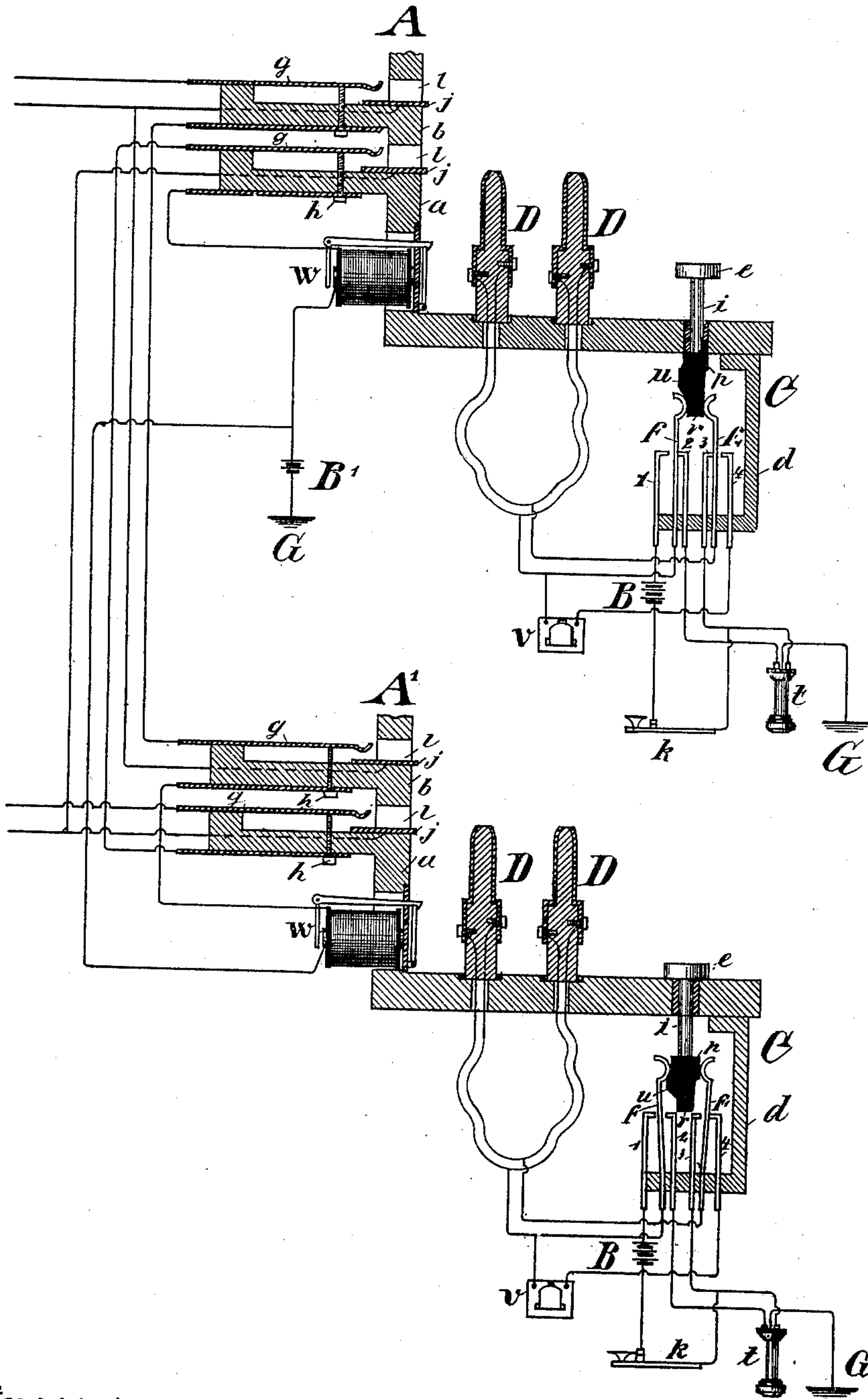


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,367.

Patented Oct. 26, 1897.



Witnesses:

Ernest Groves.  
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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. 592,367, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,076. (No model.) Patented in France March 25, 1890, No. 204,567.

*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 drawings, forming a part of this specification.

This system was patented to me in France, No. 204,567, dated March 25, 1890.

My invention relates to a metallic-circuit telephone-exchange system or an exchange containing such lines, in which the lines are connected together for conversation, and, secondarily, to a system in which the lines are connected by means of pairs of loop-switch plugs, the two contact-pieces of one plug of a pair being connected to the two contact-pieces of the other plug by means of double flexible conductors. Such a system is called a "double-cord" system.

My invention includes a system of testing and apparatus, circuits, and connections whereby the operator may quickly and with few motions connect her telephone to the circuit of the calling-line, may ascertain by a test whether the line wanted is already in use at another board, may connect the two lines together, may send a signaling-current over the circuit of the two lines, may receive a signal for disconnection, may connect her telephone to the circuit to determine whether the two subscribers are through conversation, and may disconnect the lines and place the apparatus in readiness for receiving new calls.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram showing two boards of a multiple system with my improvements applied thereto, and Fig. 2 is a similar view showing subscriber's-station apparatus.

A A' are sectional views of sections of two boards to which the same lines connect. Each switchboard has 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 when a plug is inserted

into it, and a contact-piece which is insulated from the other pieces (except by the circuit connections) and which is connected with a contact-piece of a switch-plug when the plug is inserted into the switch. This contact-piece of the switch is adapted to have a test plug or device applied to it for testing.

The contact-springs are shown at *g g*, while *h h* are the contact-points on which the springs normally rest, and *j j* are the contact-pieces of the switches. *l l* are the switch-holes, which are through the fronts of the rubber strips *a b*, on which the metal parts of the switches are mounted.

The switch-plugs marked D D are loop-plugs adapted to be inserted into the switch-holes. When a plug is inserted into a switch, one of its two contact-pieces forms connection with the spring and the other with the contact-piece *j* of the switch.

B' is a test-battery, and *w w* are line-annunciators.

G in each case in the drawings is a ground connection.

Two lines and their switches on the different boards and their line-annunciators are shown in the drawings.

The circuits of the lines are as follows and as shown: One side or branch of the line passes successively through the pair of contact-points *g h* of its line-switches on the boards, passing in each case to the spring first, and from the last point *h* through the line-annunciator to the common ground-wire of the lines in which is the test-battery B', and through the battery to the ground. The other side or branch of the line is connected to the contact-pieces *j j* of its line-switches. The two sides or branches of the line may be normally closed to each other at the subscriber's station and grounded there while the line-generator is operated to send a calling-current with the generator-armature between such ground and the normal ground of the line at the central office. The subscriber's signal-receiving bell should be in the circuit of the line when the telephone is not switched for use.

For each pair of plugs D D there is an operator's switching device. These switching devices are marked C C. There are one pair of plugs and one switching device shown at



each board. Other pairs may be added as required and connected to the operator's special apparatus, substantially as shown and as will be described.

5  $d d$  are the rubber supports of the switching devices.

$f f'$  are a pair of contact-springs of a device. 1, 2, 3, and 4 are contact-points.

$i$  is a movable piece, to one end of which is attached the irregular rubber piece  $p u r$ , and to the other end of which is the knob  $e$ . The piece  $i$ , with the rubber piece  $p u r$  and the knob  $e$ , move as one piece and may be called the "commutator-piece" of the switch. The 15 springs, points, and commutator-piece are so constructed, mounted, adjusted, and related to each other that when the commutator-piece is in its upper position, as shown at board A, the two springs  $f f'$  are in contact with the 20 two points 2 3, respectively, when the piece is moved to its central position, so that the springs rest on  $u$ ,  $f$  is in contact with 1 and  $f'$  is in contact with 3, and when the commutator-piece is moved to its inner position, as 25 shown at A',  $f$  is in contact with neither of the pieces and  $f'$  is in contact with 4.

$v v$  are clearing-out annunciators, of which there is one for each pair of plugs.

B B are calling generators or batteries.

30 K K are two-point keys, and  $t t$  are operator's telephones, of which there may be one of each kind of apparatus for each operator. The keys are two-point keys, having two contacts normally in contact, but separated at 35 the will of the operator.

The connections of a pair of plugs to its operator's switching device and to the operator's special apparatus are as shown and as follows: The two contact-pieces of one of the 40 plugs are connected to the two contact-pieces of the other plug, respectively, by two flexible-cord circuits, which are each permanently continuous—i. e., in the operation of the system the continuity of the connection between 45 the plugs is not at any time broken or interrupted by the operation of calling-keys, switches, or otherwise. One of these cord-circuits is connected to spring  $f$  of the switching device and the other is connected to spring  $f'$  50 of the device. Contacts 2 and 3 of the device are connected together through the operator's telephone. Contacts 1 and 3 are connected together through the operator's calling generator or battery and the contact-points of her 55 key. The cord-circuit, which is connected to spring  $f$ , is connected through the clearing-out annunciator of the pair of plugs to contact-piece 4. The wire which connects the two coils of the telephone is grounded.

60 In the operation of the system the commutator-piece of the operator's switching device of a pair of plugs remains normally in its outer position, as shown at the board A.

65 In the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch. 2 is the signal-bell. 3 is the calling-generator. 4 is the hand-telephone. 5 is the transmitter. 6 is the

primary, and 7 is the secondary, of the induction-coil, and 8 is the transmitter-battery. These parts may be of the usual forms of apparatus and connected as shown. The two sides 70 or branches of the line are normally closed to each other at the subscriber's station and grounded there by the automatic device of the generator while the generator is operated 75 with the generator-armature between such ground and the normal ground of the line at the central office.

The operation of the system is as follows: When a subscriber desires to call, he operates 80 his generator, thus establishing a closed circuit from the ground at his station through the armature of the generator, one side or branch of the line, and the line-annunciator to ground at the subscriber's station, thereby 85 operating his annunciator. When the operator at any board observes the annunciator of a line to indicate a call, she places one of the switch-plugs of a pair of her plugs in the switch of the line. By so doing the line is 90 disconnected from its normal ground connection through the test-battery and is included in a circuit with the operator's telephone. The connection is from the two contact-pieces 95 of the plug to the springs  $f f'$  of the switching device, and thence to the two sides of the telephone through points 2 3, respectively. The operator then finds out by conversation what line is wanted. She then tests the line by 100 placing a contact-piece of the other plug of the pair on the contact-piece  $j$  of the switch of the line tested. If she finds out that the line tested is free to be connected to, she places the plug in the switch of the line and 105 thereby disconnects the line from the normal connection through its annunciator and the test-battery and connects the two sides of the line in which the call originated to the two contact-pieces  $g$  and  $j$  of the switch of the 110 line tested. The two lines are then connected in a metallic circuit, which is bridged or cross-connected by the operator's telephone. She then presses the commutator-piece of the switching device of the pair of 115 plugs to its central position, so that the springs  $f f'$  rest on  $u$ ,  $f$  being then in contact with point 1. The circuit of the two lines is thus bridged or cross-connected through the calling generator or battery B and a split current will pass to both lines and will ring the bell 120 of the subscriber wanted. The operator then presses the commutator-piece to its lower position, as shown at switchboard A', and  $f'$  is in contact with the point 4 and the other contact-points of the switching device are 125 open. The clearing-out annunciator is thereby included in a bridge or cross connection to the circuit of the two lines and any clearing-out signal sent over the circuit of either line will be indicated on the annunciator. 130 The clearing-out annunciator is preferably of high resistance and constructed so as to offer considerable retardation to telephone-currents.



Should the operator at any time desire to listen into the circuit of the two lines connected together, she opens the contact-points of her key, and while the key is in that position moves the commutator-piece of the switching device to its outer position, when the circuit is bridged through the telephone. The opening of the key-contacts prevents any calling-current from going to the lines and giving a false signal that the lines are wanted in the event that either or both the subscribers have replaced their telephones on their switches. When the subscribers have finished conversation, either may operate his generator which is in the closed circuit of the metallic circuit of the two lines, and thus actuate the clearing-out annunciator, which is bridged across the circuit at the central office.

The operation of the test system shown is as follows: The operator places one of the contact-pieces of the second plug of the pair used on the contact-piece *j* of the switch of the line wanted. If the line is free, a closed circuit will be established from earth through one telephone-coil to the line tested and through the line to its normal earth connection through the test-battery at the central office and the operator will hear a sound or click in the telephone. If the line tested is already switched at any board, this test-circuit will be open and the operator hears nothing. The test therefore shows whether the line is in use at any board.

The operations of answering a call and making a connection are, first, to place a switch-plug in the switch of the calling-line; second, test the line wanted with the other plug of the pair; third, put the plug in the switch of the line, and, fourth, to push the commutator-piece from its upper to its lower position. The lines are thereby connected together, a calling-current is sent over them, and they are left connected together for conversation with the clearing-out annunciator bridging their circuit.

To disconnect a connection, the operator merely takes the plugs from the switches of the lines and moves the commutator-piece of the switching device to its upper position.

By the construction of the cord and switching apparatus and its operation, as described, the telephone, the generator, and the clearing-out annunciator are alternately in a bridge-circuit to the cords of a pair, (and consequently to the two lines to which the pair of plugs may be connected,) according to the position of the commutator-piece, and the signal-current is sent to the line wanted by the act of moving the commutator-piece so as to disconnect the telephone from and to connect the clearing-out annunciator with the circuit.

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 circuit 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 pair of loop-switch plugs, the two contact-pieces of one of which are connected with the two contact-pieces of the other, respectively, by flexible switch-conductors, in combination with an operator's telephone, a calling-generator, an annunciator, a switching device having two contact-springs each connected at all times to a contact on each of the plugs through a metallically-unbroken connection, respectively, two contacts connected with the two sides of said telephone, against which said springs normally bear, respectively, a third contact connected through the generator to one of said other contacts, a fourth contact connected through the annunciator to one of said flexible conductors, and a commutator-piece adapted to be successively in three positions, in the normal position said springs being in contact with said two first-mentioned contacts, in the second position one of said springs being pressed away from the contact with which it normally is in contact and into contact with said third contact, and in the third position said last-mentioned spring being out of contact with either of the contacts and said fourth contact being in contact with the other spring and said metallically-unbroken connections, substantially as set forth.

2. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected to the two contact-pieces of the other, respectively, by two flexible switch-conductors, in combination with an operator's telephone, a calling-generator, a switching device having two contact-springs each connected at all times through said conductors, respectively, to a contact on each of the plugs through a metallically-unbroken connection, two contacts connected, respectively, to the two sides of said telephone, against which, respectively, said springs normally bear, a third contact connected through said generator to one of said other contacts, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned points, in the second position the spring with which the generator is not normally in connection being pressed away from its normal contact into contact with said third contact and said metallically-unbroken connections, substantially as set forth.

3. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected to the two contact pieces of the other, respectively, by two flexible switch-conductors, in combination with an operator's telephone, an annunciator, a switching device having two contact-springs each connected at all times through said con-



ductors, respectively, to a contact on each of the plugs through a metallically-unbroken connection, two contacts connected, respectively, to the two sides of said telephone, against which, respectively, said springs normally bear, a third contact connected through said annunciator to one of said flexible conductors, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned contacts, and in the other position being out of contact with said contacts, and the spring not normally in connection with the annunciator, being in contact with said third contact, and said metallically-unbroken connections, substantially as set forth.

4. In a telephone-exchange system, two metallic-circuit lines temporarily connected in a metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, an annunciator, a switching device having two contact-springs connected with the two sides of said circuit, respectively, two contacts permanently connected with the two sides of said telephone, against which said springs normally bear, respectively, a third contact connected through the generator to one of said other contacts, which are connected with the two sides of the telephone, a fourth contact connected through the annunciator directly (and not through contacts) to one side of said circuit, and a commutator-piece adapted to be successively in three positions, in the normal position said springs being in contact with said two first-mentioned contacts, in the second position one of said springs being pressed away from the contact with which it normally is in contact and into contact with said third contact, and in the third position said last-mentioned spring being out of contact with either of the contacts and said fourth contact being in contact with the other spring, substantially as set forth.

5. In a telephone-exchange system, two metallic-circuit lines temporarily connected in a metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, a switching device having two contact-springs connected to the two sides of said circuit, respectively, two contacts permanently connected, respectively, to the two sides of said telephone, against which, respectively, said springs normally bear, a third contact connected through said generator to one of said other contacts which are connected with the two sides of the telephone, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned points, in the second position the spring with which the generator is not normally in connection being pressed away from its normal contact into contact with said third contact, substantially as set forth.

6. In a telephone-exchange system, two metallic-circuit lines temporarily connected in a metallic circuit for conversation, in combina-

tion with an operator's telephone, an annunciator, a switching device having two contact-springs connected to the two sides of said circuit, respectively, two contacts connected, respectively, to the two sides of the said telephone, against which, respectively, said springs normally bear, a third contact connected through said annunciator directly (and not through contacts) to one side of said circuit, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned contacts, and in the other position being out of contact with said contacts, and the spring not normally in connection with the annunciator, being in contact with said third contact, substantially as set forth.

7. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected with the two contact-pieces of the other, respectively, by flexible switch-conductors, in combination with an operator's telephone, a calling-generator, an annunciator, a switching device having two contact-springs connected with the two flexible conductors, respectively, two contacts connected with the two sides of said telephone, against which said springs normally bear, respectively, a third contact connected through the generator to one of said other contacts, a fourth contact connected through the annunciator to one of said flexible conductors, a key in circuit with said generator having a pair of contacts normally closed but opened at the will of the operator, and a commutator-piece adapted to be successively in three positions, in the normal position said springs being in contact with said two first-mentioned contacts, in the second position one of said springs being pressed away from the contact with which it normally is in contact and into contact with said third contact, and in the third position said last-mentioned spring being out of contact with either of the contacts and said fourth contact being in contact with the other spring, substantially as set forth.

8. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected to the two contact-pieces of the other, respectively, by two flexible switch-conductors, in combination with an operator's telephone, a calling-generator, a switching device having two contact-springs connected with said conductors, respectively, two contacts connected, respectively, to the two sides of said telephone, against which, respectively, said springs normally bear, a third contact connected through said generator to one of said other contacts, a key in circuit with said generator having a pair of contacts normally closed but opened at the will of the operator, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned points, in the second position the spring with which the generator is not normally in



connection being pressed away from its normal contact into contact with said third contact, substantially as set forth.

9. In a telephone-exchange system, two metallic-circuit lines temporarily connected in a metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, an annunciator, a switching device having two contact-springs connected to the two sides of said circuit, respectively, two contacts connected with the two sides of said telephone, against which said springs normally bear, respectively, a third contact connected through the generator to one of said other contacts, a fourth contact connected through the annunciator to one side of said circuit, a key in circuit with said generator having a pair of contacts normally closed but opened at the will of the operator, and a commutator-piece adapted to be successively in three positions, in the normal position said springs being in contact with said two first-mentioned contacts, in the second position one of said springs being pressed away from the contact with which it normally is in contact and into contact with said third contact, and in the third position said last-mentioned spring being out of contact with either of the contacts and said fourth contact being in contact with the other spring, substantially as set forth.

10. In a telephone-exchange system, two metallic-circuit lines temporarily connected in a metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, a switching device having two contact-springs connected to the two sides of said circuit, respectively, two contacts connected, respectively, to the two sides of said telephone, against which, respectively, said springs normally bear, a third contact connected through said generator to one of said other contacts, a key in circuit with said generator having a pair of contacts normally

closed but opened at the will of the operator, and a commutator-piece adapted to be in two positions, in the normal position said springs being in contact with said first-mentioned points, in the second position the spring with which the generator is not normally in connection being pressed away from its normal contact into contact with said third contact, substantially as set forth.

11. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected to the two contact-pieces, respectively, of the other by permanently and metallically continuous flexible-cord circuits, in combination with a bridge circuit or connection between the two cord-circuits which connect the two plugs, a clearing-out annunciator in said bridge circuit or connection, and switching apparatus constructed for and opening and closing said bridge-circuit at the will of the operator, substantially as set forth.

12. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of one of which are connected to the two contact-pieces of the other, respectively, by permanently and metallically continuous flexible-cord circuits, in combination with two bridge circuits or connections between the two cord-circuits which connect the two plugs, an operator's telephone in one of said bridge-circuits, a clearing-out annunciator in the other bridge-circuit and switching apparatus by which the operator may at will open or close either of said bridge-circuits, 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.