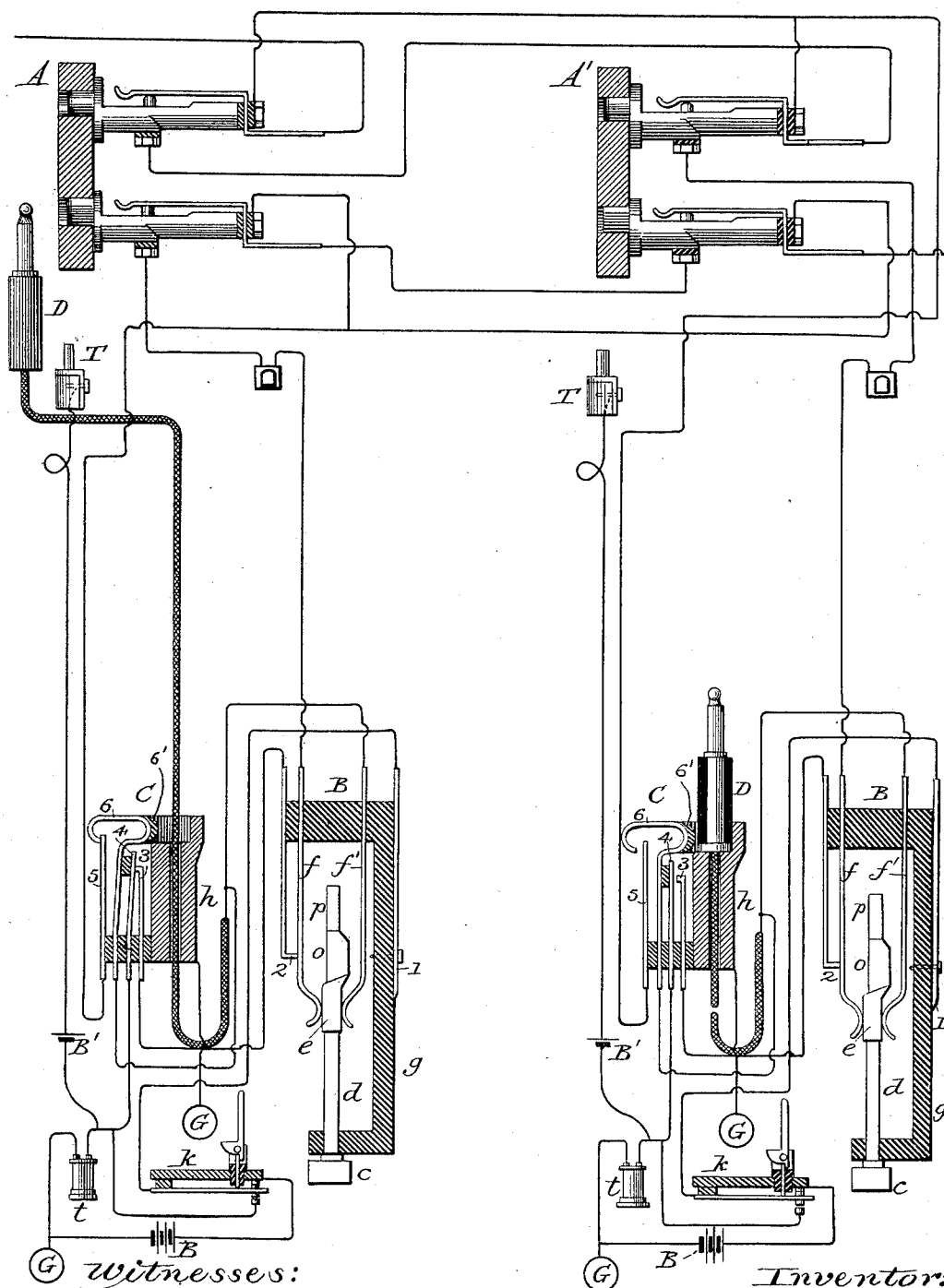


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,357.

Patented Oct. 26, 1897.



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. 592,357, dated October 26, 1897.

Application filed January 9, 1890. Serial No. 336,379. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, temporarily residing at Stuttgart, in the Empire of Germany, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to a single-circuit telephone-exchange system in which there is a cord and a plug attached to the cord for each line to which the line is normally connected. Said plug rests normally in a switching device, and when it is desired to switch the line with another line for conversation the plug is taken from its normal position and placed in the switch of the line wanted. Such a system is called a "single-cord system."

My invention consists of apparatus, circuits, and connections for each line whereby the operator may expeditiously and with few operations connect her telephone to the circuit of the line when its call is indicated, may test the line wanted to see whether it is in use, may connect the two lines together, may send signaling-current over the lines, may receive a clearing-out signal, may connect her telephone into the circuit to determine whether the subscribers are through conversation, and may disconnect the lines and place the line apparatus in readiness for receiving a new call.

In the accompanying drawing, illustrating my invention, A and A' represent sections of two multiple switchboards at the central office of the exchange to which the same lines connect. On each board 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, but is separated and insulated from the point while a plug is inserted into it, and a contact-piece which is normally insulated from the spring and is connected with it while the plug is inserted into the switch. This contact-piece is adapted to have a test-plug applied to it for testing. The spring-jacks shown in the drawing are old.

For each line is a switch by aid of which the operator's telephone and calling-generator may be connected and disconnected from the circuit of the line. As this switch is manipulated by the operator in answering the calls of the line, I call it the "answering-switch" of the line. Each line has also a switching device into which the switch-plug is placed normally or when it is not in use for switching. This device grounds the circuit of the line when the plug is inserted into it and has contacts which perform other functions in the operation of the system as the plug is in or out of the device and which I shall hereinafter describe. I will designate this device as the "plug-switching device" of the line.

Two lines and their switches on the boards, their plugs and cords, their answering-switches, their annunciators, and their plug-switching devices are shown in the drawing.

The drawing represents the answering apparatus of one of the lines as located at one of the boards and that of the other line as located at the other board.

B B represent the two answering-switches, C C the two plug-switching devices, and D D the two switch-plugs of the lines to which the flexible cords are attached and which are adapted to be placed in any spring-jack switch at the board where they may be located. These switch-plugs have each a metal tip adapted to be inserted into any line-switch and when inserted to press the spring of the switch from its contact-point and form connection with the spring, and they have also at the bottom of their handles metal sleeves in electrical connection with their tips. One plug is shown in its switching device and one plug is shown out of its device ready to be inserted into the switch of any line. In the answering-switches *g g* are rubber frames which support and insulate the parts.

f f' are contact-springs.

1 and 2 are contact-points, of which 1 is mounted in close proximity to spring *f'* and 2 in close proximity to *f*, so as to be brought into contact with them, respectively, as will hereinafter be described.

d is a rod which slides through a hole in the end of the frame.

c is a knob by which the operator slides the rod in and out as required in order to make the required connections.

e o p is an irregularly-shaped metal contact-piece attached to the rod and which moves in and out between springs *f f'* and is pressed upon by said springs as the rod is moved in and out by the operator. The knob and the metal piece afford stops which limit the inward and outward motions of the rod and the metal piece which it carries. As the rod and the irregularly-shaped metal piece move as one piece and their function is to change the circuit connections, I designate them as the "commutator-piece" of the switch. The metal parts are insulated, as shown. The outer portion of the irregularly-shaped metal piece on which the contact-springs are shown as bearing I have marked and designated as "piece *e*." The center portion is marked *o* and the inner portion of the piece is marked *p*.

The surface of the commutator-piece against which spring *f'* presses has a plane surface along *o* which extends far enough from the axis of the commutator-piece in its line of motion that when the spring rests on *o* it is pressed into contact with point 1. The surface of the commutator-piece against which spring *f* presses has a plane surface along *e* which extends far enough from such axis of the commutator-piece that when the spring rests on *e* it is pressed into contact with point 2. In all other positions of the commutator-piece the springs are not in contact with the points. In whatever position the commutator-piece may be placed the springs *f f'* bear on the metal piece *e o p*, which therefore electrically connects or bridges them. When the springs rest on the center portion *o*, spring *f'* is in contact with piece 1 and spring *f* is out of contact with piece 2. When the springs rest on the inner portion *p*, the springs *f f'* are not in contact with either piece 1 or 2.

In the plug-switching devices *C C*, *h* is a metal contact-piece connected to the ground with which the metal sleeve connected with the tip of the plug is in contact when the plug is in the device.

3, 4, 5, and 6 are contact-pieces which are insulated from *h* and are insulated from each other when the plug is in the device. 4 and 6 are spring-contacts and the others may be without elasticity. They are mounted parallel to each other and in close juxtaposition. 4 is connected with 6 near its tip by an insulation-piece, so that it moves back and forth as 6 moves. Spring 6 has an insulation-piece 6', as shown, on the side where the switch-plug presses when placed in the switching device. Piece 6 is an irregularly-shaped spring which bears on the plug when the plug is inserted, is insulated from the contact-piece of the plug, and is moved by the plug on its insertion, so as to make the switch connections I shall now describe. When the plug is in the device, it presses or wedges spring 6 away

from contact with point 5, and spring 6 carries spring 4 away from contact with point 3. When the plug is withdrawn, the spring moves until it comes in contact with piece 5 and it carries or forces piece 4 into contact with piece 3.

k is a three-point key with the points arranged substantially as shown.

t is the operator's telephone. *B* is her calling-generator. *B'* is a test-battery, and *T* is her test-plug, connected, as shown, through a flexible conductor.

The connections are as follows and as shown: Each line passes successively through its pairs of switch contact-points on the several boards, passing in each case to the spring first. It then passes through its annunciator to spring *f* of its answering-switch. The plug of the line is normally in its switching device which then grounds its contact piece or sleeve through the connection then established between it and piece *h* of the switching device. This contact-sleeve is connected through a flexible conductor to spring *f* and is also connected with the metal tip of the plug. All the normally-insulated contact-pieces of the line-switches on the several boards are connected together and are connected to contact-piece 5 of the plug-switching device. Contact-piece 6 of the switching device is connected to the circuit of the cord conductor. Contact-piece 2 of the answering-switch is connected with contact-piece 3 of the switching device. Contact-piece 4 is connected through the operator's telephone to the ground. Contact-piece 1 is connected with the lever of the key, and the upper contact-point of the key is connected through the calling-generator to the ground. The lower contact-point of the key is connected to the telephone with the telephone between said connection and the ground connection. The test-plug is connected through the telephone and test-battery to the ground.

Each operator has but one telephone, one calling-generator, one key, one test-battery and one test-plug. Their connection with the apparatus of the other lines assigned to her to answer will be readily understood.

The operation of the system is as follows: When an operator receives a call on a line, she removes the line-plug from its normal position. By so doing she connects her telephone, grounded at one end, to the circuit of the line. The connection is through the pair of contact-points 3 and 4, the point 2 being also in connection with spring *f*, which is connected to the line and completing the connection. She then finds out what line is wanted and if on testing the line she finds that it is not in use she places the switch-plug in the line-switch and thereby connects the lines together. She then pulls the commutator-piece out as far as it will come and in so doing has disconnected her telephone from the line-circuit, has connected her calling-generator to the circuit and rung the two

bells, has disconnected the generator from the circuit, and leaves the lines connected together for conversation. When by this operation the spring f passes from piece e , the connection with piece 2 is broken and the telephone is disconnected from the circuit. While the spring f' remains on the piece o , it is in contact with the piece 1, and the calling-generator (the key not being depressed) is connected, grounded on one side, to the circuit of the lines on its other side. While the springs f f' rest on the piece p , the circuit of the lines is disconnected from both the operator's telephone and generator and they are in a closed circuit for conversation with the annunciator of the line in which the call originated in their circuit. When the plug of a line is withdrawn from its normal position for use, the normally open test-circuit of the line is connected with the line, the connection being made through the pairs of contact-points 5 and 6 of the switching device. When the plug is placed into the switch of the line wanted, the test-circuit of that line is also connected to the circuit through the contact piece or sleeve of the plug. When the plug is withdrawn and inserted into its normal position, both test-circuits are again opened.

The test of the line is as follows: Its normally open test-wire is crossed or connected with it when it is switched for conversation either by its plug being taken from its normal position or the plug of another line being placed in one of its switches, and the test-wire is therefore connected with the ground through the ground connection at the subscriber's station. When the test-plug is connected to the test-piece of a line and the line is not connected for use, no test-circuit is completed and the instrument will not sound. When, however, the line is switched for use, there is a complete circuit from the ground through the test receiving instrument and battery to the normally open test-circuit of the line and thence to the line and to its ground at the subscriber's station and the instrument will sound or respond, indicating that the line is in use.

When an operator desires to find out by listening whether the subscribers who are connected together are through conversation, she presses down the lever of the key k and while the lever is in this position pushes the commutator into its central position, and her telephone, grounded on one side, is connected on its other side to the circuit. When this is done, the circuit of the two subscribers is not interrupted, the telephone merely being connected as a third leg to the circuit, the connection being from spring f' to point 1 and thence to the key k and its lower contact-point to ground through the telephone. When she determines the condition of the line, she moves the commutator from such position and then releases the key.

When she desires to clear out a connection,

she removes the plug from the switch and places it in its switching device. She then while the key k is depressed pushes the commutator-piece into its inward position, (which is the position shown in the drawing.) When the apparatus is in this condition, it is ready to receive a new order from the subscriber with no other motion of the operator than to remove the plug from its normal position.

By the operation of the key k as described the operator can readily connect her telephone by a third leg to any circuit for listening and she can also change the commutator-piece from its outer position (which is the one in which it remains while the subscribers are in conversation) to its inner position, where it is ready to receive calls without sending a signaling-current over the line-circuit, as would be the case were the signaling-generator not thereby disconnected from the contact-piece 1 while the commutator-piece is passing its central position, where the spring f' bears on the piece 1. I prefer to have the key k actuated by a cam-lever, as shown in the drawing, or to have some other mechanism by which the contact-spring of the key may be placed in one or the other of its two positions and left there without the continued manipulation of the operator. By this means an operator may place the key in position where her telephone is connected to the lever and, leaving it there, be free to operate one after another of her answering-switches, so as to listen on the circuits or to put them in their normal condition.

The employment of the two pairs of contacts, that between f and 2 and that between 3 and 4 and the circuit, as described, enables me to connect a line to the operator's telephone for receiving an order by the mere act of withdrawing the plug from its normal position and then to disconnect the telephone from the circuit by the mere act of pulling the commutator-piece to the position in which it remains while conversation is going on between the two subscribers.

The arrangement of the spring f' , the contact-piece 1, normally connected to the calling-generator, and the portion o of the commutator-piece enables an operator to send a signal-current over the circuit of the lines connected by the mere act of withdrawing the commutator-piece from its normal position to the one it occupies while conversation is going on.

It will be seen from the description of the operation of the commutator-piece and the contacts with their connections operated upon by the commutator-piece that when the commutator-piece is in one position the operator's telephone is connected with the line, that when it is moved to another position the telephone is disconnected from the line and the generator is connected with the line, and that when it is moved to another position both the telephone and generator are disconnected from the line. It will also be seen that the op-

eration of moving the commutator-piece from the first to the last position is accomplished by one motion of the operator, as he moves the commutator-piece in one direction or plane. Generally two motions at least of the commutator-piece are required to accomplish these results in telephone-exchange operation. The system of calling, therefore, practically saves one motion of the operator when she answers a call.

Other arrangements of circuits and contacts than those shown and described may be employed in which the operator may by one motion of the commutator-piece of the line disconnect the telephone from the line, then connect the generator to the line, and finally leave the line disconnected from either telephone or generator. This arrangement of parts in connection with the key *k* and the connections to it, as described, enable the operator to listen and to place the apparatus in its normal position for receiving orders without disturbance of the subscribers.

By the organization as described the operator is enabled in a multiple system to answer a subscriber, make his connection, and call the line wanted with a minimum of operations and work. These operations are merely to take his plug from its normal position, place her test-plug on the test-bolt of the line wanted, place the plug in the switch of the line wanted, and withdraw the commutator-piece into its outer position.

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

1. In a telephone-exchange system, a switching device for a switch-plug normally connected to a line and in which the plug normally rests, said switching device having two contact-points which are normally separated when the plug is in the device and are in contact while the plug is out of the device, and an answering-switch for the line having a pair of contact-points normally closed but open while the switch-commutator is drawn from its normal position, and a pair of contact-points normally open but closed while the commutator is drawn from its normal position and again open while the commutator rests in the position it occupies while its line is switched for conversation, said pair of contact-points of the switching device and said first-mentioned pair of contact-points of the answering-switch being in a circuit which connects the line to the ground through the operator's telephone, and the other pair of contact-points of the answering-switch being in a circuit which connects the switch-plug to the ground through the operator's calling-generator, substantially as set forth.

2. In a telephone-exchange system, an answering-switch for a telephone-line, having a pair of contact-points to one of which the line is connected and to the other of which the operator's telephone is connected, grounded at its other end, and having another pair of contact-points to one of which the cord and

plug of the line is connected, and to the other of which the calling-generator is connected, grounded at its other end, in combination with a commutator-piece containing a metal contact-piece on which rest said first-mentioned contact-pieces of each pair and which electrically bridges or connects them, said commutator-piece being adapted to occupy three positions at the will of the operator, in the first of which said first-mentioned pair of contact-points alone are in contact, in the second of which said second pair of contact-points alone are in contact, and in the third of which neither of the two pairs are in contact, substantially as set forth.

3. In an answering-switch for a telephone-line, a contact-spring and a contact-point on one side of said spring, in combination with a commutator-piece, adapted to be placed in three positions at the will of the operator and to press against said spring on its other side, said commutator-piece having three surfaces against which said spring alternately presses, the middle surface being farthest from the center of said commutator-piece in its line of motion, whereby when the spring rests on said middle surface, and only then, it is in contact with said contact-point, substantially as set forth.

4. In an answering-switch for a telephone-line, a contact-spring and its contact-point and another contact-spring and its contact-point, in combination with a commutator-piece adapted to be placed in three positions and on which said springs press, said commutator-piece having three commutator-surfaces against which one of said springs alternately presses, the middle surface being farthest from the center of said commutator-piece in its line of motion, and having two other commutator-surfaces against which the other spring alternately presses, the commutator-surface on which said spring presses in the first position of the commutator-piece being farther from the center of the commutator-piece in its line of motion than the surface against which the spring presses in the two other positions of the commutator-piece, whereby in the middle position of the commutator-piece, and only then, the first-mentioned spring is in contact with the first-mentioned point, and in the first position of the commutator-piece, and only then, the second-mentioned spring is in contact with the second-mentioned point, substantially as set forth.

5. In an answering-switch for a telephone-line, a contact-spring and its contact-point and another contact-spring and its contact-point, in combination with a commutator-piece adapted to be placed in three positions and on which said springs press, said commutator-piece having a contact-piece of metal with three commutator-surfaces against which one of said springs alternately presses, the middle surface being farthest from the center of said commutator-piece in its line of motion, and two other commutator-surfaces

against which the other spring alternately presses, the commutator-surfaces on which said spring presses in the first position of the commutator-piece being farther from the center of the commutator-piece in its line of motion than the surface against which the spring presses in the two other positions of the commutator-piece, whereby said springs are electrically connected, and in the middle position of the commutator-piece, and only then, the first-mentioned spring is in contact with the first-mentioned point, and in the first position of the commutator-piece, and only then, the second-mentioned spring is in contact with the second-mentioned point, substantially as set forth.

6. In a telephone-exchange system, an operator's switch having a contact-spring, a contact-point on one side of the spring and a commutator-piece adapted to be placed in three positions at the will of the operator, and to press against said spring on its other side, said commutator-piece having three surfaces against which said spring alternately presses, the middle surface being farthest from the center of said commutator-piece in its line of motion, whereby when the spring rests on said middle surface, and only then, it is in contact with said contact-point, in combination with a telephone-circuit connected to said spring, a calling-generator and a circuit connection from said point through said generator to ground, substantially as set forth.

7. In a telephone-exchange system, an operator's switch having a contact-spring, a contact-point on one side of the spring and a commutator-piece adapted to be placed in three positions at the will of the operator, and to press against said spring on its other side, said commutator-piece having three surfaces against which said spring alternately presses, the middle surface being farthest from the center of said commutator-piece in its line of motion, whereby when the spring rests on said middle surface, and only then, it is in contact with said contact-point, in combination with a telephone-circuit connected to said spring, a calling-generator, a circuit connection from said point passing normally through said generator to ground, an operator's telephone and a switch by which the operator may at will switch the generator out of and the telephone into said circuit connection, substantially as set forth.

8. In a telephone-exchange system, telephone-lines and switch-plugs, one for each

line, each plug being adapted to be placed in a switch of either of the other lines and thereby connect its line with the other line, in combination with an operator's telephone grounded on one side, a calling-generator grounded on one side, and a commutator-piece for each line adapted to be moved in one plane or direction to occupy three switching positions in said plane, in one of which the other side of the telephone is connected to the line, in another of which said side of the telephone is disconnected from the line and the other side of the calling-generator is connected to the line, and in another of which neither said other side of the telephone nor said other side of the generator is connected to the line.

9. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation, in combination with an operator's telephone grounded on one side, a calling-generator grounded on one side, and a commutator-piece adapted to be moved in one plane or direction to occupy three switching positions in said plane, in one of which the other side of the telephone is thereby connected to the line, in another of which said side of the telephone is thereby disconnected from the line and the other side of the calling-generator is thereby connected to the line, and in another of which neither said other side of the telephone nor said other side of the generator is connected to the line.

10. In a telephone-exchange system, telephone-lines and switch-plugs, one for each line, each plug being adapted to be placed in a switch of either of the other lines and thereby connect its line with the other line, in combination with an operator's telephone, a calling-generator grounded on one side, and a commutator-piece for each line adapted to be moved in one plane or direction to occupy three switching positions in said plane, in one of which the telephone is connected to the line, in another of which the telephone is disconnected from the line and the other side of the calling-generator is connected to the line, and in another of which neither the telephone nor said other side of the generator is connected to the line.

In witness whereof I hereunto subscribe my name this 20th day of December, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
MARGARETHA RIEHL.