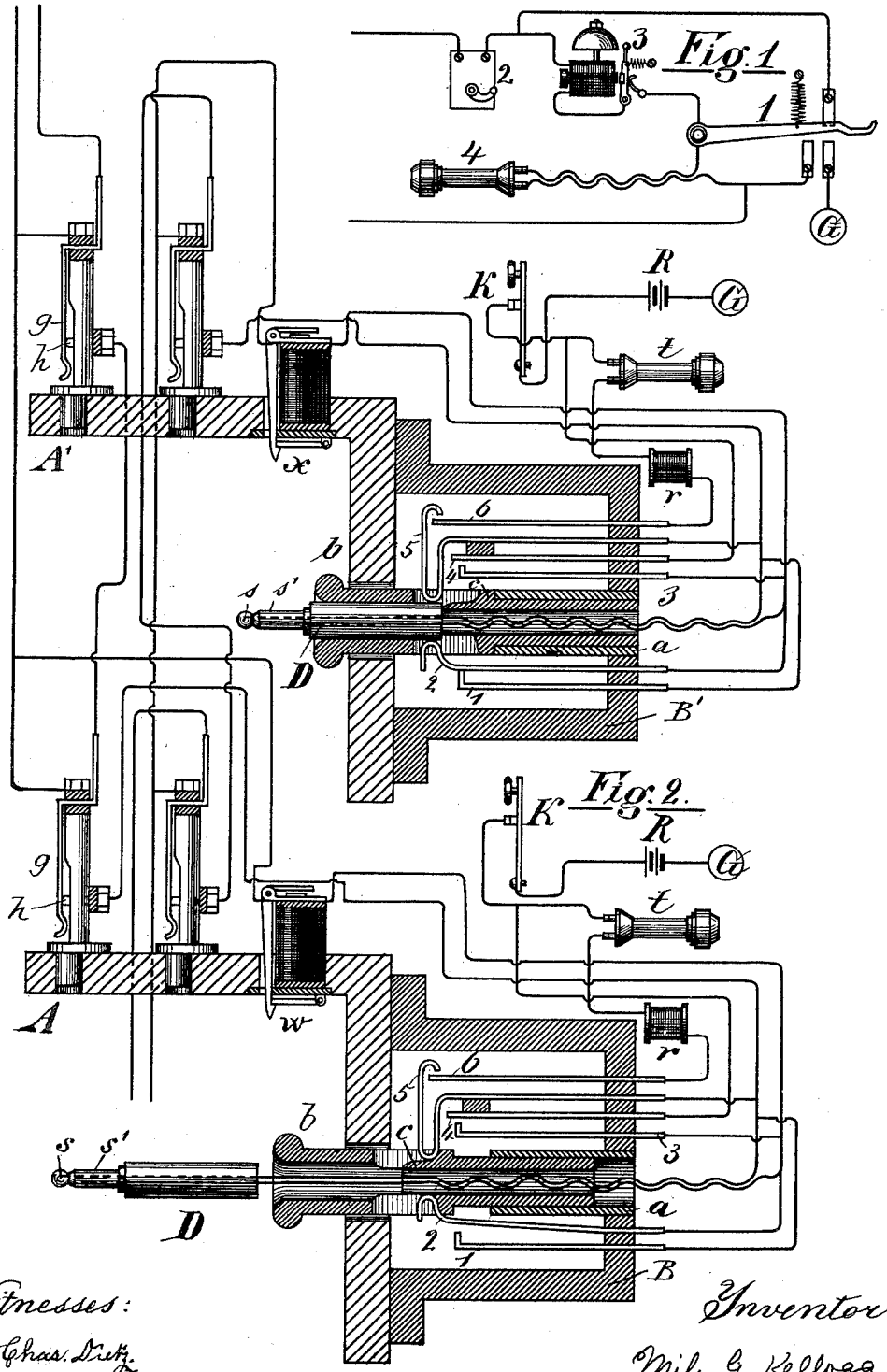
(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCHBOARD.

No. 592,380. Patented Oct. 26, 1897.



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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. 592,380, dated October 26, 1897.

Application filed July 28, 1890. Serial No. 360,133. (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 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.

My invention relates especially to a metallic-circuit telephone-exchange system in which there is a cord and a plug attached for each line and in which when it is desired to connect a line with another line the plug is placed in the switch of that line. Such a system is called a "single-cord" system. Said plug generally rests normally in a special switching device, and when it is desired to switch the line the plug is taken from the device to be placed in the switch of the line wanted.

My invention consists in a system of testing, a system of clearing-out annunciators and circuits, and in an organization of apparatus and circuits for each line whereby the operator may expeditiously and with few motions connect her telephone to the line when its call is indicated, may test the line wanted, may connect the two lines together for conversation, may connect her telephone to their circuit to determine whether they are through conversation, and may receive and attend to any clearing-out signal. In the organization which I shall describe and claim the apparatus and their connections are simple and the work required of the operators comparatively small.

In the accompanying drawings, illustrating my invention, Figure 2 represents the central-office apparatus and connections, and Fig. 1 the subscriber's-station apparatus and connections necessary to illustrate my invention.

In Fig. 2, A A' are sectional views of sections of two switchboards. On each board of the exchange is a spring-jack or similar switch for each line. Each switch has a contact-spring which is normally in contact with a contact-point and is separated and insulated from the point when a plug is inserted, and has another or third contact-piece insulated from the rest, except by the circuit connections. This third contact-piece is adapted to have a test-plug applied to it. The switches shown in the drawings are of well-known construction. For each line there is also a compound answering switch or device located at the board where its cord and plug are located and its calls are to be answered. This answering switch or device is operated on in part by the switch-plug when placed in its normal position in it and in part by the operator who answers the calls of the line. The construction, operation, and manipulation of these answering-switches will hereinafter be described in detail.

Two lines and their switches on the boards, their plugs and cords, their compound answering-switches, and their annunciators, are shown in Fig. 2. The answering apparatus of one line is shown as located at one board, and that of the other line is shown as located at the other board.

B B' represent the compound answering-switches of the two lines, and D D their switch-plugs, to which their double insulated flexible conductors are attached. These plugs are adapted to be placed in any switch at their boards and are each adapted to be placed normally, or when not in use for switching, in the compound answering-switch of its line and to operate the switch, as will be described. One of the plugs is shown in its switch, and the other plug is shown out of its switch.

In switches B B', *a a* are cylinders, preferably of metal, adapted to receive the movable commutator-pieces *b b*. These pieces may be of rubber and of the shape substantially as shown or of other shapes to correspond with variations in the other parts. 1, 2, 3, 4, 5, and 6 are contacts insulated from each other. 2, 4, and 5 are spring-contacts. The others may be rigid. Pieces 1 and 2 are mounted parallel to each other and in close juxtaposition, so that contact between them will be made and broken by the operation of the switch-plug, as hereinafter indicated. The pairs of contacts 3 4 and 5 6 are mounted parallel to each other and in close juxtaposition, so that the contact of each pair is made and broken, as hereinafter described, by the operation of the plug. Spring 4 is connected near its upper end to spring 5 by means of an

insulation-piece fastened to both. It therefore moves back and forth as spring 5 moves. Springs 2 and 5 are constructed and adjusted to press toward the center of piece *b* and press against and be acted upon by the plug, as will be indicated. Piece *b* has a hole or socket adapted to receive the plug-handle. It has also two chambers at its side adapted to receive the bent portions of springs 2 and 5, as shown, and has a shoulder adapted to rest on the piece *a* when *b* is moved to its lower position.

In the chamber adapted to receive the bent portion of spring 5 is a shoulder or projection, (marked *c*,) on which spring 5 bears when *b* is moved to its upper position, and which then cause the contacts to change as will be indicated.

Pieces *b b* are intended and adapted to occupy two positions—the upper position, as shown in B, and the lower position, as shown in B′.

When the switch-plug is in its socket in piece *b*, this piece should occupy its lower position, and the handle of the plug then presses on springs 2 and 5, so that spring 2 is brought into contact with spring 1 and spring 5 is pressed out of contact with spring 6, while spring 4, which is attached to but insulated from spring 5, is carried out of contact with piece 3. When the plug is withdrawn from the socket by the operator, the springs 2 and 5 are released from the pressure of the plug-handle and (the movable piece *b* being still in its lower position) the contact between 2 and 1 is broken, and that between 3 and 4 and that between 5 and 6, respectively, are established. When the plug is removed from the socket and the operator places piece *b* in its outer position, the contact between 1 and 2 still remains broken, and the shoulder *c* in the chamber of the piece presses spring 5 out of contact with piece 6, and spring 4 is carried out of contact with piece 3. When, therefore, the plug is in its socket and piece *b* is in its lower position, 1 and 2 are in contact and the other pairs of contacts of the answering-switch are out of contact. When the plug is out of the socket and the piece *b* still remains in its lower position, 1 and 2 are out of contact and 3 and 4 and 5 6, respectively, are in contact, and when the plug is out of the socket and piece *b* is raised to its upper position all of the three pairs of contact-points are out of contact.

The switch-plugs D D are of a usual construction of loop-switch plugs adapted for use with the spring-jack switches. The outsides of the handles have a rubber insulation. Each plug has two contact-pieces insulated from each other, one of them, *s*, being at the end of the plug-tip and the other, *s′*, being an insulated cylinder placed along the surface of the tip. When a plug is inserted into a switch, the piece *s* presses against the spring of the switch and forces it away from the contact-point and makes connection with it, and the other piece of the plug forms connection with the third or insulated contact-piece of the switch.

t t are operators' telephones; R R, calling-batteries; *r r*, resistance-coils, and K K, circuit-opening keys. Each operator has one of each of said parts and they are connected to each other and to her answering-switches substantially as shown and as will be described.

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

G G are ground connections. The connections are substantially as follows: One side or branch of each line passes successively through the pairs of contact-points of its switches, passing in each case to the spring first. It then passes through one of the insulated conductors of the switch-cord to contact-piece *s* of the switch-plug. The other side or branch of the line is connected to all of said third contact-pieces of the line-switches and is thence connected through the line-annunciator and the other conductor of the cord to contact-piece *s′* of the plug. The first-mentioned side or branch of the line is also connected to contact-pieces 1 and 5 of the compound answering-switch of the line, and the other side or branch of the line is connected to piece 3 of said switch, and also to contact-piece 2 of the switch. One side of the operator's telephone is connected to contact-piece 6, and the other side of the telephone is connected to contact-piece 4 of the switch and also to the ground through the calling-battery and the pair of contact-points of the key. The resistance-coil *r* is placed in the circuit with the telephone, between the contact-piece 6 and the contact-piece 4. Each compound answering-switch is connected to its line and to the operator's special apparatus substantially as described. These switches are distributed among the boards as their lines are assigned to the different operators to attend.

Weights or other suitable devices may be used to bring the switch-plugs into their normal position in their answering-switches when they are released from a connection, and they may also force the movable pieces *b* to their normal or lower positions.

The keys K K are two-point keys, the two points of which remain normally in contact, but are disconnected by the operator when he presses on the key-lever.

In the subscriber's-station apparatus shown in Fig. 1, 1 is the telephone-switch. 2 is the calling-generator. 3 is the signal-receiving bell, and 4 is the telephone. G is a ground connection.

The signal-receiving bell is an ordinary automatic vibrating or circuit-breaking bell which rings and alternately makes and breaks the circuit in which it is placed when a battery-current of sufficient strength passes

through it. The switch has contact-points and circuits substantially as shown. When the subscriber's telephone is on the switch, the line is grounded through a pair of contact-points and the signal-receiving bell is in the circuit of the line between the ground connection and the contact-pieces of the line-switches, and when the telephone is taken off the switch for use the ground connection is broken at the pair of contact-points and the signal-bell is shunted by a wire of small resistance, so that it will not be operated by a battery-current sent over the line and is practically out of the circuit. Other arrangements of circuits and contacts could be employed which would disconnect the line from the ground and switch or shunt the bell from the circuit when the subscriber's telephone is switched for use.

The operation of the system is as follows: When the plug of a line is in its normal position in the socket of the answering-switch and the line is not switched at any board and the subscriber's telephone is on its switch, the line is in a complete metallic-circuit, which contains the subscriber's calling-generator and signal-receiving bell and the line-annunciator and is grounded at the subscriber's station. The closed circuit of the line passes successively through the pairs of contact-points *g h* of its switches and the pair of contact-points 1 2 of its compound answering-switch. When the line is in this condition and a call is indicated on the annunciator, the operator withdraws the plug of the line from its normal position and the line is thereby automatically opened at the pair of contact-points 1 2 of the answering-switch and closed to the operator's telephone through the closing of the contacts at 3 4 and 5 6, respectively. The subscriber will in the meantime have taken down his telephone for use and by so doing removed the ground connection at his office and switched his bell out of and his telephone into the circuit, and the operator will by conversation find out what line is wanted. She then places the tip *s* of the plug of the line which called on the third or insulated contact-piece of the switch of the line wanted, and if the telephone of this line is on its switch (and the line therefore not in use) a circuit will be established and a current will pass from the test-battery to the line and through the branch of the line which contains the signal-receiving bell at the subscriber's station and thence to ground through the contact-points of the switch and the operator's telephone will be in this circuit. The bell will be actuated by the battery and will ring alternately, making and breaking its circuit, and this make and break of the circuit will be indicated to the operator in her telephone. She will therefore know that the subscriber's telephone is not switched for use and that she may switch to the line. She will then place the plug in the switch of the line tested and the two lines are connected together into metallic circuit and the subscriber wanted will have been called. She then raises the movable piece *b* of the answering-switch to its upper or outer position and the lines are in condition for carrying on conversation.

Should the operator afterward desire to listen into the circuit to determine whether the subscribers are through conversation, she presses on the key K, thereby opening its contact-points, and while the key is in this position she presses the piece *b* of the answering-switch to its lower position. By doing so the metallic circuit of the two lines is crossed or bridged by a circuit which contains her telephone and the resistance-coil, the connections being made by the closing of the pairs of contacts 3 4 and 5 6. She can then listen and determine whether conversation is passing over the circuit. The resistance-coil prevents an undue amount of the telephone-current from being diverted through the bridge connection. The use and operation of the key is to open the circuit of the subscriber's apparatus to the ground when she listens to determine whether conversation is through, so that if either subscriber has placed his telephone on its switch his bell will not be rung, thereby ringing his bell when he is not wanted for another connection.

If when the test was made as above described the subscriber's telephone were switched for use, his bell would not ring (and its make and break be indicated on the operator's telephone) for two reasons: First, the bell is switched out of the circuit and would not be influenced by any current passing over the line-circuit, and, second, the ground connection being broken and the test-circuit being a ground-circuit no current would pass through the line.

The apparatus required in this system and the movements required of an operator to answer a call and complete a connection are few and simple. These movements are, first, to withdraw the plug of the line from its normal position; second, to test the line wanted with the tip of the same plug; third, to insert the plug into the tip of the line wanted, and, fourth, to raise the movable piece *b* to its upper position. When the operator receives a disconnecting-signal, she is merely required to take the plug from the switch and place it in its normal position in piece *b* of the answering-switch and push this piece to its lower position. Both lines are then ready to receive a new call by the operations above described.

I use the terms "bridge" and "cross-connect" in connection with a complete metallic circuit to describe a connection between one side or branch of the circuit and its other side or branch, and an instrument in a bridge or cross-connecting circuit to a metallic cir-

cuit is not in the direct circuit, but is in a circuit connection across the two sides or branches of the circuit.

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

1. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's circuit or system containing a telephone and grounded through a battery, contact-points and connections by which when the plug is removed from the switching device the two sides or branches of the line are automatically closed to the two sides, respectively, of said operator's circuit or system, and a key or switch by which the operator may at will open such ground connections through the battery, substantially as set forth.

2. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's battery, contact-points and connections by which the battery, grounded on one side, is automatically connected on its other side to the circuit of the line when the plug is removed from the switching device, and a key or switch by which the operator may at will open such ground connection through the battery, substantially as set forth.

3. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's battery, contact-points and connections by which the battery, grounded on one side, is automatically connected on its other side to the circuit of the line when the plug is removed from the switching device, a commutator-piece adapted to be moved by the operator to disconnect the battery from such connection with the line, and a key or switch by which the operator may at will open such ground connection through the battery, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's circuit or system containing a telephone and grounded through a battery, contact-points and connections by which when the plug is removed from the switching device the two sides or branches of the line are automatically closed to the two sides, respectively, of said operator's circuit, a commutator-piece adapted to be moved by the operator to break such connection between the line and the operator's circuit, and a key or switch by which the operator may at will open such ground connection through the battery, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and which has two pairs of contact-points, each open while the plug is in the device but automatically closed on the withdrawal of the plug, two contact-points, one of each pair, connected to the two sides or branches, respectively, of the line, the two other points connected to the two sides of an operator's telephone, respectively, and the circuit containing such last points grounded through a battery, and a key or switch with contact-points by which the operator may at will open such ground connection through the battery, substantially as set forth.

6. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and which has two pairs of contact-points, each open while the plug is in the device but automatically closed on the withdrawal of the plug, two contact-points, one of each pair, being connected to the two sides or branches, respectively, of the line, the two other points being connected to the two sides, respectively, of an operator's telephone and the circuit connecting such last points being grounded through a battery, a commutator-piece adapted at the will of the operator to open such pairs of contact-points automatically closed on the withdrawal of the plug, and a key or switch with contact-points by which the operator may at will open such ground connection through the battery, substantially as set forth.

7. In a telephone-exchange system, a switch-plug, a metallic-circuit line, its two sides connected through two flexible conductors to the two contacts on said switch-plug, a switching device into which the plug is placed normally, or while the line is not in use, a pair of contacts in said switching device connected to said two flexible conductors, normally closed to each other but disconnected while the plug is out of the switching device.

8. In a telephone-exchange system, a switch-plug, a metallic-circuit line, its two sides connected through two flexible conductors to the two contacts of said plug, a switching device into which the plug is placed normally or while the line is not in use, a pair of con-

tacts in said switching device normally connected and thereby normally connecting together said flexible conductors, automatically opened by the withdrawal of said plug from said switching device.

9. In a telephone-exchange system, metallic-circuit lines, loop-switch plugs, one for each line, each having its two contact-pieces connected, respectively, through flexible conductors, to the two sides or branches of the line, switching devices, one for each plug, each switching device having a pair of contact-points which are closed while the plug is in its normal position in the device and automatically opened on the withdrawal of the plug, said points being connected, respectively, to the two sides or branches of the line, in combination with switches, one for each line, each having a pair of contact-points normally in contact and through which one side or branch of the line passes and a contact-piece to which the other side of the line is connected, each switch being adapted to receive either of said plugs and when the plug is inserted to have the pair of contacts opened and the two contact-pieces of the plug connected with the two sides or branches of the line to which the switch belongs, substantially as set forth.

10. In a telephone-exchange system, metallic-circuit lines, loop-switch plugs, one for each line, each having its two contact-pieces connected, respectively, through flexible conductors, to the two sides or branches of its line, switching devices, one for each plug and into which the plug is normally placed, each device having a pair of contact-points which are closed while the plug is in the device but automatically opened on the withdrawal of the plug, said points being connected, respectively, to the two sides or branches of the line, in combination with switches, one for each line, each having a pair of contact-points normally in contact and through which one side or branch of the line passes and a contact-piece to which the other side of the line is connected, each switch being adapted to receive either of said plugs and when the plug is inserted to have the pair of contact-points separated and the two contact-pieces of the plug connected with the two sides or branches of the line to which the switch belongs, and annunciators, one for each line, connected in the circuit of one branch of the line between a contact-piece of the line-plug and the line-switch, substantially as set forth.

11. In a telephone-exchange system, metallic-circuit lines, loop-switch plugs, one for each line, each having its two contact-pieces connected, respectively, through flexible conductors, to the two branches of the line, switching devices, one for each plug and into which the plug is normally placed, each device having a pair of contact-points which are closed while the plug is in the device but are automatically opened on the withdrawal of the plug, said points being connected to the two sides or branches, respectively, of its line, in combination with switches, one for each line, each having a pair of contact-points normally in contact and through which one side or branch of the line passes and a contact-piece to which the other side is connected, each switch being adapted to receive either of said plugs and when the plug is inserted to have the pair of contact-points which are normally in contact separated and the two contact-pieces of the plug connected with the two sides or branches of the line to which the switch belongs, and annunciators, one for each line, each connected in the circuit of one branch of its line between the said contact-piece of its switch and the contact-piece of its plug, substantially as set forth.

12. In a telephone-exchange system, a loop-switch plug having two plug-contacts, a metallic-circuit line having its two sides connected through two flexible conductors to said plug-contacts respectively, a switching device into which the plug is placed normally or while the line is not in use, said flexible conductors being normally connected together through the influence of said plug, but automatically disconnected by the withdrawal of the plug from its switching device, and an operator's telephone set adapted to be connected automatically in a bridge across said metallic circuit by said withdrawal.

13. In a telephone-exchange system, a loop-switch plug having two plug-contacts, a metallic-circuit line having its two sides connected through two flexible conductors to said plug-contacts respectively, a switching device into which the plug is placed normally or while the line is not in use, said flexible conductors being normally connected together through the influence of said plug, but automatically disconnected by the withdrawal of the plug from its switching device, an operator's telephone set adapted to be connected automatically in a bridge across said metallic circuit by said withdrawal, and a commutator-piece adapted to be moved by the operator and break such closed connection between the telephone and the line.

14. In a telephone-exchange system, a metallic-circuit line and a switch-plug to the two contact-pieces of which the two sides of the line are connected by flexible conductors, in combination with a switching device for the plug into which it is normally placed, said device having a pair of contact-points which are in contact when the plug is in the device and automatically open to each other when the plug is withdrawn, the two sides of the line being connected to said contact-points, respectively, and two pairs of contact-points which are open while the plug is in the device and automatically closed on its withdrawal, two of such contact-points, one of each pair, being connected to the two sides, respectively, of the line and the two other points being

connected to the two sides, respectively, of an operator's telephone, substantially as set forth.

15. In a telephone-exchange system, a metallic-circuit line and a loop-switch plug to the two contact-pieces of which the two sides of the line are connected by flexible conductors, in combination with a switching device for the plug into which the plug is normally placed, which has a pair of contact-points which are in contact when the plug is in the device and out of contact when the plug is withdrawn, the two contact-points being connected to the two sides, respectively, of the line, and which has two pairs of contact-points which are open to each other when the plug is in the device and automatically closed when it is withdrawn, two of such contact-pieces, one of each pair, being connected to the two sides, respectively, of the line and the two other points connected to the two sides, respectively, of an operator's telephone, and a commutator-piece adapted to be moved by the operator to open said pairs of contact-points which are closed on the withdrawal of the plug, substantially as set forth.

16. In a telephone-exchange system, a metallic-circuit line which is grounded at the subscriber's station and has a vibrating bell in its circuit when the subscriber's telephone is not switched for use and a loop-switch plug for the line, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's circuit or system containing a telephone and grounded through a battery, contact-points and connections by which when the plug is removed from the switching device the two sides or branches of the line are automatically closed to the two sides, respectively, of said operator's circuit, and a key or switch by which the operator may at will open such ground connection through the battery, substantially as set forth.

17. In a telephone-exchange system, a metallic-circuit line which is grounded at the subscriber's station when the subscriber's telephone is not switched for use and a loop-switch plug for the line, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a switching device into which the plug is normally placed and on which it operates, an operator's battery, contact-points and connections by which the battery, grounded on one side, is automatically connected on its other side to the circuit of the line when the plug is removed from the switching device, a commutator-piece adapted to be moved by the operator to disconnect the battery from such connection with the line, and a vibrating bell at the subscriber's station in circuit between such ground connections at the subscriber's station and the central office, substantially as set forth.

18. In a telephone-exchange system, a metallic-circuit line, a switch at the subscriber's station with contact-points by which the line is grounded when his telephone is not switched for use but not otherwise, and a vibrating bell at the subscriber's station in one side or branch of the line when the telephone is not switched for use, in combination with a circuit connection at the central office containing a battery and test receiving instrument, said circuit connection being grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with said branch of the line, said battery having sufficient strength to operate said bell and the test receiving instrument being such as to respond to the vibrations of the bell when the battery, bell and instrument are thus placed on closed circuit, whereby, by one motion, the operator tests the line and also calls the subscriber whose telephone is not switched for use, substantially as set forth.

In witness whereof I hereunto subscribe my name this 23d day of June, 1890.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,

C. STRICH-CHAPELL.