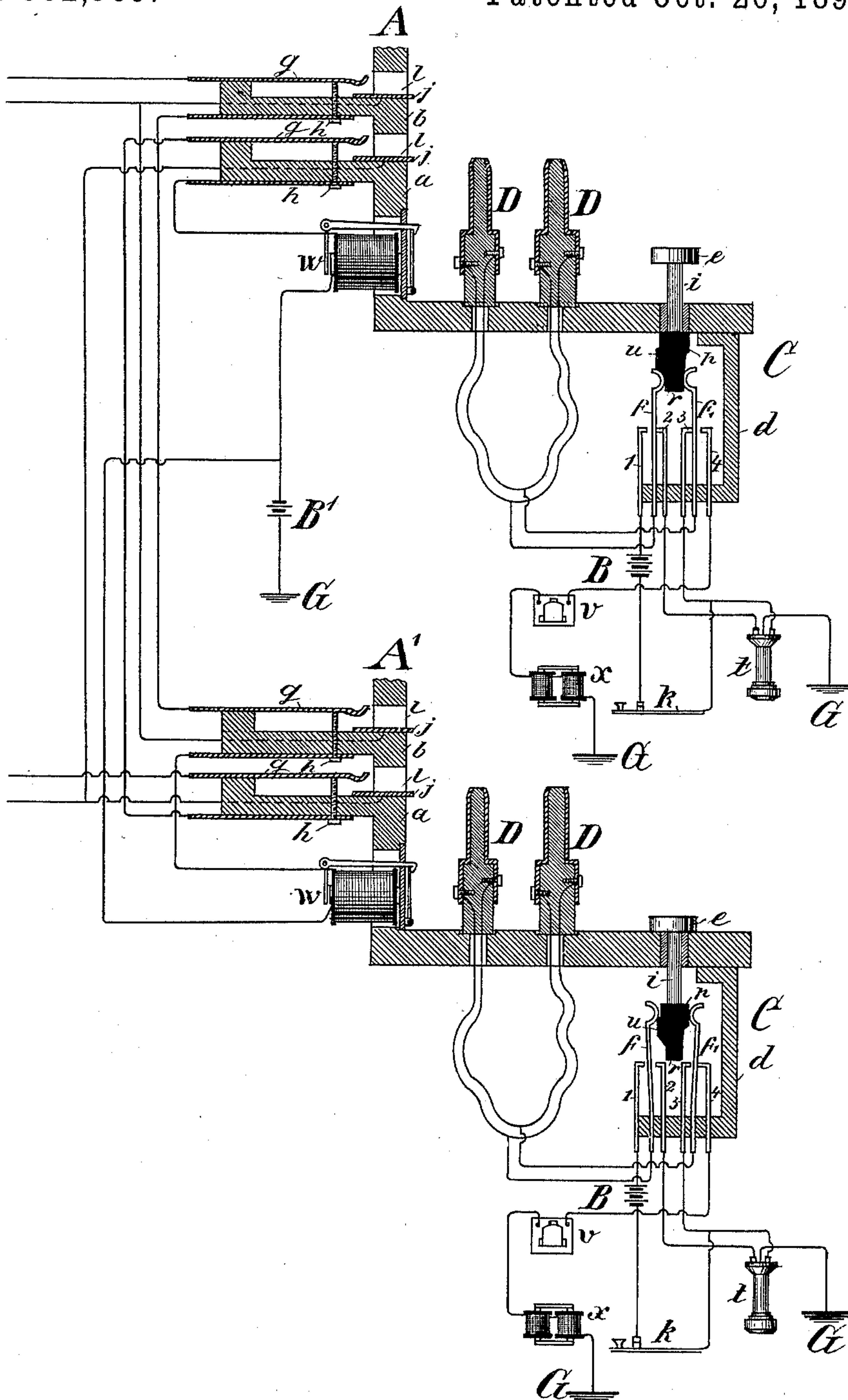


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,369.

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. 592,369, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,078. (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 metallic-circuit telephone-exchange system in which the lines are connected together for conversation 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, may connect the two lines together, may send a signaling-current over the line wanted, may connect her telephone to the circuit to determine whether the subscribers are through conversation, and may disconnect the lines and place the apparatus in readiness for receiving new calls.

In the accompanying drawing, illustrating my invention, A A' are sectional views of sections of two switchboards 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 from the point when a switch-plug is inserted into the switch, and has a contact-piece which is insulated from the rest (except by the circuit connections) and which is connected with a contact-piece of the switch-plug when the plug is inserted. This contact-piece 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 bear, and *j j* are the contact-pieces of the switches.

*l l* are the switch-holes 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 switches, and when a plug is inserted into a switch it separates the points normally in contact, and one of its contact-pieces forms connection with the spring *g*, while the other forms connection 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 drawing is a ground connection.

Two lines and their switches on the boards and their annunciators are shown in the drawing. The circuits of the lines are as follows and as shown: One side or branch of the line passes successively through the pairs of contacts *g h* of its switches on the boards, passing in each case to the spring first, and from the last contact *h*, through the line-annunciator, to the common ground-wire of the lines in which is the test-battery, and through the battery to ground. The other side or branch of the line is connected to pieces *j j* of the line-switches. The line should be grounded at the subscriber's station while his telephone is not switched for use, and this ground connection should be open while the telephone is switched for use. This can be accomplished in the usual way for such a connection by means of contact-points on the telephone-switch. The subscriber's signal-receiving bell may be placed in this ground-circuit.

For each pair of plugs there is an operator's switching device. These devices are marked C C. There are one pair of plugs and one switching device shown for each board. Other pairs may be added and connected, as will be described.

*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 irregularly-shaped rubber piece *p u r* and to the other end of which is attached 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." The springs and points 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 springs  $f f'$  are in contact with points 2 and 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 piece is moved to its inner position, as shown at A',  $f$  is in contact with neither of the points and  $f'$  is in contact with 4.

$v v$  are clearing-out annunciators, and  $x x$  are retardation-coils, of which there will be one of each for each pair of cords.

B B are calling generators or batteries.

$k k$  are two-point keys, and  $t t$  are operators' telephones, of which there may be one of each kind of apparatus for each 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 plugs are connected to the two contact-pieces of the other plug, respectively, by two flexible-cord circuits. One of these cord-circuits is connected to spring  $f$  and the other cord-circuit is connected to spring  $f'$  of the operator's device of the pair of plugs. Contacts 2 and 3 are connected together through the operator's telephone. Contact 1 is connected through the calling-generator and the normally closed contacts of the operator's key to contact-piece 3 of the switching device. Contact 4 is connected to ground through the clearing-out annunciator and retardation-coil of the pair of cords. Instead of using a separate retardation-coil the required retardation and resistance in this circuit connection or branch may be obtained in any other well-known way—for instance, by using annunciators of high resistance and retardation, as is well known and understood in the art.

The wire which connects the two coils of the telephone is connected with the ground.

The commutator-piece of each switching device remains normally in its outer position, as shown at board A.

The operation of the system is as follows: When the operator at any board observes the annunciator of a line to indicate a call, she places one plug of a pair of her plugs in the switch of the line. By so doing the line is disconnected from its normal ground connection through the test-battery and is included in circuit with the operator's telephone. The connection is from the two contact-pieces of the plug to the springs  $f f'$  of the switching device and thence to the two sides of the telephone through contacts 2 and 3, respectively. The operator then finds out by conversation what line is wanted. She then tests the line wanted by placing a contact-piece of the other plug of the pair on the piece  $j$  of the switch of the line wanted, and if she hears a click in her telephone she knows that the line is not in use and places the plug in the

switch. By so doing the line is disconnected from its connection to ground through the test-battery, and the circuit of the two lines is established with the circuit bridged or cross-connected through the operator's telephone. The operator then presses the commutator-piece to its central portion and the telephone is disconnected from the circuit and the circuit is bridged or cross-connected through the calling-generator. This connection is made by the contacts between  $f$  and 1 and between  $f'$  and 3, respectively. A calling-current will be thereby directed through the circuit of the line wanted and its bell will be rung. The operator then presses the commutator-piece to its inner position, as shown at A', and  $f'$  is in contact with 4, and the other points of the device are open. The generator is thereby disconnected from the circuit, and the circuit is grounded through the clearing-out annunciator and retardation-coil of the pair of cords, and any clearing-out signal will be indicated.

Should the operator desire at any time to listen to the circuit to determine whether the subscribers are through conversation, she opens the contact-points of her key and while the key is in that condition moves the commutator-piece to its outer position. The circuit is then bridged or cross-connected through the telephone. The operation of the key prevents any calling-current from going to the lines to give a false signal that they are wanted.

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, to test the line wanted with the other plug; third, to place the plug in the switch of the line wanted, and, fourth, to press the commutator-piece from its outer to its inner position. The lines are thereby connected together and signaling-current sent over the line wanted, and they are left connected together with their circuit grounded through the clearing-out annunciator.

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

The subscriber's-station apparatus should be such that his circuit is grounded at his station with his generator between such ground connection and the normal ground connection of the line at the central office when he is sending in his call.

I use the term to "bridge or cross-connect" a 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 is not in the direct circuit, but in a circuit connection across the two sides or branches of the circuit.

Instead of the clearing-out annunciator and retardation-coil in the grounded connection, an annunciator of high retardation or self-in-



duction may be used. By the use of this high retardation or self-induction in the grounded circuit of two connected lines from one side of the circuit only through the clearing-out annunciator, the balance of the circuit is substantially obtained as though there was no grounded connection to the circuit.

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

1. In a multiple-switchboard exchange, two metallic-circuit lines temporarily connected together in a metallic circuit for conversation, an operator's telephone temporarily in a bridge across said metallic circuit, an annunciator and high retardation in a circuit connected on one side permanently to ground, and on the other side to one limb and only one, of the metallic circuit, a switching device, two pairs of contacts in said bridge, one on each side of said telephone, a pair of contacts in said grounded annunciator-circuit, and a commutator-piece adapted to be in two positions, in one position said telephone-contacts being closed and in another position said telephone-contacts being open, and said annunciator-contacts being closed.

2. In a multiple-switchboard exchange, a pair of loop-switch plugs, the two contact-pieces of one connected to the two contact-pieces of the other respectively by flexible cord conductors, an operator's telephone in a bridge across the two conductors, in combination with an annunciator and high retardation in a circuit connection permanently grounded at one end, and at the other end connected to one, and only one, of said flexible cord conductors, two pairs of contacts in said bridge, one on each side of the telephone, a pair of contacts in said annunciator-circuit, a switching device, and a commutator-piece adapted to be in two positions, in one position said telephone-contacts being closed, and in another position said telephone-contacts being open and said annunciator-contacts being closed.

3. In a multiple-switchboard exchange system, two metallic-circuit lines temporarily connected together for conversation, a bridge-circuit across said metallic circuit, a permanently-grounded circuit connection from one limb, and one only, of said metallic circuit, said grounded connection including an annunciator and high retardation, a switching device with sets of contacts to connect at will either said telephone or generator into said bridge-circuit, and a set of contacts operated at the will of the operator to close said grounded annunciator-circuit.

4. In a multiple-switchboard exchange system, a pair of loop-switch plugs, the two contact-pieces of one connected respectively to the two contact-pieces of the other by flexible cord conductors, a permanently-grounded connection for one, and one only, of said cord conductors, said grounded connection including an annunciator and high retardation, a bridge across said cord conductors, a calling-

generator, an operator's telephone, and a switching device with contacts and connections by means of which the operator may at will introduce said generator or said telephone into said bridge-circuit and may close said grounded annunciator-circuit.

5. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, and a bridge circuit or connection across the two sides of said metallic circuit, in combination with an operator's telephone, a calling-generator, an annunciator and a retardation-coil in a circuit connection grounded on one side, a switching device containing pairs of contacts to connect at will either said telephone or said generator in said bridge-circuit, a pair of normally open contacts adapted to be closed at the will of the operator, one of which is connected to said metallic circuit and the other to the other side of said circuit connection, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

6. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of each of which are respectively connected with the two contact-pieces of the other, by flexible switch-conductors, and an operator's telephone temporarily in a bridge across the two conductors, in combination with a calling-generator, an annunciator and a retardation-coil in a circuit connection grounded on one side, a switching device containing pairs of contacts to connect at will either said telephone or said generator in said bridge-circuit, a pair of normally open contacts adapted to be closed at the will of the operator, one of which is connected to one of said conductors and the other to the other side of said circuit connection, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

7. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, an annunciator and a retardation-coil in a circuit connection grounded on one side, a switching device containing two contacts  $f$  and  $f'$  connected respectively to the two sides of said metallic circuit, two contacts 2 and 3 connected to the two sides, respectively, of said telephone, two contacts 1 and 3 connected to the two sides, respectively, of said generator, two contacts  $f'$  and 4, one of which is connected to said metallic circuit and the other of which is connected to the other side of said circuit connection, said circuit connection being on that side disconnected at the central office from said metallic circuit except as connected to it through said two last-mentioned contacts, and a commutator-piece adapted to be placed at will in three positions, in one position said two first-



mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, 5 and in another position said two fourth-mentioned contacts being closed to each other, substantially as set forth.

8. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, in 10 combination with an operator's telephone, a calling-generator, an annunciator in a circuit connection grounded on one side, a switching device containing two contacts  $f$  and  $f'$  connected respectively to the two sides of said 15 metallic circuit, two contacts 2 and 3 connected to the two sides, respectively, of said telephone, two contacts 1 and 3 connected to the two sides, respectively, of said generator, 20 two contacts  $f'$  and 4, one of which is connected to said metallic circuit and the other of which is connected to the other side of said circuit connection, said circuit connection being on that side disconnected at the 25 central office from said metallic circuit except as connected to it through said two last-mentioned contacts, and a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned 30 contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts 35 being closed to each other, substantially as set forth.

9. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, in 40 combination with an operator's telephone, a calling-generator, a retardation-coil in a circuit connection grounded on one side, a switching device containing two contacts  $f$  and  $f'$  connected respectively to the two sides 45 of said metallic circuit, two contacts 2 and 3 connected to the two sides, respectively, of said telephone, two contacts 1 and 3 connected to the two sides, respectively, of said generator, two contacts  $f'$  and 4, one of which 50 is connected to said metallic circuit and the other of which is connected to the other side of said circuit connection, said circuit connection being on that side disconnected at the central office from said metallic circuit except 55 as connected to it through said two last-mentioned contacts, and a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned 60 contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, substantially as 65 set forth.

10. In a telephone-exchange system, two metallic-circuit lines temporarily connected

together in metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, an annunciator and a 70 retardation-coil in a circuit connection grounded on one side, a switching device containing two contacts connected respectively to the two sides of said metallic circuit, two contacts connected to the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, of said 75 generator, two contacts, one of which is connected to said metallic circuit and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned 80 contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of 85 contacts normally closed but opened at the will of the operator, substantially as set forth. 90

11. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of each of which are respectively connected 95 with the two contact-pieces of the other by flexible switch-conductors, in combination with an operator's telephone, a calling-generator, an annunciator and a retardation-coil in a circuit connection grounded on one side, 100 a switching device containing two contacts connected respectively to the two switch-conductors, two contacts connected to the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, 105 of said generator, two contacts, one of which is connected to one of said switch-conductors, and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in 110 three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, 115 and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially 120 as set forth.

12. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, in combination with an operator's telephone, 125 a calling-generator, an annunciator in a circuit connection grounded on one side, a switching device containing two contacts connected respectively to the two sides of said metallic circuit, two contacts connected to 130 the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, of said generator, two contacts, one of which is connected to said metallic cir-



cuit and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

13. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of each of which are respectively connected with the two contact-pieces of the other, by flexible switch-conductors, in combination with an operator's telephone, a calling-generator, an annunciator in a circuit connection grounded on one side, a switching device containing two contacts connected respectively to the two switch-conductors, two contacts connected to the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, of said generator, two contacts, one of which is connected to one of said switch-conductors, and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

14. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, a retardation-coil in a circuit connection grounded on one side, a switching device containing two contacts connected respectively to the two sides of said metallic circuit, two contacts connected to the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, of said generator, two contacts, one of which is connected to said metallic circuit and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned con-

tacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

15. In a telephone-exchange system, a pair of loop-switch plugs, the two contact-pieces of each of which are respectively connected with the two contact-pieces of the other, by flexible switch-conductors, in combination with an operator's telephone, a calling-generator, a retardation-coil in a circuit connection grounded on one side, a switching device containing two contacts connected respectively to the two switch-conductors, two contacts connected to the two sides, respectively, of said telephone, two contacts connected to the two sides, respectively, of said generator, two contacts, one of which is connected to one of said switch-conductors, and the other of which is connected to the other side of said circuit connection, a commutator-piece adapted to be placed at will in three positions, in one position said two first-mentioned contacts being closed to said two second-mentioned contacts, in another position said two first-mentioned contacts being closed to said two third-mentioned contacts, and in another position said two fourth-mentioned contacts being closed to each other, and a key in circuit with said generator, having a pair of contacts normally closed but opened at the will of the operator, substantially as set forth.

16. In a telephone-exchange system, two metallic-circuit lines temporarily connected together in a metallic circuit for conversation, and an operator's telephone temporarily in a bridge across the two sides of said circuit, in combination with a circuit connection of high resistance and retardation grounded on one side, an annunciator whose coil comprises part of said circuit connection, a switching device, two normally closed pairs of contacts in said bridge, one on each side of the telephone, a pair of contacts normally open, one of which is connected with said metallic circuit and the other with the other side of said circuit connection, and a commutator-piece adapted to be in two positions, in one position said normally closed contacts being closed, and in another position said normally closed contacts being open, and said normally open contacts being closed, 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.