

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,397.

Patented Oct. 26, 1897.

Fig. 1.

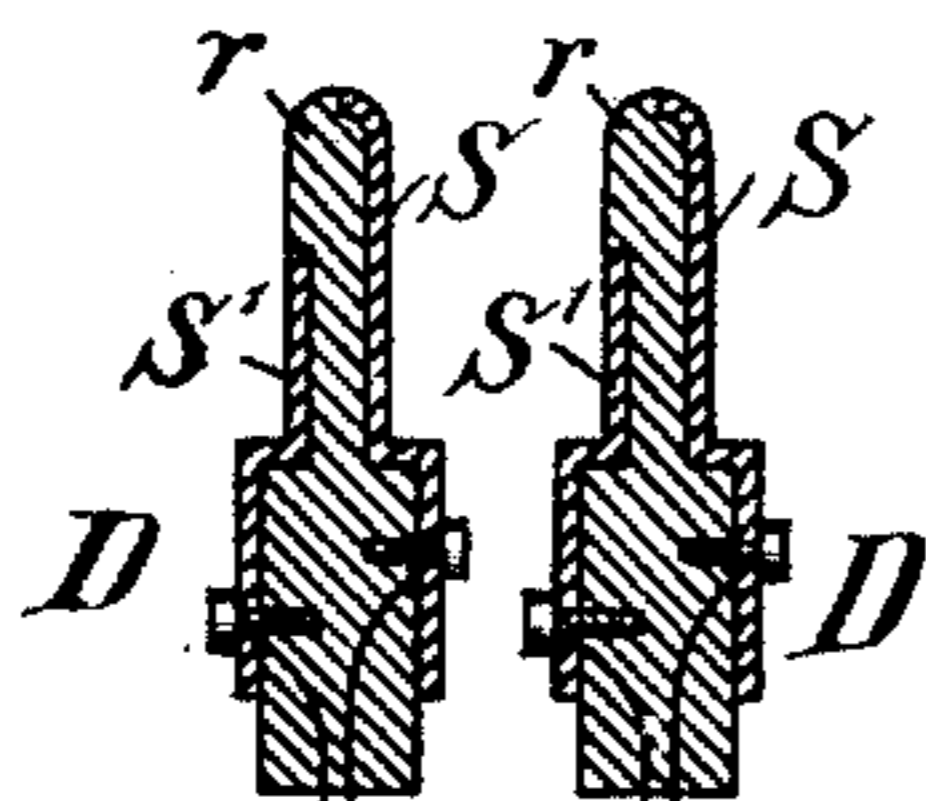
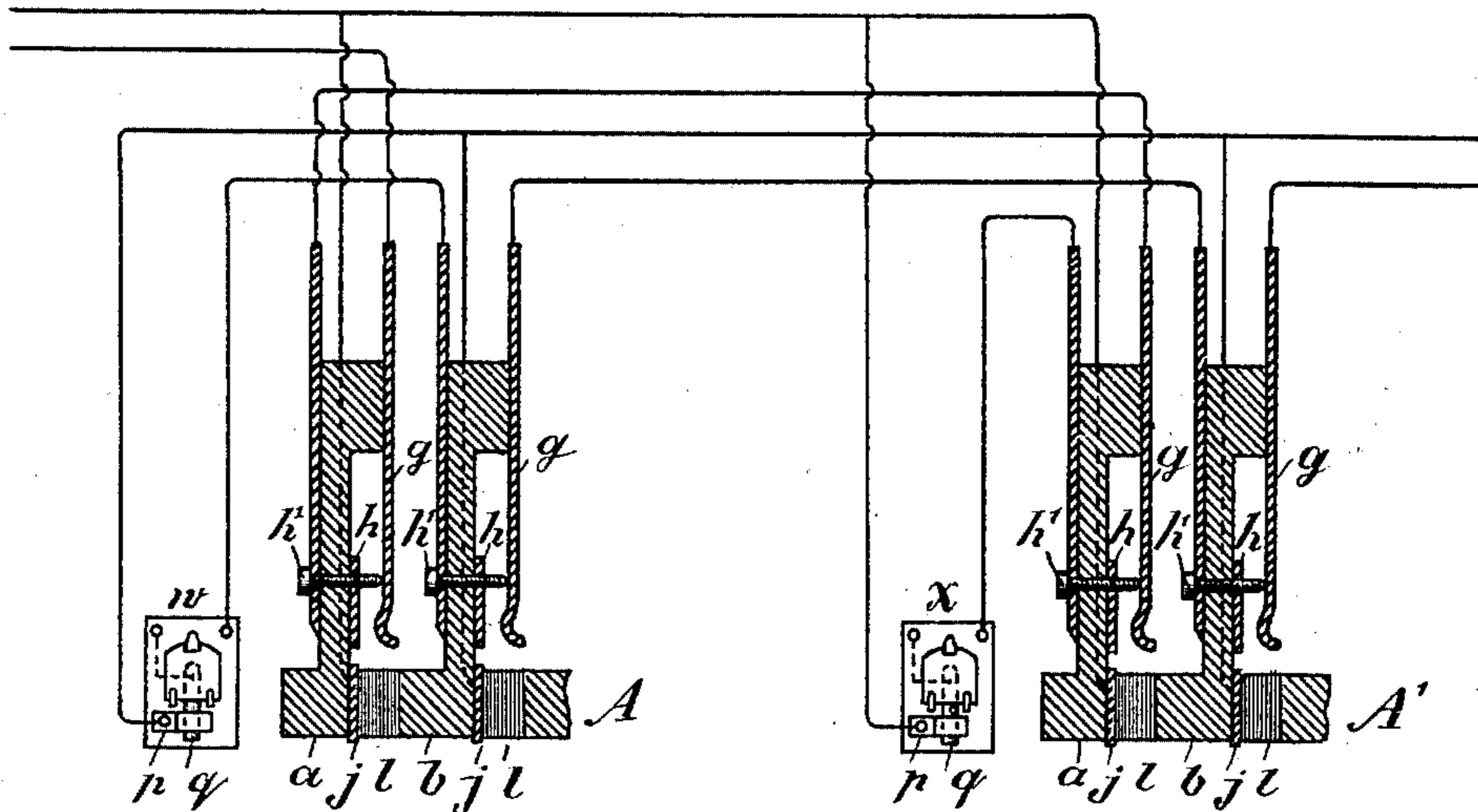


Fig. 2.

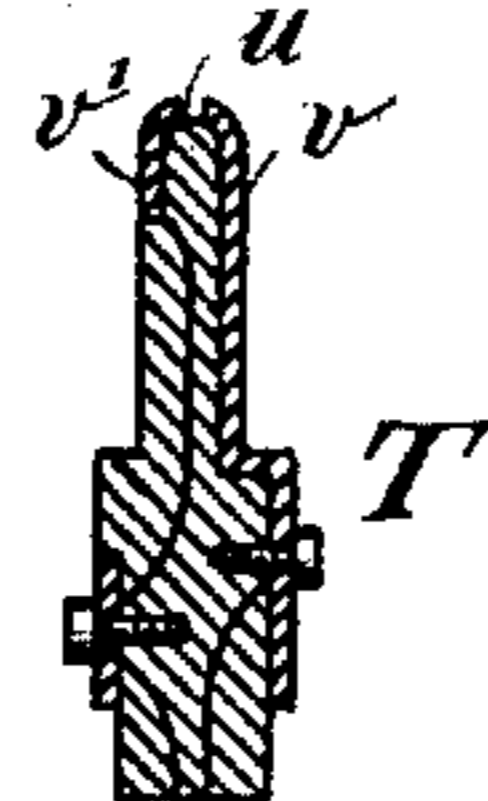
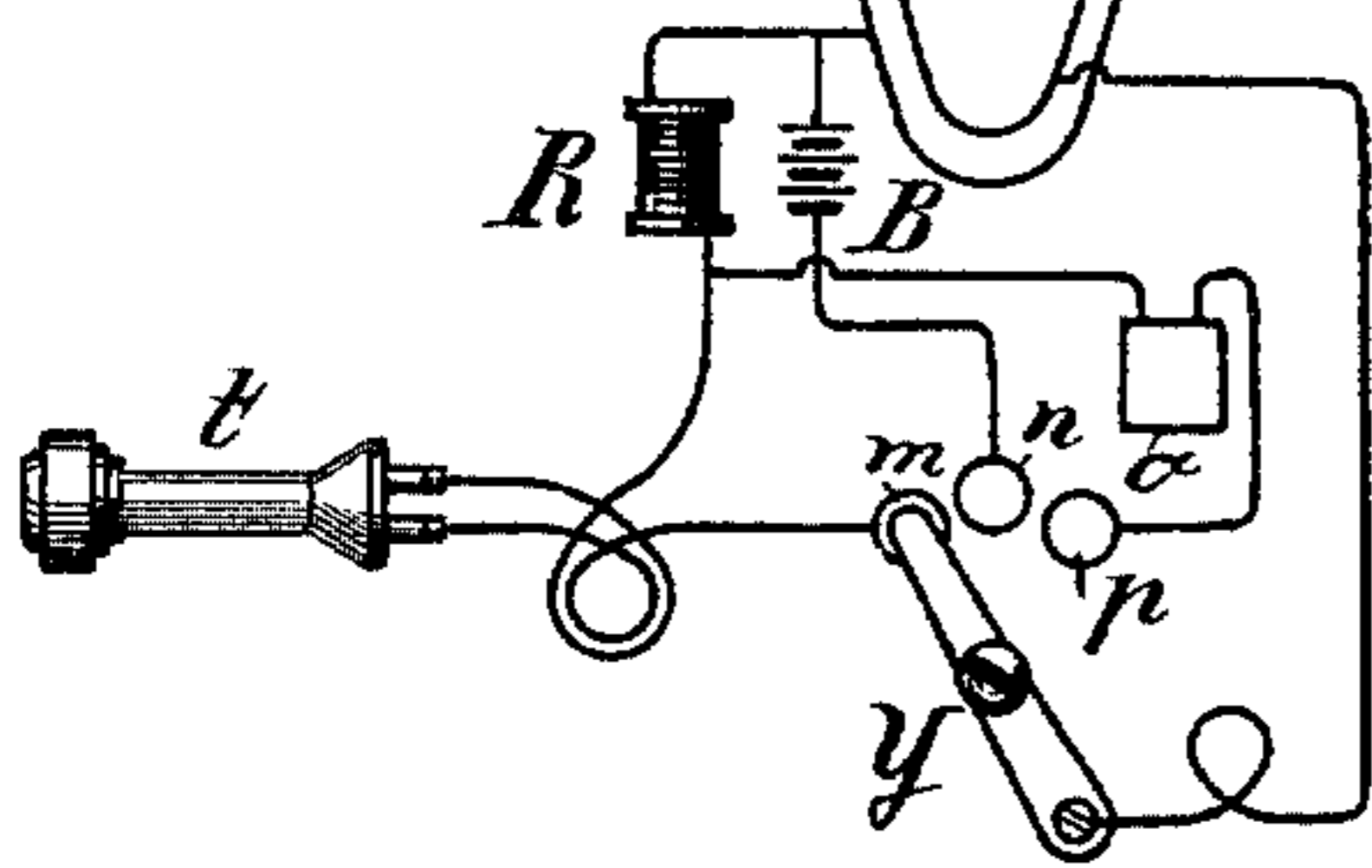
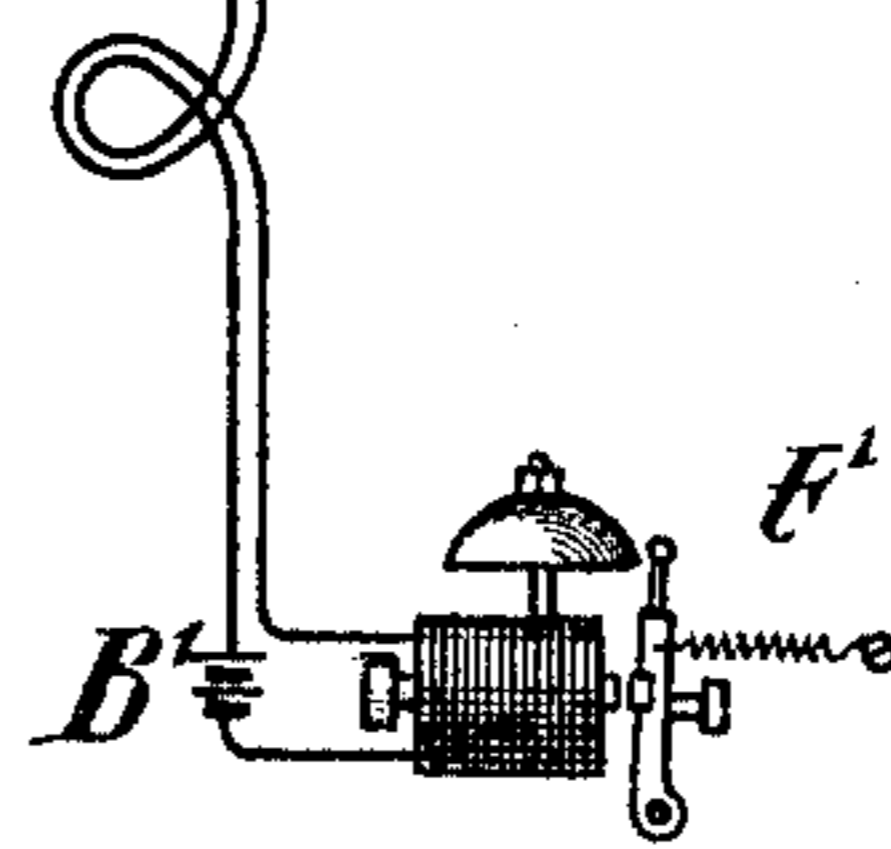


Fig. 3.



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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. 592,397, dated October 26, 1897.

Application filed May 16, 1891. Serial No. 392,966. (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

5 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.

10 My invention relates especially to a telephone-exchange system in which the lines are metallic-circuit lines and in which the necessary switching between the lines is accomplished by means of pairs of double or loop

15 plugs connected together by double flexible cord conductors.

It consists, first, of a system of testing the lines at any board to determine whether or not they are in use; secondly, of an organization of loop-switches and connections for said cords by which the movements required of the operator in making the necessary connections and disconnections are few and convenient to make, and, thirdly, of an arrangement of the annunciators and switches of the

20 different lines by which the clearing-out annunciators are included in a bridge-circuit with their respective pairs of cords.

In the accompanying drawings, illustrating

30 my invention, Figure 1 represents sectional views of sections of two multiple switchboards and the main-line central-office connections and apparatus of the two lines connected to the two switchboards. Fig. 2 represents a diagram of an operator's cord system and apparatus necessary to illustrate my invention. Fig. 3 represents an operator's test system.

I place as many switchboards in the central

40 office as are found necessary or desirable in order to properly operate the exchange. In each board is a spring-jack switch for each line. Each switch has a contact-spring which normally connects with a contact-point and is separated from the point while a plug is inserted into the switch and has a contact-piece insulated from the rest, except by the circuit connections. To the contact-point is attached an extension piece or connection along the

45 surface of the switch-hole, by means of which one of the contact-pieces of the loop test-plug,

hereinafter described, forms connection with the contact-point when the plug is inserted, as hereinafter described. The insulated contact-piece mentioned above is also placed

55 along the surface of the switch-hole and preferably in front of said extension-piece to the contact-point, and is so placed that one of the contact-pieces of the loop-switch plugs, hereinafter described, forms connection with said

60 contact-piece when the plug is inserted. Said plugs are constructed and said contact-pieces and extension-pieces of the switches are so placed that when the test-plug is inserted into a switch the contact-piece of the

65 plug does not come into contact with said contact-piece and when a switch-plug is inserted into a switch the contact-piece of the plug does not come into contact with the extension piece or point of the switch.

In Fig. 1, A A' are sectional views of sections of the two switchboards shown. *g g* represent the springs of the different switches, *h' h'* the contact-points of the switches on which the springs normally rest, and *h h* the

75 extension-pieces of the points placed along the surface of the holes of the switches in front of the points. *j j* are the insulated contact-pieces of the switches, also placed along the holes of their respective switches and

80 preferably in front of the extension-pieces. *a b* are the rubber strips on which the metal parts of the switches are mounted and through the fronts of which are the switch-holes *l l*. These holes are rectilinear holes

85 and are adapted to receive the loop-plug mentioned above and to cause them to operate the switches, as described. W and X are calling-annunciators, one for each line shown and each connected into the circuit of its

90 line, as will hereinafter be described.

Each annunciator has a pair of contact-points normally (or when the annunciator does not indicate a call) in contact with each other, but which are separated by the annunciator while it indicates a call. The two contact-points of a pair are marked *p* and *q*, respectively. One of them, *q*, is a spring-contact which is pressed by the annunciator-drop, when the drop falls, away from its corresponding contact-point *p*. The contact-point *p* is

95 represented as an angle-piece which passes

100

over the spring q and is in contact with the spring when the spring is not actuated by the annunciator-drop.

Two metallic-circuit lines are shown in the drawing, and they are connected to their respective boards as follows and as shown: One side or branch of the line is connected to the contact-pieces $j j$ of its switches on the several boards. The other side or branch of the line passes successively through the pairs of contacts $g h$ of its switches on the several boards, passing in each case to the spring first. It then passes through its line-annunciator and the pair of contact-points $p q$ of the annunciator, and is thence connected to the other side or branch of the line to which the contact-pieces $j j$ are connected.

The two branches of the line are normally on closed circuit at the subscriber's station and may be provided with any usual and appropriate subscriber's-station apparatus.

The subscriber's calling and clearing-out generator is, of course, in the metallic circuit of the line when operated to send either calling or clearing-out signals.

In the operator's cord system shown in Fig. 2, $D D$ are a pair of loop-switch plugs adapted for use with the switches shown in Fig. 1. $r r$ are the rubber insulations of the plugs. $S S'$ are the two contact-pieces of the plug. The plugs are constructed and the contact-pieces are arranged so that when a plug is inserted into a switch the spring is pressed away from its contact-point. The contact-piece S forms connection with the spring g , the contact-piece S' forms connection with the contact-piece j of the switch, and the contact-point h' is insulated from the contact-pieces of the plug. The plugs should be inserted into the switches in such a direction that they form the connections as above described.

Y is the operator's switch for the pair of cords shown. t is the operator's telephone. B is her calling-generator. o is a clearing-out annunciator, and R is a resistance-coil. The switch has a lever and three contact-points, on which the lever may be alternately placed at the will of the operator.

One contact-piece of one plug of the pair of plugs is connected by a flexible conductor to one contact-piece of the other plug. The two other contact-pieces of the plugs are also connected together by a flexible conductor. One of said flexible conducting-circuits, which connects two of the contact-pieces of the pair of plugs, is connected to the lever of the switch. The other flexible conducting-circuit described above is connected to one side of the resistance-coil. The other side of the resistance-coil is connected to one side of the operator's telephone and also to one side of the clearing-out annunciator.

The three contact-points of the switch are marked m , n , and p , respectively. They are placed adjoining each other in the order in which they are mentioned above and so that

the lever alternately rests on each point as it is moved by the operator. The other side of the operator's telephone is connected to the contact-point m and the other side of the clearing-out annunciator is connected to the contact-point p . One side of the operator's calling-generator is connected to the last-mentioned flexible conducting-circuit (that to which the resistance-coil is connected) and the other side is connected to the contact-point n of the switch.

The lever of the switch Y normally rests on the contact-point m .

Only one pair of switch-plugs, with their cords, clearing-out annunciator, and switch, is shown. Other pairs, as are found desirable, may be added to the operator's system in a way which will be apparent to those skilled in the art. She needs but one telephone, calling-generator, and resistance-coil.

In the operator's test system shown in Fig. 3, T is the loop test-plug, t' is the test receiving instrument, and B' is a test-battery. u is the rubber insulation of the plug, and $v v'$ are its contact-pieces. The plug is constructed and the pieces are arranged so that when the plug is inserted into any switch the spring is pressed away from its contact-point, the contact-piece v forms connection with the spring g , the contact-piece v' forms connection with the extension-piece h , and the contact-piece j of the switch is not in contact with the contact-pieces of the plug. The plugs should be inserted into the switches in such a direction that they form the connections as above described.

The two contact-pieces $v v'$ of the plug are connected by a flexible conducting-loop in which is the test receiving instrument and battery.

Each operator has a cord system and a test system, and they are conveniently mounted at her board for her work. The conducting-cords of the plugs should be long enough so that she can connect any plug with any switch at her board.

The operation of the switch system is as follows: When an operator receives a call on the annunciator of a line, she places one of the plugs D of a pair of her plugs in the switch of the line. By so doing she opens the closed circuit of the line and loops her telephone into the circuit. The closed circuit of the line is opened at the pair of contacts $g h$ of the switch. The two cords of the plug are connected to the two branches of the line by the connection of the two contact-pieces of the plug with the two contact-pieces g and h of the switch, and the two cords are bridged or connected by a bridge-circuit which contains the operator's telephone and the resistance-coil. When the operator finds out by conversation what line is wanted, she tests the line wanted, as will be hereinafter described, and if she finds it is not busy she places the other plug of the pair in the switch of the line, opening the closed circuit of the

line and connecting its two branches to the cord-circuits of the plug. She then moves the lever of the switch so that it rests on the point *n*. When the lever is in this position, the circuit is bridged by the operator's generator and a signal-current from the generator goes in split current to the two lines. She then moves the lever of the switch so that it rests on *p* and the lines are connected in metallic circuit for conversation with the clearing-out annunciator and resistance-coil in a circuit which bridges the metallic circuit. When the operator receives the clearing-out signal, she will remove the plugs from the switches and move the lever of the switch so that it rests on the point *m* when they are ready to be used for another connection.

The test receiving instrument and battery should be so constructed and adjusted to each other and the circuits of the exchange that the instrument will sound or respond when it and the battery are looped into the normal closed circuit of any line of the exchange, but will not respond when they are in open circuit or the line in which the test is made is looped into circuit with any other line, and has, therefore, the resistance of both lines in its circuit. This construction and adjustment can be readily accomplished and may be facilitated, if desired, by the addition of artificial resistances, so as to equalize the resistance of the various lines of the exchange. This construction and adjustment depends on the fact that an electromagnet may be readily made so as to operate when a battery and a certain resistance are in circuit with it and not to operate when the resistance is considerably larger. This operation can be obtained in different ways, dependent on the style of the electromagnet, the number of convolutions of its coil, the size of the battery, and the adjustment of the retractile spring. These parts should be such that the electromagnet will be actuated when the test system is looped into the normal circuit of any line of the exchange, but will not be actuated when the circuit is open or the additional resistance of another line is introduced.

The test system is as follows: When an operator at any board tests any line, she places her test-plug in the switch of the line, and by so doing connects the two contact-pieces of the plug with the two contact-points *g h* of the switch. If the line is not switched and its annunciator does not indicate a call, the test receiving instrument and battery will be included in the closed metallic circuit of the line and the instrument will sound, indicating that the line is free to be connected to. If, however, when the test is made the line is switched at some board and the plug is inserted in the cut-off portion of the line, the circuit of the test receiving instrument is open at the contact-points *g h* of the switch used in switching and the instrument will not sound. If, again, when the line is switched

the test-plug is inserted in the portion of the circuit which is included with the other line, the instrument will not sound, because the resistance is that of two lines combined. If, again, when the test is made the line is not switched at any board, but its annunciator indicates a call, the circuit is open at the pair of contact-points of the annunciator and the instrument will not sound. When, therefore, the test is made and the instrument does not sound, the operator knows that either the line is switched at some board or its annunciator indicates a call and she will not connect to the line.

In this system when two subscribers are connected together in metallic circuit for conversation and either the operator's telephone or the clearing-out annunciator is connected to the circuit, it is through a circuit which bridges the metallic circuit and which contains the resistance-coil. The resistance of this bridge-circuit may, by means of the resistance-coil, be made such as not to very materially affect the talking-circuit of the two lines.

Of course instead of the resistance of such a character as not to materially affect the talking-circuit of the two lines the telephone and the annunciator themselves may each readily be made of such character as to offer the required resistance to telephone-currents.

In multiple-switchboard systems an operator to whom certain lines are assigned to answer frequently receives several calls at practically the same moment, and it may require some time before she can switch to a certain line and answer its call. In systems in which the test depends only on whether the line has been switched at some board another operator may test the line before there has been time to answer the call and may switch the line with another line, to the annoyance and confusion of both subscriber and operator who receives the call. The latter will be especially disturbed, because, having received the call, she will consider that the line is free and will connect her telephone to it without making a test, and will then find it impossible to carry on conversation with the calling subscriber, or will intercept the conversation going on between the two lines. In my system the line tests busy as soon as the call is indicated and any operator who tests the line before its call is answered will become aware of the fact that it is engaged and will not connect to the line and thereby disturb the satisfactory operation of the exchange.

I claim as my invention—

1. In a telephone-exchange system, a metallic-circuit line normally on closed circuit and with an annunciator normally in its circuit with contact-points by which the circuit is open while the annunciator indicates a call, in combination with a test receiving instrument and battery and switch apparatus by which the instrument and battery may be

looped into the normal circuit of the line, the instrument being so constructed and adjusted that it will sound or respond when thus looped and the circuit in which it is included is
5 neither open nor contains the resistance of two telephone-lines, but not otherwise, substantially as set forth.

2. In a telephone-exchange system, multiple switchboards and a metallic-circuit line
10 connected to each of the boards and normally on closed circuit with an annunciator in the circuit having contact-points by which the circuit is open while the annunciator indicates a call, in combination with test receiving
15 instruments, one at each board and connected in a loop with a test-battery, and switching apparatus by which each instrument with its battery may at its board be looped into the normal circuit of the line, the
20 instrument being so constructed and adjusted that it will sound or respond when thus looped and the circuit in which it is included is neither open nor contains the resistance of two
25 telephone-lines, substantially as set forth.

3. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board and normally on closed circuit with an annunciator in its
30 circuit with contact-points by which the circuit is open while the annunciator indicates a call, and switch apparatus by which any two of the lines may be connected together in metallic circuit, in combination with test receiving
35 instruments and batteries, one of each at each board, and switch apparatus by which each instrument with its battery may be looped into the normal circuit of any line, the instrument being so constructed and adjusted
40 that it will sound or respond when thus looped and the circuit is neither open nor contains the resistance of two lines, but not otherwise, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards and a metallic-circuit line
45 normally on closed circuit and passing successively through pairs of switch contact-points, one pair on each board, and having normally in its circuit an annunciator with a pair of contact-points by which the circuit is
50 open when the annunciator indicates a call, in combination with switch apparatus at each board by which the two sides or branches of the line may be connected with the two sides or branches of any of the other lines and when
55 they are thus connected at a board, said pair of switch contact-points at the board is open, and loop test-plugs, one at each board, the two contact-pieces of which are connected to the two sides, respectively, of a loop which
60 contains a test receiving instrument and battery, each plug being adapted to be inserted into the line-switch at its board and when inserted to disconnect the pair of contact-points of the switch and connect them with the two
65 contact-pieces of the plug, respectively, the instrument being so constructed and adjusted

that it will sound or respond when thus switched into circuit and the circuit in which it is included is neither open nor contains the resistance of two telephone-lines, but not
70 otherwise, substantially as set forth.

5. 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
75 cord conductors, in combination with an operator's telephone, a clearing-out annunciator, a calling-generator, and a switch having a lever connected to one of the conductors and three contacts connected respectively
80 through the telephone, the generator and annunciator with the other conductor, said lever being adapted to be brought at will in connection with either contact, whereby the operator may at will bridge or cross-connect the
85 cord-circuits through either the telephone, or the generator or the annunciator, substantially as set forth.

6. In a telephone-exchange system, a pair of loop-switch plugs the two contact-pieces of
90 one of which are connected to the two contact-pieces of the other, respectively, by two flexible cord conductors in combination with an operator's telephone, a clearing-out annunciator, a resistance-coil and a switch having
95 a lever connected to one of the conductors and two contacts connected respectively through the telephone annunciator to the resistance-coil and through it with the other conductor, said lever being adapted to be brought at will
100 in connection with either contact, whereby the operator may at will bridge or cross-connect the two cord-circuits through either the telephone and resistance-coil or the annunciator and resistance-coil, substantially as set
105 forth.

7. In a telephone-exchange system, a pair of loop-switch plugs the two contact-pieces of
110 one of which are connected to the two contact-pieces of the other, respectively, by two flexible-cord circuits, in combination with a switch having a movable lever and three contact-bolts on which the lever may alternately be placed, an operator's telephone, a calling-generator and a clearing-out annunciator said lever
115 being connected to one of said cord-circuits, one of said bolts being connected to the other cord-circuit through the telephone, another of said bolts being connected to said other cord-circuit through the generator and
120 the third bolt being connected to said other cord-circuit through the annunciator, substantially as set forth.

8. In a telephone-exchange system, a pair of loop-switch plugs the two contact-pieces of
125 one of which are connected to the two contact-pieces of the other, respectively, by two flexible-cord circuits, in combination with a switch having a movable lever and three contact-bolts on which the lever may be alternately
130 placed, an operator's telephone, a calling-generator and a clearing-out annunciator, said

lever being connected to one of said cord-circuits, the bolt on which the lever normally rests being connected to the other cord-circuit through the telephone, the next adjoining bolt
5 being connected to said other cord-circuit through the generator and the last bolt being connected to said other cord-circuit through the annunciator, substantially as set forth.

10 9. In a telephone-exchange system, two metallic-circuit lines temporarily connected together into a metallic circuit for conversation, in combination with an operator's telephone, a calling-generator, a clearing-out annunciator and a switch having a lever and three con-
15 tact-bolts on which the lever may alternately be placed, one side of said metallic circuit being connected to the lever, the other side being connected through the telephone to one of said bolts, through the generator to another of said
20 bolts and the annunciator to the third of said bolts, substantially as set forth.

10. In a telephone-exchange system, two metallic-circuit lines temporarily connected together into metallic circuit for conversation, in combination with an operator's telephone, 25 a calling-generator, a clearing-out annunciator and a switch having a lever, a contact-bolt on which the lever normally rests and two other contact-bolts on which the lever may be alternately placed, one side of said metallic 30 circuit being connected to the lever, the other side being connected through the telephone to the first-mentioned bolt, through the generator to the next adjoining bolt and through the annunciator to the remaining bolt, substan- 35 tially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

FRANK S. OBER,
EDWARD C. DAVIDSON.