

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,390.

Patented Oct. 26, 1897.

Fig. 1

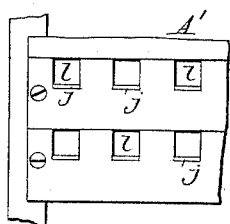
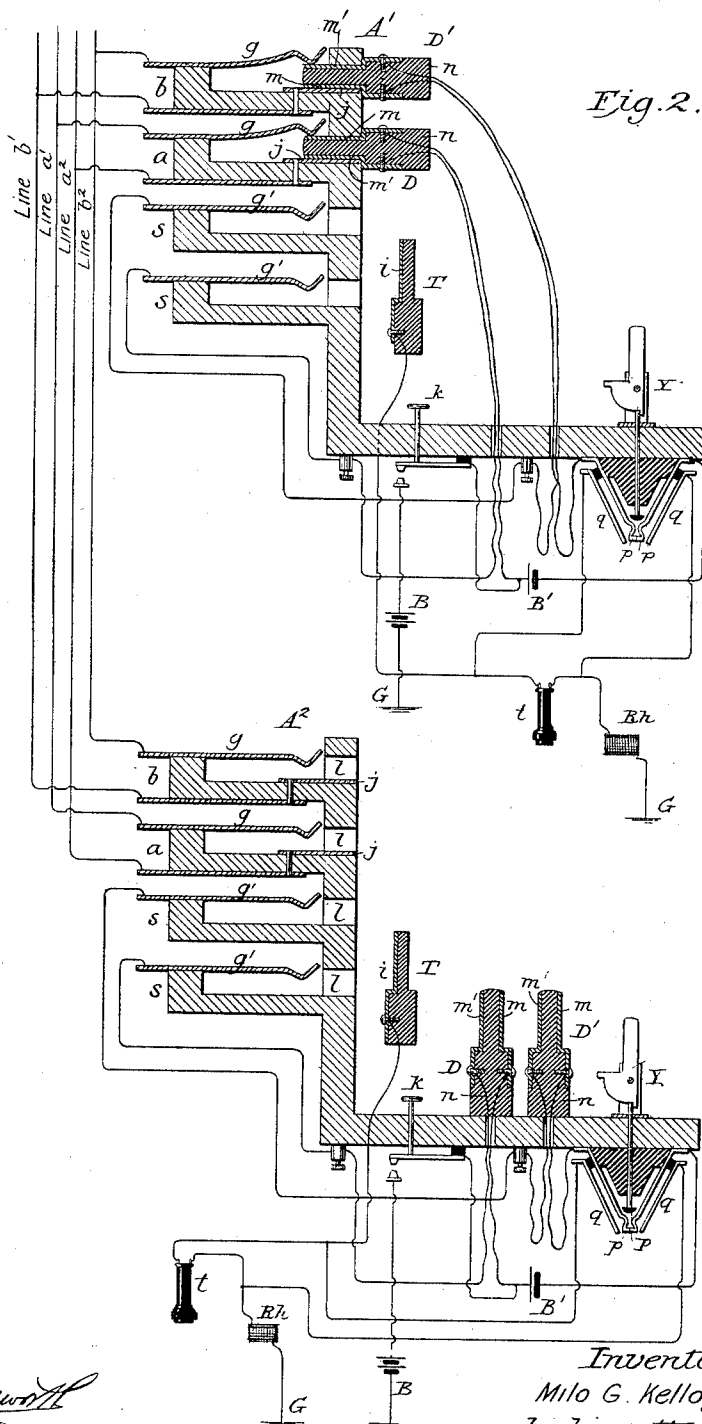


Fig. 2.



Witnesses,
Samuel P. Heringworth
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Inventor,
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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. 592,390, dated October 26, 1897.

Application filed February 26, 1891. Serial No. 383,002. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in 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.

My invention relates especially to telephone-exchange systems in which the lines are single-circuit lines normally open at the central office.

Certain features of the invention may be used with lines which are normally grounded at the central office.

Certain features of the invention are common to the multiple-switchboard system and to switchboards which are not multiple.

Certain features relate especially to the multiple-switchboard system.

Briefly stated, my invention consists in connecting the telephone-lines in pairs with the different switches on the board or boards, there being one switch for each line on each board and each switch having two contact-pieces suitably placed and insulated, one of the lines of a pair of lines being connected with one of said switch contact-pieces and the other line being connected with the other switch contact-piece, in connection with switch-plugs, apparatus, and circuits which I shall hereinafter describe, by which the operators may expeditiously and with few motions connect together any two of the lines which are connected at her board.

It consists also in a test system for such lines and system.

Figure 1 is a front view of a section of one of the switchboards, and Fig. 2 shows sections of two boards with four lines connected to them, a pair of switch-plugs located at each of the boards and connected to the operator's apparatus and their special switch apparatus, which will hereinafter be described.

The switches of the lines are marked a and b , the two former being located on the two boards shown and the two latter being also located on the two boards shown, respectively.

l are the switch-holes through the front of the rubber strips of the shape substan-

tially as shown and on which the metal parts of the switches are mounted. These holes are preferably square or rectilinear. To one side of the center of the holes are the switch-springs g . On the opposite sides of the center of the holes and along the surface of the holes are placed the contact-pieces j . There is one spring g and one contact-piece j for each switch.

Four lines are shown in Fig. 2. Line a' is connected with contact-springs g of switches a , and line a'' is connected with contact-pieces j of the same switches. In like manner lines b' and b'' are connected with the springs g and contact-pieces j , respectively, of switches b . The lines are normally open at the central office and are grounded at their outer ends. The calls are sent to the central office by means of the Law or the American district systems of calling. At the subscribers' stations are usual station apparatus for carrying on conversation and sending calls for such open-circuit lines. There is a signal-receiving bell in the circuit of each line at its station when the subscriber's telephone is not switched for use.

D are a pair of switch-plugs adapted to be inserted into any switch at their board and to form connections when inserted, as will hereinafter be described. n are the rubber insulations of the plugs, and m are the two contact-pieces of the plugs. When a plug is inserted into a switch, it may be inserted in such a direction that its piece m forms connection with spring g of the switch, and its piece m' forms connection with the contact-piece j of the switch or in the reverse position, so that m forms connection with j and m' forms connection with g . For each plug there is a switching device s , into which any other plug located at its board may be placed and which has a contact-piece which connects with the contact-piece m of the plug thus inserted. The contact-piece of this switching device is connected through a flexible switch-conductor with the contact-piece m' of its plug. The contact-pieces m of a pair of plugs are connected together by a flexible-cord circuit, and in this cord-circuit is a test-battery B' . There is a test-battery for each pair of cords.

Y is a looping-in switch with contacts p p and q q and connections by which the operator's telephone may be looped into said cord-circuit.

5 B is a calling-generator grounded on one side, and K is a calling-key by which the other side of the generator may be connected to said cord-circuit.

t is a test receiving instrument grounded
10 on one side and connected on its other side, preferably through a resistance R_h , through the flexible conducting-cord to contact-piece i of the test-plug T. The plug is constructed substantially as shown and so that the operator
15 may at will apply its contact-piece i to either the spring g or the contact-piece j of any switch. As she inserts the plug in one direction its contact-piece forms connection with contact-spring g of the switch, and as
20 she inserts it in the opposite direction piece i will form connection with piece j of the switch. The test-plug may also be inserted in the plug switching device and its contact-piece form connection with spring g' of the device. Each
25 operator has as many pairs of plugs as she may reasonably require for her work, and they are connected to their special apparatus and to the operator's apparatus, substantially as shown and as heretofore described.

30 The operation of the system is as follows: When an operator receives the order from a line, she places one plug of a pair of her plugs in the switch at her board to which the line is connected and in such a direction in the
35 switch that the contact-piece m of the plug forms connection with that contact of the switch which is connected to the line. If the switch of line wanted does not have a switch-plug in it, she tests the line by placing the
40 contact-piece i of her test-plug in connection with that contact of the switch which is connected with the line, and if the line tests "free" or not in use she places the other
45 plug of the pair of plugs she is using for the connection into the switch in such a direction that the contact-piece m of the plug forms connection with the contact of the switch which is connected with the line. The lines
50 are thereby connected together into one circuit for conversation, and the operator may by depressing the calling-key K, connected with the pair of plugs, send a calling-current in both directions to the circuit. If the
55 verbal calls or orders are received over the subscribers' individual lines, the right-hand plug D' is placed in the switch of the calling subscriber, and the operator's telephone is thereby in closed circuit with the line. The circuit is from the ground at the central office
60 through the resistance and operator's telephone, thence through the two pairs of contacts of the switch Y to the contact-piece m of the plug, thence to line and ground at the subscriber's station. As heretofore described,
65 when a plug is inserted into a switch in such a direction that its contact-piece m forms connection with one of the contact-pieces of

the switch the contact-piece m' of the switch-plug forms connection with the other contact of the switch. Since contact-piece m' of the
70 plug is connected with contact-spring g' of the switching device of the plug, it follows that the line with which piece m' then connects terminates temporarily in the contact-spring g' of the switching device. When,
75 therefore, an operator desires to test or switch a line in whose switch there is already a switch-plug, she merely inserts her test or switch plug, as the case may be, into the switching device of the plug inserted into the
80 line-switch and makes connection with the line through the contact-piece of the switching device. When the operator on receiving the call of the line finds that a switch-plug is already in the switch with which the line is
85 connected, she connects with the line by placing a switch-plug in the switching device of the plug in such a direction that its contact-piece m forms connection with the contact-piece of the switching device.
90

The test system is as follows: When a line is not switched at any board, there is no battery in its circuit. When it is switched, the test-battery of the pair of cords used is in circuit with the line. When, therefore, the test is
95 made as described and the line is not in use, no sound or indication will be made in the test receiving instrument. When, however, the line is switched for use and the test is made, there will be a closed circuit through
100 it and the test-battery of the pair of cords, used and the instrument will indicate or sound, indicating that the line is switched for use. This circuit is from the ground through
105 the resistance and test receiving instrument to the contact-piece of the test-plug used, thence to the contact-piece of the line to which the test is applied, thence to the test-battery connected with the line, and through it to the
110 ground of the other line connected with the battery.

I have shown and described a multiple-switchboard system. For the smaller exchanges but one switchboard may be used and the switching would be the same as described. The test system and special test apparatus, such as battery, &c., would not then
115 be required. The system of switching is applicable to other systems of lines and of testing than that described, and the system of testing is applicable to other switch systems than that described. For instance, there may be an induction-coil translator at the central office for each line, and the line may be connected in circuit with one coil of the translator,
120 and the switch contact-pieces of the line may be grounded through the other coil of the line-translator. In that case the line would not be directly connected to its switch contact-pieces, and yet all the advantages of
125 my system would be obtained. My invention is broad enough to include this and other variations of the system which I have described. When, therefore, I use the term "line" in the

specification and claims, I intend to include also those lines or talking-circuits whose metallic continuity is interrupted at the translator. With this system and organization only one-half as many switches are required for a given number of lines, and switches for twice as many lines may be placed within a given space, as in the usual telephone-switchboard system. The system therefore doubles the capacity of a given-sized switchboard. It also doubles the capacity of the telephone-switchboard before the multiple system is required. For instance, if the multiple switchboard is found desirable when an exchange has reached six hundred lines, it would in this system be no more necessary or desirable in exchanges of twelve hundred lines.

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

1. In a telephone-exchange system, telephone-lines divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and the two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, substantially as set forth.

2. In a telephone-exchange system, telephone-lines normally open at the central office and divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and the two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, substantially as set forth.

3. In a telephone-exchange system, telephone-lines divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and the two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug having also a second contact-piece and a switching device with a contact-piece con-

nected by a flexible conductor with said second contact-piece of the plug, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said first-mentioned contact-piece is connected with one of the contact-pieces of the switch and its said second contact-piece is connected with the other contact-piece of the switch and in the other of which the first-mentioned contact-piece of the plug is connected with the second-mentioned contact-piece of the switch and the second-mentioned contact-piece of the plug is connected with the first-mentioned contact-piece of the switch, each plug being also adapted to be inserted into each of said switching devices and when inserted to connect its said first-mentioned contact-piece with said contact-piece of the switching device, substantially as set forth.

4. In a telephone-exchange system, telephone-lines normally open at the central office and divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected in combination with pairs of switch-plugs, the plugs having each a contact-piece and said contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug having also a second contact-piece and a switching device with a contact-piece connected by a flexible conductor with said second contact-piece of the plug, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said first-mentioned contact-piece is connected with one contact-piece of the switch and its second-mentioned contact-piece is connected with the other contact-piece of the switch and in the other of which the first-mentioned contact-piece of the plug is connected with the second-mentioned contact-piece of the switch and the second-mentioned contact-piece of the plug is connected with the first-mentioned contact-piece of the switch, each plug being also adapted to be inserted into each of said switching devices and when inserted to connect its said first-mentioned contact-piece with said contact-piece of the switching device, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, telephone-lines divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted in two positions or directions into each switch at its board, in one of which its said contact-piece is connected with one of the contact-pieces of the switch

and in the other of which it is connected with the other contact-piece of the switch, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, telephone-lines normally open at the central office and divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two contact-pieces of a pair being connected by a flexible conducting-circuit, each plug being adapted to be inserted in two positions or directions into each switch at its board, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, telephone-lines divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and said contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug having also a second contact-piece and a switching device located at its board with a contact-piece connected by a flexible conductor with said second contact-piece of the plug, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said first-mentioned contact-piece is connected with one contact-piece of the switch and its said second-mentioned contact-piece is connected with the other contact-piece of the switch and in the other of which the first-mentioned contact-piece of the plug is connected with the second-mentioned contact-piece of the switch and the second-mentioned contact-piece of the plug is connected with the first-mentioned contact-piece of the switch, each plug being also adapted to be inserted into each of said switching devices at its board and when inserted to connect its said first-mentioned contact-piece with said contact-piece of the switching device, substantially as set forth.

8. In a telephone-exchange system, telephone-lines divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and the contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted into each switch in two positions or directions, in one of which

its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and a test-battery in said conducting-circuit between each pair of plugs, substantially as set forth.

9. In a telephone-exchange system, telephone-lines normally open at the central office and divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and the contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch, and in the other of which it is connected with the other contact-piece of the switch, and a test-battery in said conducting-circuit between each pair of plugs, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, telephone-lines divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted in two positions or directions into each switch at its board, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and a test-battery in said conducting-circuit between each pair of plugs, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, telephone-lines normally open at the central office and divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and said two contact-pieces of a pair being connected together by a flexible conducting-circuit, each plug being adapted to be inserted in two positions or directions into each switch at its board, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and a test-battery in said conducting-circuit between each pair of plugs, substantially as set forth.

12. In a telephone-exchange system, multi-

ple switchboards, telephone-lines divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and said contact-pieces of a pair being connected together by a flexible conducting-circuit, a test-battery in each of such conducting-circuits, each plug having also a second contact-piece and a switching device at its board with a contact-piece connected through a flexible conductor with said second contact-piece of the plug, each plug being adapted to be inserted into each switch at its board in two positions or directions in one of which its said first-mentioned contact-piece is connected with one contact-piece of the switch and its said second-mentioned contact-piece is connected with the other contact-piece of the switch and in the other of which its said first-mentioned contact-piece is connected with said second-mentioned contact-piece of the switch and its said second-mentioned contact-piece is connected with said first-mentioned contact-piece of the switch, each plug being also adapted to be inserted into each of said switching devices at its board and when inserted to connect its said first-mentioned contact-piece with said contact-piece of the switching device, substantially as set forth..

13. In a telephone-exchange system, telephone-lines grounded at their outer ends and divided into pairs and switches for said lines on a switchboard, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs, the plugs having each a contact-piece and said contact-pieces of a pair being connected by a flexible conducting-circuit, a test-battery in each of such flexible conducting-circuits, each plug being adapted to be inserted into each switch in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with any of said contact-pieces of said switches, substantially as set forth.

14. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends and divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two plugs of a pair being connected by a flexible conducting-circuit, a test-battery in each of such conducting-circuits,

each plug being adapted to be inserted into each switch at its board in two positions or directions, in one of which its said contact-piece is connected with one of said contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with any of said contact-pieces of said switches at its board, substantially as set forth.

15. In a telephone-exchange system, multiple switchboards, telephone-lines normally open at the central office, grounded at their outer ends and divided into pairs, and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two contact-pieces of a pair being connected by a flexible conducting-circuit, a test-battery in each of such conducting-circuits, each plug being adapted to be inserted into each switch at its board in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which it is connected with the other contact-piece of the switch, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with any of said contact-pieces of said switches at its board, substantially as set forth.

16. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends and divided into pairs and switches for said lines, one switch for each pair of lines on each of said boards, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with pairs of switch-plugs at each board, the plugs having each a contact-piece and the two contact-pieces of a pair being connected by a flexible conducting-circuit, a test-battery in each of such conducting-circuits, each plug having also a second contact-piece and a switching device at its board with a contact-piece connected through a flexible conductor with said second contact-piece of the plug, each plug being adapted to be inserted into each switch at its board in two positions or directions, in one of which its said first-mentioned contact-piece is connected with one of the contact-pieces of the switch and its second-mentioned contact-piece is connected with the other contact-piece of the switch and in the other of which its said first-mentioned contact-piece is connected with the second-mentioned contact-piece of the switch and its said second-mentioned contact-piece is connected with the first-mentioned contact-

piece of the switch, each plug being also adapted to be inserted into each of said switching devices at its board and when inserted to connect its said first-mentioned contact-piece with said contact-piece of the switching device and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with any of said contact-pieces of said switches and switching devices at its board, substantially as set forth.

17. In a telephone-exchange system, telephone-lines divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with a switch-plug having a contact-piece connected through a flexible conductor to one of said lines and adapted to be inserted into either of said switches in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which its said contact-piece is connected with the other contact-piece of the switch, substantially as set forth.

18. In a telephone-exchange system, telephone-lines normally open at the central office and divided into pairs and switches for said lines on a switchboard, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its pair are respectively connected, in combination with a switch-plug having a contact-piece connected through a flexible conductor with one of said lines and adapted to be inserted into either of said switches in two positions or directions, in one of which its said contact-piece is connected with one of the contact-pieces of the switch and in the other of which its said contact-piece is connected with the other contact-piece of the switch, substantially as set forth.

19. In a telephone-exchange system, the combination of a switchboard having a series of switches, two independent line-contacts at each switch, pairs of telephone-lines, the lines of each pair being respectively connected with the contacts at a switch, operator's central-office apparatus, and switching devices adapted to be placed in either of said switches in two positions or directions to connect either of the two lines of any switch with such apparatus.

20. In a telephone-exchange system, the combination of multiple switchboards, each having a series of switches, two independent line-contacts at each switch, pairs of telephone-lines, the lines of each pair being respectively connected to the contacts of a

switch on each board, operator's central-office apparatus at each board, switching devices at each board adapted to be placed in either of said switches in two positions or directions to connect either of the two lines of any switch at a board with such apparatus at said board, and test devices whereby the operator at any board can test any line to determine whether or not it is switched for conversation.

21. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends and normally open at the central office, and switch-terminals for said lines, one terminal for each line on each board to which the line is permanently connected, in combination with pairs of switch-plugs at each board, the contacts of each pair of plugs being connected together by a loop which contains a battery, said plugs being adapted to be connected with said switch-terminals, and when a pair are connected with the terminals of any two lines to connect the lines together in circuit, and test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a test plug or device adapted to be brought for testing into connection with any of said switch-terminals at its board, substantially as set forth.

22. In a telephone-exchange system, multiple switchboards, and a telephone-line normally open at the central office, and grounded at its outer end, and a switch-terminal on each of said boards to which the line is permanently connected, in combination with a test-battery through which said line is grounded as long as switched for conversation, and test receiving instruments, one at each board grounded on one side and connected on its other side to a test plug or device, adapted to be brought into connection with the switch-terminal at its board, substantially as set forth.

23. In a telephone-exchange system, multiple switchboards and a telephone-line grounded at its outer end and a switch-terminal on each of said boards to which the line is permanently connected, in combination with a test-battery through which said line is grounded as long as switched for conversation and test receiving instruments, one at each board grounded on one side and connected on its other side to a test plug or device, adapted to be brought into connection with the switch-terminal at its board, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

FRANK S. OBER,

EDWARD C. DAVIDSON.