conversation, and an electric battery at the central office as long as the lines are thus connected in a circuit connection connected on one side to the circuit of said lines, in combination with test receiving instruments, one at each board, each instrument being connected on one side to the other side of said circuit connection, and connected on its other side to its switch testing device, and test-bolts or contact-pieces, one for each line on each board, to each of which said test device at its board may be applied, each of said test-bolts or contact-pieces being connected to the circuit of its line between the line-switches and the subscriber's station, substantially as set forth.

3. In a telephone-exchange system, the multiple switchboards of the exchange, each board being provided with switching devices whereby the operator may connect any two subscribers' lines together in circuit for conversation, and an electric battery through which each such circuit is grounded at the central office as long as it is switched for conversation, in combination with test bolts or pieces, one at each board for each line, each test-bolt being connected to its line between its switches and the subscriber's station, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with each test bolt or piece at its board, substantially as set forth.

4. In a telephone-exchange system, the multiple switchboards of the exchange, each board being provided with switching devices whereby the operator may connect any two subscribers' lines together in circuit for conversation, and an electric battery to one side of which each such circuit is connected at the central office as long as it is switched for conversation, in combination with test bolts or pieces, one at each board for each line, each test-bolt being connected to its line between its switches and subscriber's station, and test receiving instruments, one at each board, each instrument being connected on one side to the other side of said battery and connected on its other side to a plug or device adapted to be brought into connection with each test bolt or piece at its board, substantially as set forth.

5. In a telephone-exchange system, the

multiple switchboards of the exchange to which the same telephone-lines are connected, two of said lines temporarily connected together at either of said boards for conversation, and a clearing-out annunciator and an electric battery at the central office as long as the lines are thus connected in a circuit connection from the circuit of said lines to the ground, in combination with test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to its switch testing device, and test-bolts or contact-pieces, one for each line on each board, to each of which said test device at its board may be applied, each of said test-bolts or contact-pieces being connected to the circuit of its line between the line-switches and the subscriber's station, substantially as set forth.

6. In a telephone-exchange system, the multiple switchboards of the exchange, to which the same telephone-lines are connected, two of said lines temporarily connected together at either of said boards for conversation, and a clearing-out annunciator and an electric battery at the central office as long as the lines are thus connected in a circuit connection connected on one side to the circuit of said lines, in combination with test receiving instruments, one at each board, each instrument being connected on one side to the other side of said circuit connection, and connected on the other side to its switch testing device, and test-bolts or test-pieces, one for each line on each board, to each of which said test device at its board may be applied, each of said test-bolts or contact-pieces being connected to the circuit of its line between the line-switches and the subscriber's station, substantially as set forth.

7. In a telephone-exchange system, the multiple switchboards of the exchange, each board being provided with switching devices whereby the operator may connect any two subscribers' lines together in circuit for conversation, an electric battery through which each circuit is grounded at the central office as long as it is switched for conversation, and a clearing-out annunciator in each of such connections to ground, in combination with test bolts or pieces, one at each board for each line, each test-bolt being connected to its line between its switches and the subscriber's station, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with each test bolt or piece at its board, substantially as set forth.

8. In a telephone-exchange system, two telephone-lines connected together in a circuit for conversation, and an electric battery at the central office in a connection between said circuit and the ground, in combination with test bolts or pieces, one for each line on a switchboard, each connected to its line between the switch where the line is switched

for conversation and the subscriber's station, and a test receiving instrument at said board, grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said test-bolts, substantially as set forth.

9. In a telephone-exchange system, two telephone-lines connected together in circuit for conversation, and an electric battery and a retardation-coil at the central office in a connection between said circuit and the ground, in combination with test bolts or pieces, one for each line on a switchboard, each connected to its line between the switch where the line is switched for conversation and the subscriber's station, and a test receiving instrument at said board, grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said test-bolts, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, subscribers' lines grounded at their outer ends, switches for said lines, one switch for each line on each board, and connecting apparatus at each board to connect any two lines together for conversation which have their switches at such board, in combination with a test-battery and clearing-out annunciators, circuit connections whereby each line is grounded at the central office through a clearing-out annunciator and said test-battery as long as it is switched for conversation, test bolts or pieces one for each line on each board, connected to its line between its switches and the subscriber's station, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each test-bolt at its board, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, subscribers' lines grounded at their outer ends, switches for said lines, one switch for each line on each board, and connecting apparatus at each board to connect any two lines together for conversation which have their switches at such board, in combination with a test-battery and retarding-coils, circuit connection whereby each line is grounded at the central office through a retarding-coil and said test-battery as long as it is switched for conversation, test bolts or pieces one for each line on each board, connected to its line between its switches and the subscriber's station, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each test-bolt at its board, substantially as set forth.

12. In a telephone-exchange system, two subscribers' lines grounded at their outer ends and temporarily connected together at the central office in a circuit for conversation, and an electric battery and a clearing-out an-

nunciator in a circuit connection between such circuit and the ground, in combination with resistances at each subscriber's station and means for including a greater resistance into each line-circuit while the subscriber's telephone is switched for conversation than while it is switched out of use, the battery being of such strength as to operate said annunciator when the subscribers' telephones are switched out of use but not to operate it while they are switched for use, substantially as set forth.

13. In a telephone-exchange system, multiple switchboards, two subscribers' lines grounded at their outer ends and temporarily connected together at one of the boards in a circuit for conversation, and an electric battery and a clearing-out annunciator in a circuit connection between such circuit and the ground, in combination with resistances at

each subscriber's station, means for including a greater resistance into each line-circuit while the subscriber's telephone is switched for conversation than while it is switched out of use, the battery being of such strength as to operate said annunciator when the subscribers' telephones are switched out of use but not to operate it while they are switched for use, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each line, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

ANNA P. KELLOGG,
LEROY D. KELLOGG.