

C. E. SCRIBNER.

SINGLE CORD MULTIPLE SWITCH BOARD SYSTEM.

No. 428,698.

Patented May 27, 1890.

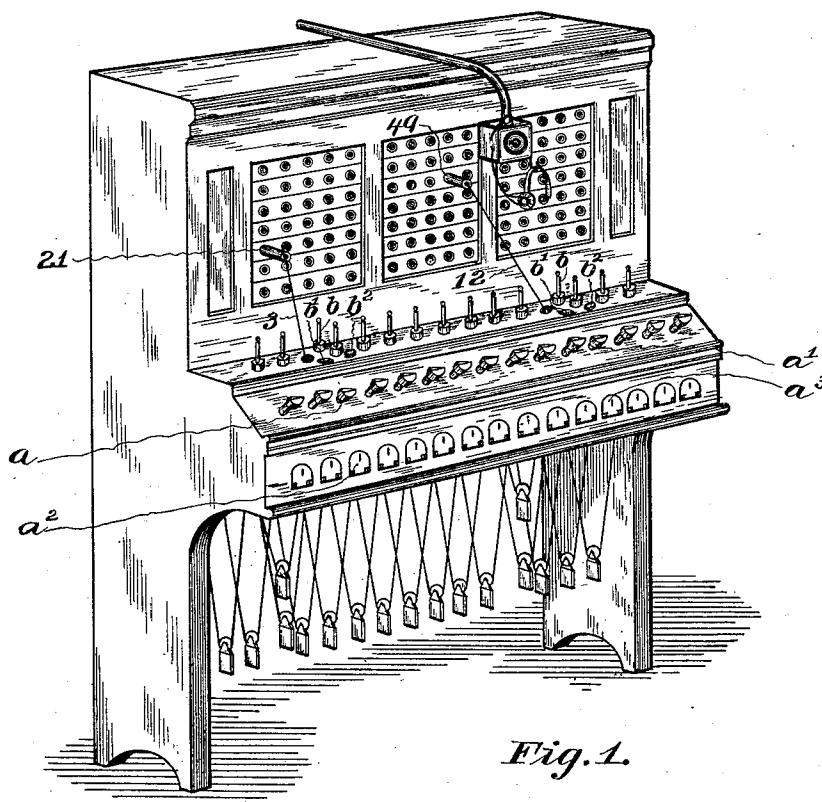


Fig. 1.

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Inventor:

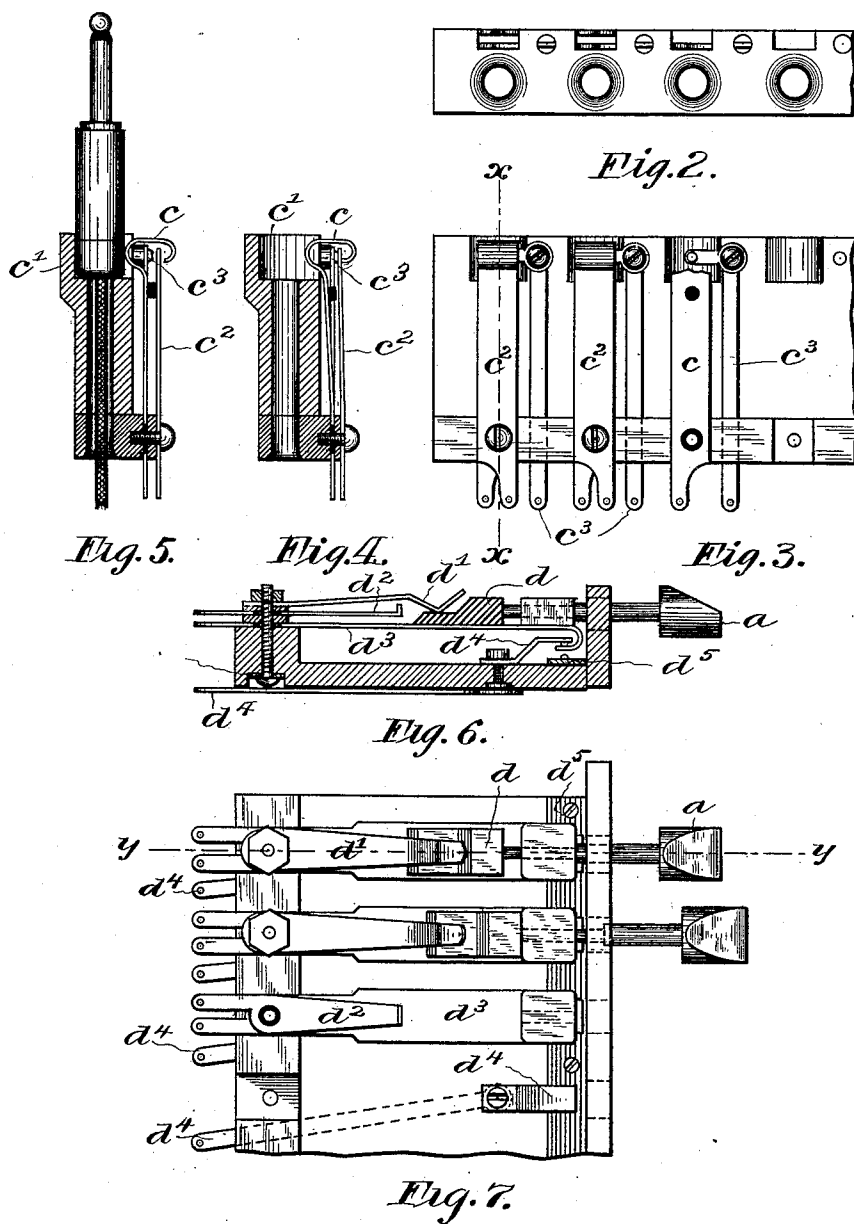
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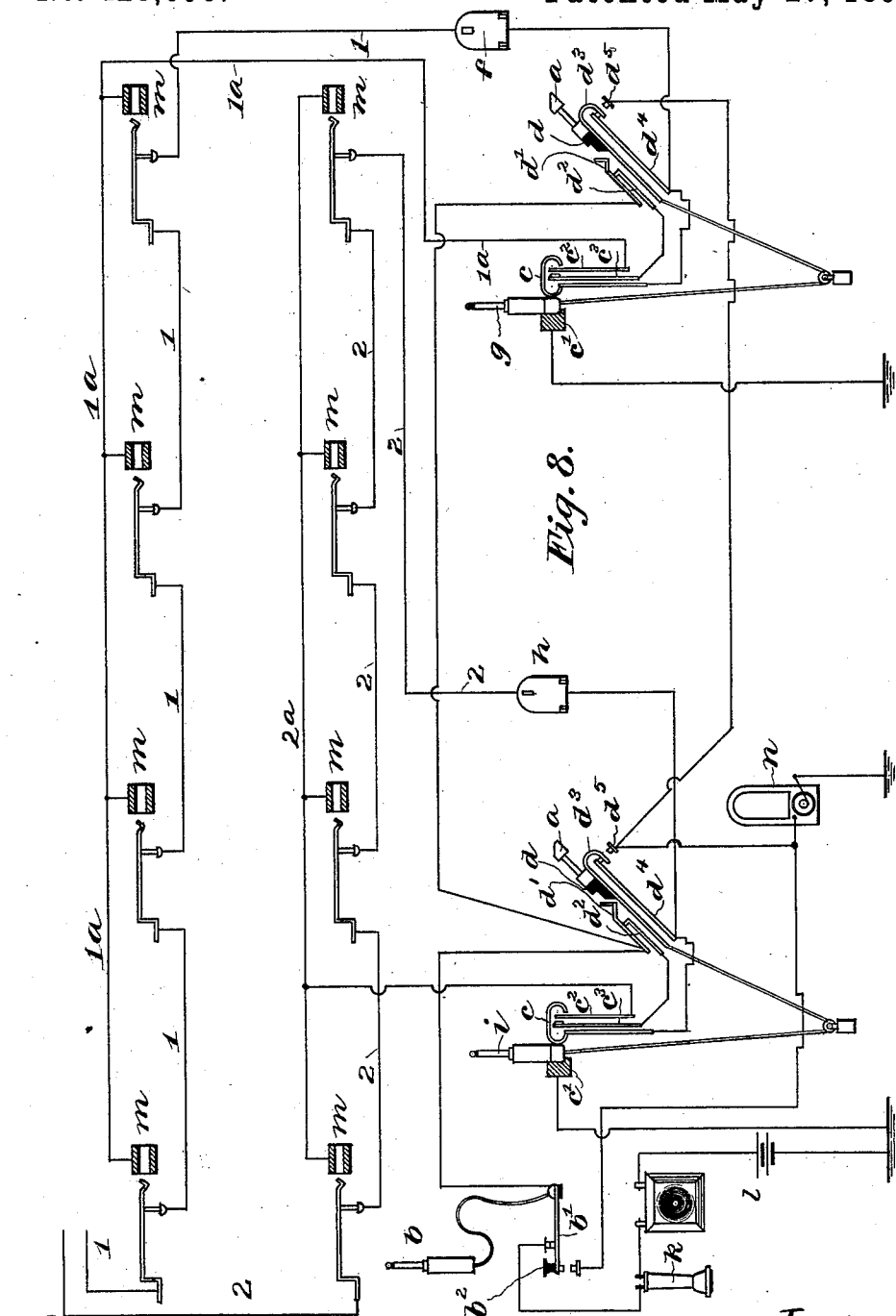
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UNITED STATES PATENT OFFICE.

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SINGLE-CORD MULTIPLE-SWITCH-BOARD SYSTEM.

SPECIFICATION forming part of Letters Patent No. 428,698, dated May 27, 1890.

Application filed June 1, 1888. Serial No. 275,748. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Single-Cord Multiple-Switch-Board Systems, (Case 147,) 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 to multiple-switch-board apparatus of a telephone-exchange; and its object is to facilitate making the connections and disconnections between the various subscribers' telephone-lines of the exchange.

My invention relates more especially to that system of telephone-exchange in which the different lines terminate each in a different flexible cord, each cord being provided with a terminal plug.

In multiple-switch-board systems, as is well known to those skilled in the art, the lines are provided each with a different switch or terminal on each of the multiple switch-boards, so that each line is connected with several switches, the different switches of each line being distributed upon different boards. The boards are preferably placed end to end, so as to form a continuous line of switch-boards. When the boards are so placed, each of the different boards is usually termed a "section" of the multiple switch-board. I shall, however, in my description speak of the different sections as different boards. The object of providing several switch-boards, each with a terminal for each of the lines, is to provide room for the switchmen or operators to work.

In the circuit of each telephone-line at the central office is included an individual annunciator. These individual annunciators are distributed upon the different boards so that the calls of a certain group of lines will be indicated upon one board and the calls of another group of lines upon another board, and the operators at the different boards will answer the calls of their respective groups; but an operator having answered the call of any particular line is enabled to make the

connection between this calling-line and the line of the subscriber called for upon his own board, whether the line asked for be one of said operator's particular group or some other line of the exchange, since the operator has upon her board a terminal or switch of each of the telephone-lines.

Where the lines terminate each in a different flexible cord and plug, all connections are made by inserting the terminal plug of one line into the switch of another line. This system of making the connections is popularly spoken of as the "single-cord system," as distinguished from systems in which a pair of cords and plugs are used to make the connection between two lines. In combining single-cord systems with multiple-switch-board systems the cords and plugs are distributed upon the different boards the same as the annunciators—that is to say, the cords and plugs of each group will be placed upon the same board with the individual annunciators of the same group.

The number of switch-boards required will depend upon the number of lines in the exchange, the frequency of the calls, and the ability of the operators to make the connections. The importance therefore of reducing the motions required of the operator in receiving an order for a connection, testing the line called for to see whether or not it is in use, making the connection, disconnecting the operator's telephone, and signaling the subscriber called is obvious. It is also important to provide facilities whereby one operator who is not very busy may assist an operator of an adjoining board who happens to be receiving calls faster than she can answer them.

Speaking more particularly, therefore, the object of my invention is to provide apparatus whereby the operator's work may be made with the smallest possible number of motions or steps, while at the same time the operators may assist one another.

My invention consists in a special connecting-cord and plug branched from the operator's telephone-circuit and a special ringing key connected therewith to enable one operator to assist another.

My invention also consists in the circuits

and combinations hereinafter described and claimed.

I have shown a device which I term a "grounding-switch," operated by the terminal plug of the line in whose circuit said grounding-switch is placed. This grounding-switch is described and claimed in my Case No. 140, Serial No. 257,081, filed December 6, 1887, for electric loop-switches. I have also shown herein a combined listening and ringing key for disconnecting the operator's telephone and sending current to line of a subscriber that has been asked for. This listening and ringing key is described and claimed in my Case No. 146, Serial No. 275,747, filed June 1, 1888, for loop-keys.

My invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1, Sheet 1, is a perspective view illustrative of one switch-board of a multiple-switch-board system of a telephone-exchange. Figs. 2, 3, 4, and 5 are detailed views illustrative of the grounding-switch. Figs. 6 and 7 are detailed views of the combined listening and ringing keys. Fig. 8 is a diagram showing two telephone-lines connected with spring-jack switches on different switch-boards and the circuits and connections with an operator's outfit at the central office.

I have indicated upon the switch-board (illustrated in Fig. 1) spring-jack switches or terminals for one hundred and five lines, and have indicated the terminal plugs and cords of fifteen lines, together with their corresponding keys and annunciators.

I will consider that there are in one exchange seven boards in all, duplicates each of the board illustrated in Fig. 1, these boards being preferably placed end to end. Each of these boards would be provided with the plugs, cords, keys, and annunciators for fifteen different lines, in the manner illustrated in Fig. 1.

It will be understood that a multiple-switch-board system would not be required for an exchange having only one hundred and five subscribers, the multiple system being especially designed for large exchanges, where more than one board is required to give room for the operators to work to advantage. Usually multiple systems are not used in exchanges having less than five hundred subscribers. I have illustrated the smaller number of line-terminals, in order that the drawings may be readily understood, this number being sufficient to illustrate my system.

In Fig. 1 I have shown the terminal plug of line 3 inserted in the spring-jack of 21 and the plug of line 12 inserted in the spring-jack of 49. The terminal plug of line 3 being inserted in the spring-jack of another line, the key a of said line will be pushed in, so as to disconnect the telephone from circuit. In like manner key a' of line 12 is shown pushed in—that is to say, in position to disconnect the telephone from the united circuit of lines 12 and 49. The shutters of

the annunciators a^2 and a^3 of the lines have been restored, so that the annunciators may serve as clearing-out signals. I have shown the plug b , contact-plate b' , and push-key b^2 near each end of the board. The plugs and keys b b^2 and their connections are a portion of the apparatus by means of which one operator may assist an operator at an adjoining board. The grounding-switches are placed under the shelf which supports the plugs thereof and do not appear in Fig. 1.

I will describe the grounding-switch as illustrated in Figs. 2, 3, 4, and 5. Fig. 2 is a view from below of four grounding-switches. Fig. 3 is a plan view thereof. Fig. 4 is a sectional view on line $x x$ of Fig. 3. Fig. 5 is a similar sectional view showing the heel of the plug inserted so as to form a connection between the spring c and the socket c' . When the heel of the plug is thus inserted, said spring c is connected with the metallic heel, and at the same time wedged away from contact with spring c^2 , the rubber stud upon spring c coming against said spring c^2 . Said spring c^2 is at the same time lifted from its normal contact c^3 . When the plug is lifted from its socket, the spring c closes upon connection c^2 while said connection c^2 is closed upon connection c^3 . The object of making and breaking these connections will be explained in connection with Fig. 8.

I will now describe the disconnecting and calling key as illustrated in Figs. 6 and 7, in which Fig. 6 is a sectional view of one of the keys on line $y y$ of Fig. 7, and Fig. 7 a plan view showing two keys in different positions and portions of two other keys, all upon the same strip.

When the wedge of insulating material d is inserted under spring d' , said spring d' is lifted from its connection with spring d^2 . It is sometimes necessary to separate contact d^3 from contact d^4 and close contact d^3 at the same time upon contact d^5 . In order to do this, it is only necessary to press down upon the knob a of the key, and this may be done without reference to the position of wedge d . As will be explained in connection with Fig. 8, the separation of spring d' from contact d^2 disconnects the operator's telephone from circuit, and the closing of the connection d^3 with contact d^5 serves to send current to line and call the subscriber with whom connection has been made.

Referring now to Fig. 8, line 1 is shown connected through a series of spring-jack switches, each switch being on a different board, to an annunciator f , and from said annunciator to connection d^4 of its listening and ringing key, and from thence the circuit may be traced to spring c of the grounding-switch, thence through the heel of the plug g , inserted in its socket, and through said heel to the socket c' , which is permanently connected with ground. The circuit of line 2 may be traced in like manner through a different spring-jack on each of the boards, and thence

through its annunciator *h*, and thence to spring *d*⁴ of its listening and ringing key, and thence to spring *c* of the grounding spring-jack; and thence through the heel of the plug *i*, inserted therein, to the socket *c'*, which is permanently connected with ground. It will be observed that line 1 is provided with a test-wire 1^a and line 2 with a test-wire 2^a, the test-wires being connected to contacts *c*² of the grounding spring-jacks, respectively, of their lines. It will be observed that the terminal plugs *g* and *i* are upon the same switch-board.

The telephone *k* is connected with the springs *d'* of the different listening-in keys.

When the wedge *d* of a listening-in key is out, as shown in Fig. 8, spring *d'* rests upon contact *d*². The spring *d*² of each listening-in key being connected with contact *c*³ of the grounding spring-jack of its line, the circuit of telephone *k* will be open at said spring *c*³ as long as the heel of the plug remains inserted in the socket. On removing any plug from its socket the spring *c* of the grounding spring-jack whose plug has thus been lifted will be disconnected from its normal ground, and coming against spring *c*² will carry said spring *c*² into contact with contact-point *c*³, as shown more clearly in Fig. 4.

I will now describe the manner of making the connection and disconnection between two telephone-lines at the central office. Suppose that the operator at the central office sees the shutter *h* fall. She will immediately lift plug *i*, the lifting of said plug *i* bringing her telephone *k* into the circuit of line 2. This circuit may be traced from the ground through the test-battery *l*, telephone *k*, spring *d'* of the listening-in key of the line, thence to the back contact *d*² of said listening-in key, thence to spring *c*³ of the grounding spring-jack, and thence to line-spring *c*, the circuit between springs *c*³ and *c* being completed through the medium of spring *c*². The telephone *k* is thus connected into the circuit of line 2 by simply lifting the plug *i*. The operator listening at telephone *k* receives the order which is given, and then immediately with the tip of plug *i* touches test-piece *m* of the spring-jack of the line called for. Suppose that the line called for is line 1. If line 1 is in use or connected at any other of the boards, this test-wire 1^a will be closed with line 1 in the usual manner by the insertion of the plug in the spring-jack of the line at the board where the connection is made. If, however, line 1 is not in use, test-wire 1^a will be open. The operator, therefore, listening at telephone *k* as she touches the tip of the plug *i* to test-piece *m* will know whether or not the line is in use, since if the line is in use her test-battery *l* will be closed through telephone *k*, and she will hear the usual click. If, however, the line is not in use, the circuit of battery *i* will not be completed when the tip of plug *i* is touched to test-piece *m*, and she will therefore hear no click in her tele-

phone, and will therefore know that the line is free. Having ascertained that the line is free, the operator will insert plug *i* into the spring-jack upon her board of the line called for, thus completing the connection. In order to signal the subscriber thus called for, she has only to press down upon knob *a* of her listening-in key, so as to close connection *d*³ to connection *d*⁵, with which the generator *n* is connected. The two subscribers being thus connected together, the operator by simply pressing against the knob forces wedge *d* under spring *d'*, thus disconnecting her telephone from the circuit of the two connected lines. The shutter of annunciator *h* is then restored, so that the annunciator *h* may serve as a clearing-out signal. The steps of the operator in receiving a call and making a connection are thus briefly as follows, viz: first, lifting the plug; second, listening at the telephone to get the order; third, touching the tip of the plug to the test-piece of the line wanted and at the same time listening at the telephone; fourth, inserting the plug in the spring-jack of the line wanted; fifth, pressing down on the knob of the listening-in key to throw current to the line wanted; sixth, disconnecting the telephone, and, seventh, restoring the shutter of the annunciator of the calling subscriber. The apparatus is so arranged that these steps are performed in the quickest and most convenient manner. When the subscribers are through talking, one or the other sends current to the line, throwing down the shutter of the annunciator *h*. The operator thereupon withdraws wedge *d* from under spring *d'*, so as to listen in, and then disconnects the line, restoring plug *i* to its normal position in the socket of its grounding spring-jack. The shutter *h* is again restored, so as to be ready to respond to the next signal. The plug *b* and cord connected therewith are connected with a key *b*² in the operator's telephone-circuit. By depressing key *b*² the plug *b* and its cord are disconnected from the telephone *k*. The lever *b'* of the key *b*² may serve as the metallic plate *b'*, which is shown in Fig. 1. Suppose now that the operator who uses telephone *k* observes that an operator at an adjoining board is receiving more calls than she has the time to answer. The operator at telephone *k*, seeing the shutter of a line on an adjoining board fall, picks up the plug of said line, and touching it to plate or connection *b'* is in connection with the subscriber who has sent in the call. She may thus receive the order of the subscriber whose plug she has thus taken up and proceed to make the necessary test. This test is made upon her own board in the usual manner by simply touching the tip of plug *b* to the test-piece of the spring-jack upon her board of the line called for. Finding that the line called for is free, she at once inserts the plug which she has picked up from an adjoining board in the spring-jack of the line called for. She then touches the tip of plug *b* to the heel of the plug thus in-

serted, at the same time pressing down upon key b^2 . Current is thus sent from the generator to signal the subscriber with whom connection has been made. The plug b and key b^2 may be conveniently used for testing out the lines when for any reason such tests may be desired.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a single-cord switch-board system, the combination, with a grounding spring-jack and its plug with which it is operated, of a listening-key and circuits connecting them together and with a telephone outfit, contact-points of the grounding spring-jack and the key being connected with the circuits to connect the telephone to the plug automatically when said plug is lifted and to disconnect the telephone from the plug when the listening-key is operated.

2. A telephone line extending through a series of spring-jack switches distributed on different switch-boards and through an annunciator to a listening and calling key and thence through a flexible cord to the terminal plug of the line, said plug being inserted in a grounding spring-jack, in combination with a telephone included in a ground-circuit branched to the listening-key, said grounding spring-jack operating automatically on the removal of the plug to connect said telephone-line with said telephone, and electrical connections, whereby on lifting said plug the telephone is brought into circuit while the normal ground-connection of the line is at the same time removed, substantially as described.

3. A grounding spring-jack with the metallic heel of the terminal plug of the line inserted therein to close the circuit of the line to ground, in combination with a telephone included in a circuit connected to spring d' of a listening-switch and contact d^2 thereof to contact c^3 of the grounding spring-jack, and springs or connections c^2 of the grounding spring-jack, whereby on lifting the plug the normal ground of the line is taken off, while the telephone is brought into circuit, substantially as described.

4. The combination, with a telephone included in a ground-circuit, of a listening-in and calling switch and a grounding-switch, a telephone-line connected therewith and terminating in a plug i , normally inserted in the grounding-switch to close the circuit of said line to ground and to disconnect the circuit of the telephone from said line, said normal ground being removed and the telephone connected to line on the removal of the plug, substantially as described.

5. The combination, with a telephone-line 1, extending through a series of spring-jack switches and an annunciator to connections d^4 of a circuit-changing device and thence normally by spring d^3 of said circuit-changing de-

vice, and a flexible cord connected therewith to a terminal plug g , said terminal plug being inserted in a grounding-switch to close said circuit to ground, of a branch connection between said connection d^4 and spring c of the grounding-switch, and a telephone k , included in a circuit connected with the contact c^3 of the grounding-switch, whereby on taking up the plug the normal ground-connection of the line is taken off, while said telephone is brought into circuit therewith, substantially as described.

6. The combination, with a telephone-line 1, extending through a series of spring-jack switches and an annunciator to connections d^4 of a circuit-changing device and thence normally by spring d^3 of said circuit-changing device, and a flexible cord connected therewith to a terminal plug g , said terminal plug being inserted in a grounding-switch to close said circuit to ground, of a branch connection between said connection d^4 and spring c of the grounding-switch, a telephone k , included in a circuit connected with the contact c^3 of the grounding switch, and the test-circuit 1^a of said line connected with the test-piece of each of the switches of the line and extending to connection c^2 of the grounding-switch, whereby on removing the test-plug the telephone is brought into circuit and the test-wire connected to ground, substantially as described.

7. The combination, with an operator's telephone k , included in a ground-circuit, of the metallic piece b' in circuit with the telephone, with which piece the line-terminal plug of an adjoining board may be connected, a flexible branch terminating in a connecting-plug b , and a key for closing circuit from generator n over said flexible branch when terminal plug b is inserted in the spring-jack of a line wanted, whereby an operator at one board is enabled to assist an operator at another board.

8. The combination, with a ground-circuit, including a telephone, of a flexible branch connected therewith, the spring-jack switches of the different lines upon a switch-board, and a key b^2 and a generator n , substantially as described.

9. The combination, with a telephone-line connected with switches distributed on different switch-boards, of a listening-key included in the circuit of said line, the terminal plug of said line inserted in the spring-jack of another line, and a telephone in a circuit branched to the listening-key and included in the circuit of the line or disconnected therefrom accordingly as the wedge d is inserted under or withdrawn from under spring d' of the listening-key.

In witness whereof I hereunto subscribe my name this 15th day of March, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

CHAS. C. WOODWORTH,
GEORGE P. BARTON.