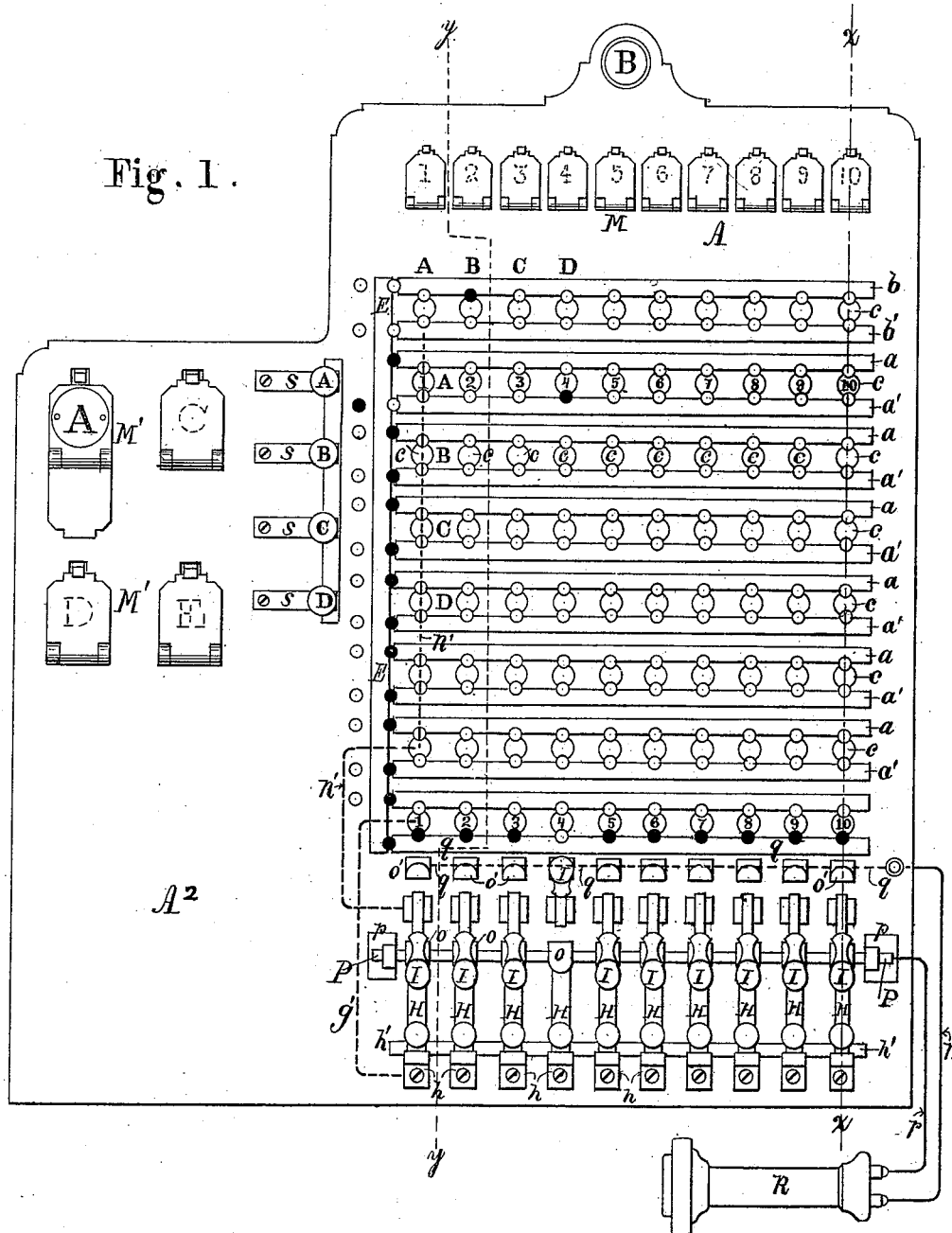


H. W. BRECKENRIDGE & J. W. DUXBURY.
 SYSTEM AND APPARATUS FOR TELEPHONE CENTRAL OFFICES.
 No. 266,344. Patented Oct. 24, 1882.

Fig. 1.



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(No Model.)

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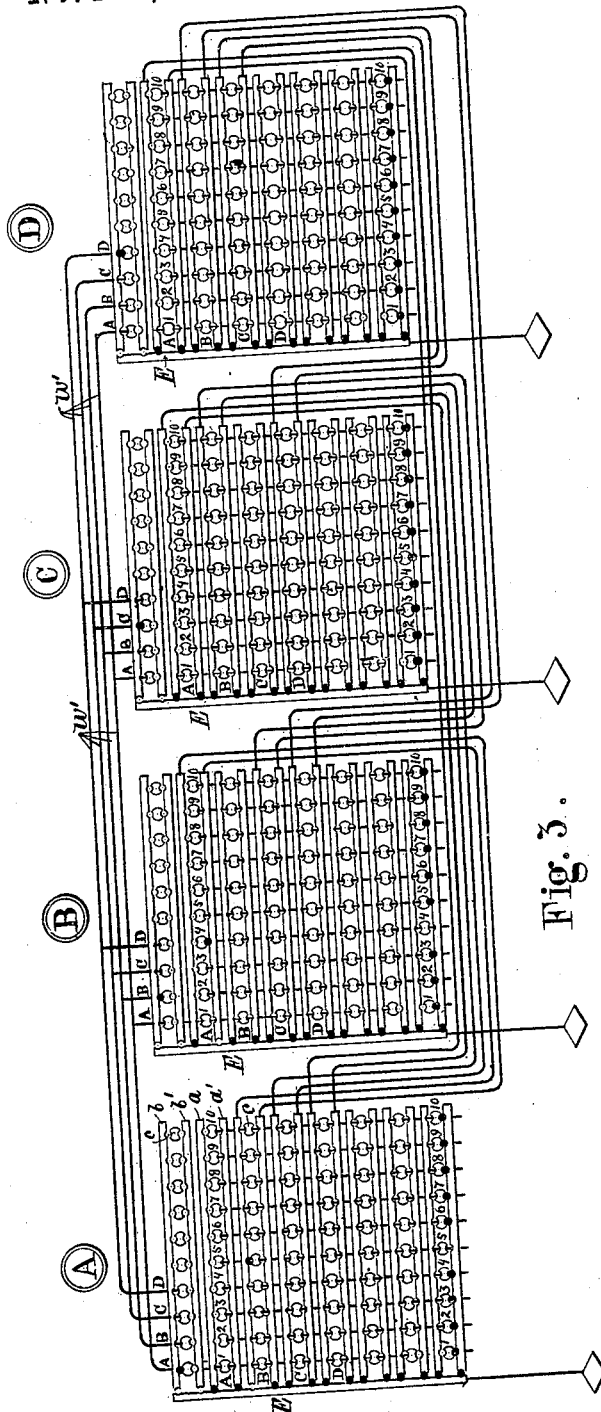


Fig. 3.

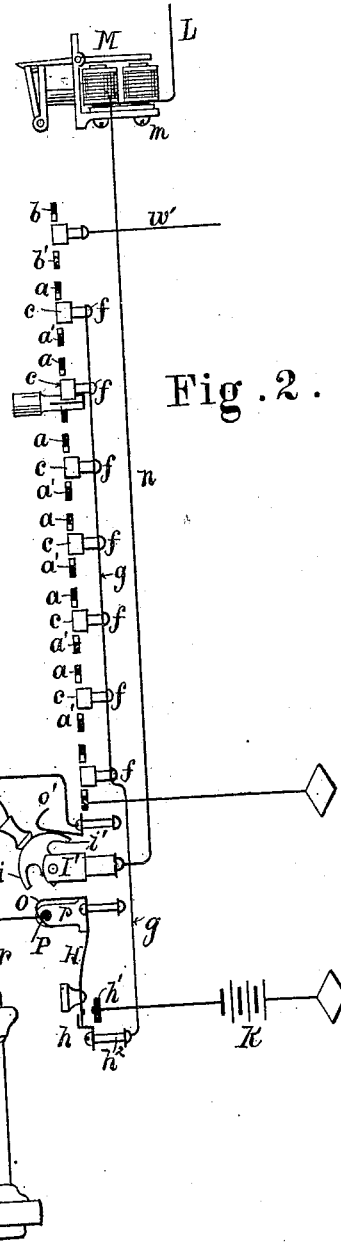


Fig. 2.

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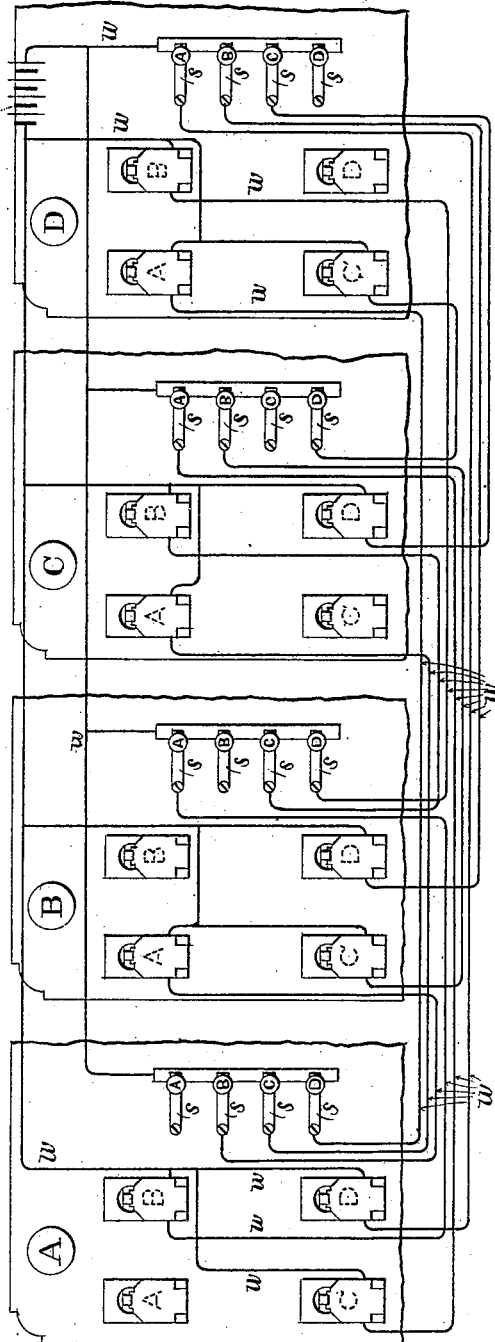
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Fig. 4.



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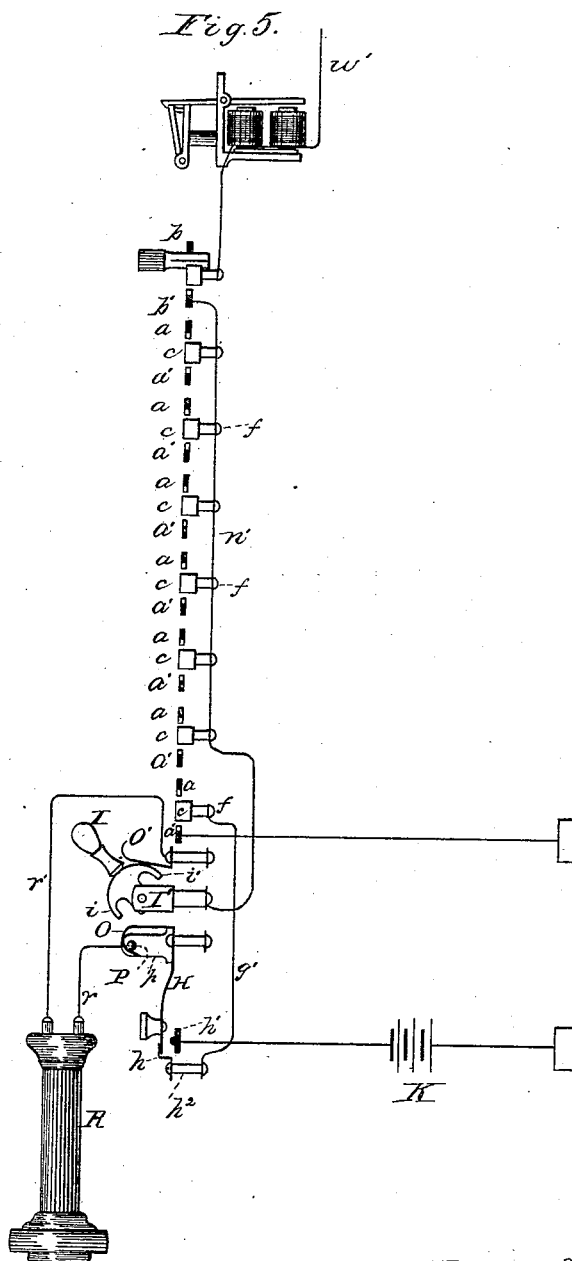
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(No Model.)

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UNITED STATES PATENT OFFICE.

HENRY W. BRECKENRIDGE AND JOHN W. DUXBURY, OF PROVIDENCE, R. I.

SYSTEM AND APPARATUS FOR TELEPHONE CENTRAL OFFICES.

SPECIFICATION forming part of Letters Patent No. 266,344, dated October 24, 1882.

Application filed October 17, 1881. (No model.)

To all whom it may concern:

Be it known that we, HENRY W. BRECKENRIDGE and JOHN W. DUXBURY, both of the city and county of Providence and State of Rhode Island, have invented a new and useful Improvement in Systems and Apparatus for Telephone Central Offices; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

Our invention relates to a system and apparatus for use in the central office of a telephone-exchange of that class in which the subscribers' lines are divided into groups terminating or centering at different switch-boards, each of which is provided with means for connecting its lines with all the other switch-boards in the office.

The objects of the invention are to facilitate connections between subscribers whose lines terminate at different switch-boards, and to avoid confusion and loss of time in the central office by obviating the necessity for shouting and card communication between the switch-board operators in giving directions from one to another in regard to desired connections.

To these ends the invention consists in certain novel electrical connections between the switches of the central switch-boards in a central office whereby subscribers' lines are connected from one board to another; in providing for telephone communication between the switch-board operators over local telephone-circuits and by annunciators connected therewith; in a novel system of receiving a subscriber's call, connecting the calling line with the switch-board at which the line of the called subscriber terminates, notifying the operator at said switch-board, and ascertaining the calling subscriber's wants by repetition from him direct; and in certain novel details of construction and connections by which subscribers' line-circuits are always kept closed when not in use, thus enabling communication between subscribers and the central office at all times when they are not in telephonic communication with other subscribers.

In the accompanying drawings, Figure 1 is a front elevation of a switch-board constructed according to our invention and adapted for

use in our improved system. Fig. 2 is a diagram illustrating a partial vertical section of the board on the dotted line *xx*, Fig. 1. Fig. 3 is a diagram illustrating the switch-connections between the several switch-boards in a central office. Fig. 4 is a diagram illustrating the local annunciator-circuits. Fig. 5 is a skeleton section on the line *yy* of Fig. 1.

Referring to Fig. 1, the switches are each composed of two parallel metal bars, *a* and *a'*, arranged upon the face of the board *A*, and having between them a series of metal disks, *c*, the adjacent edges of the said disks and bars being recessed for the reception of plugs in the usual manner for connecting the bars and disks electrically.

The disks *c* are all provided at their backs with pins *f*, (shown in Fig. 2,) which project through the board, and through these pins and wires *g* all the disks in the vertical column are connected together and with the stationary contact-point *h* of a key, *H*, said key being connected with one of the contact-springs *o* of a telephone-switch lever, *I*, by which the receiving-telephone *R* belonging to the switch-board may be connected in or removed from the subscriber's circuit. The anvil *h'* of the key *H* is connected with one pole of a calling-battery, *K*, the other pole of which is connected with the ground.

The top-switch of the board is a local telephone-switch, the use of which will be hereinafter explained, while the other switches are for connecting subscribers' lines.

A vertical metallic bar, *E*, is arranged upon the board adjacent to one end of each of the switch-bars, the ends of said bars and the opposite portions of the edge of the vertical bar being recessed for the reception of plugs. The vertical bar is in practice connected with the ground, and through it and the plugs the switch-bars are to be always kept in connection with the ground when not in use.

The letter *M* designates a series of annunciators, one only being shown in Fig. 2. A subscriber's line, as shown at *L*, Fig. 2, connects with one of the terminals of the coils of the annunciator-magnet *m*, and the other coil terminal is connected by a wire, *n*, with the post *I'*, which supports the pivoted switch-lever *I*. This lever has two curved arms, *i* and *i'*, which

by swinging the lever may be brought alternately in contact with the springs o and o' , which project from the board. The springs o are curved over a horizontal metallic bar, P , supported in front of the board by standards p , and to one end of the bar P is connected one of the telephone-wires, r , the other wire, r' , being connected to a wire, q , which connects the several springs o' together. The springs o are so arranged that their curved tips are normally in contact with the bar P , but are removed therefrom when the arms i of the switch-levers are swung into contact with the springs, pressing the said springs downward.

There is a switch-lever, I , a key, H , contacts, and connections, as shown, for each subscriber's line and vertical column of disks c . The lower bar of the lowermost switch on the board is connected with the ground, and should be plugged into connection with all the disks above it at all times when the disks are not in use for connecting with other switches, this bar serving as a ground-bar for all the subscribers' lines, as the bar E serves as a ground-bar for all the switch-bars. When a subscriber on any particular line causes the drop of his annunciator to fall the current which operates it passes from the line L through the coil of magnet m , over wire n , post I' , lever I , its arm i , (which should be kept normally in contact with spring o , the arm i' being then not in contact with spring o' ,) over spring o , key H , contact h , pin h^2 , wire g , pin f of the lowermost disk in the column, to which the wire g is connected, over the disk and a plug to the bar below, and thence to the ground. When the connections are thus it will be seen that the telephone R is not in circuit; but on observing the fall of the annunciator-drop the operator swings his switch-lever which is connected to same line up to position shown in Fig. 2, thus bringing the arm i of said lever in contact with its spring o' , when a circuit will be established from the wire n , over post I' , the lever-arm i' , spring o' , wire r' , through the telephone-coil, over wire r , bar P , spring o , key H , and thence to the ground, as before. The telephone being thus in circuit, the operator may inquire as to the wants of the subscriber, which being ascertained, the proper connections will be made.

The means of making the connections will be now described with reference to Fig. 3.

Each connecting-switch (composed of parallel bars a and a' and intermediate disks c) on a board is designated by a particular mark—letters being used in the present instance—and the switch-boards are similarly lettered—that is, each board has its switches lettered A B C D , &c., and the boards themselves are also lettered A B C D , &c., respectively. The switch having a certain letter on any board is used for connecting that board with a board having the same letter as the said switch and with a switch on said board having the same letter as the first board. For instance, referring to the Fig. 3, the bars of switch B on board

A are connected with the bars of switch A of board B , the bars of switch C of board A are connected with the bars of switch A of board C , the bars of switch D of board A are connected with switch A of board D , and so on, the letter of the switch on any board indicating what other board said switch is connected with.

The upper bar of each switch, except that switch having the same letter as its board, is connected with the lower bar of the switch with which it is connected on another board. For instance, the upper bar of switch B on board A is connected with the lower bar of switch A on board B . This is to avoid any doubt as to which bar is to be used, it being understood that the first connection made from a board, or after the receipt of a subscriber's call, is made through the upper bar, and this connection is to the lower bar of the switch through which communication is desired to be established. For instance, when the operator at table D receives notice that a line terminating at board A is desired to be connected with a line terminating at his board, he knows that the connection is to be made through the lower bar of his switch A , and at the proper time plugs between said lower bar and the disk above which bears the number of the line called.

The notification from one operator to another that a connection is desired is made by means of a local annunciator and a circuit between the boards for actuating the same. Each switch-board has a lateral extension, as shown at A^2 , Fig. 1, upon which are arranged the local annunciators M' , one for each of the other boards—that is, switch-board A will have local annunciators connected with keys, as shown at S , Figs. 1 and 4, at boards A , B , C , and D , respectively, and lettered the same as the said boards, the board B is provided with annunciators connected with keys at boards A , C , and D , respectively, and so on.

Each local annunciator is connected with a key at a board having a corresponding letter. For example, local annunciator B at board A is connected with key A at board B , annunciator C is connected with key A at board C , and so on, so that by manipulating a key at any board an annunciator at a board having a letter corresponding to the letter of the key manipulated is operated, said annunciator having a letter corresponding to that of the board at which the manipulated key is located. Thus when any switch-board operator observes the fall of the drop of a local annunciator at his board he knows immediately by the letter of the annunciator that the operator at a board having the same letter is signaling that a connection is to be made, this connection being made on the lower bar of the switch having the same letter as the board signaling, as before explained.

In Fig. 4 the wires comprising the local-annunciator circuits are indicated by the letter w , complete metallic circuits with return-wires

being shown, though, of course, ground-connections might be used.

Ordinarily it is unnecessary for the operators at the different switch-boards to communicate with each other except through the local annunciators; but if anything should go wrong in making connections, and conversation become necessary, this conversation will be carried on over local telephone-circuits, the wires of which are indicated by the letter *w'* in Fig. 3.

It has been before stated that the top switch on each board is for making local telephone-connections. The disks *c* between the bars of this top switch are lettered A B C D, &c., and these disks of each top switch are connected with similarly-lettered disks of the other top switches by wires *w'*, as shown in Fig. 3.

The left-hand annunciators of the top rows of annunciators are not used in subscribers' circuits, but are for calling between the different switch-boards for conversational purposes. The wires *w'* (see Figs. 3 and 5) from the top disks of each board connect respectively with similarly-lettered disks at each other board, and at each board one of these wires passes through its left-hand annunciator before it connects with the top disk having the same letter as the board—as, for instance, the top disks A of boards B, C, and D are connected with the top disk A of board A, the circuit passing first through the left-hand annunciator of board A, the top disk B of boards A, C, and D connect with the top disk B of board B, the circuit passing first through the left-hand annunciator of board B, and so on. The lower bar of the top switch of each board (see Figs. 1 and 5) is connected by a wire, *n'*, with disks No. 1, or the left-hand disks, of all the switches below it, except the left-hand disk of the bottom switch, and said wire *n'* also connects with the post *I'* of the left-hand telephone-switch. The lower No. 1, or left-hand disk of each board, is connected by a wire, *g'*, with the upper stop, *h*, of the key H of said left-hand switch. Now, when the operator at any board wishes to converse with the operator at any other board he removes the plug from the end of the top bar of his top switch (where it should normally be kept) and inserts it between the lower bar and the disk having the letter of the board to be called. He thus connects the left-hand annunciator of the board to be called with the post *I'* of his own board, and then, after turning his left-hand switch *I* to contact with the adjacent spring *o'*, as shown in Fig. 5, he can, by depressing the left-hand key H, send a current from the battery K over the local line (one of the wires *w'*) to operate the left-hand annunciator of the board he wishes to call, and from which he can, by leaving the key raised, receive a reply through his telephone. The operator at the board called, on seeing the drop of his left-hand annunciator fall, removes the plug from the end of the lower bar of his top switch and inserts it between said bar and the top disk bearing the letter of his board. He then turns his left-hand switch *I* to the posi-

tion shown in Fig. 5, and with his telephone inquires as to who wishes to converse with him. The conversation may then proceed, and the plugs and the telephone-switches are to be placed in their normal positions when it is finished.

By the use of these local conversational telephone-circuits, it will be seen, all confusion by shouting and loss of time by moving about the office and awaiting the movements of messengers are avoided.

The following directions will give a brief recapitulation of the working of the system and apparatus.

For connecting its own subscribers' lines the switch at each board will be used which bears the letter of the board. Suppose a call comes to board A over its line 5 from a subscriber desiring to communicate with a subscriber on line 6 of the same board. On observing the fall of the drop of annunciator 5, connect in the telephone on line 5 through its switch and ask what is wanted. After getting an answer and requesting the calling subscriber to wait a moment, put up the drop of the annunciator, remove the plug from below the disk 5 of the lower switch and insert it between the lower bar of switch A and its disk 5, and call the subscriber on line 6. On receiving his answer, remove the plug from disk 6 of the lower switch and insert it between disk 6 and the lower bar of switch A; then remove the plug from the end of the lower bar of switch A and put up the drop of annunciator No. 6. The connection between the two subscribers will then be completed. When the communication is finished either of the subscribers may announce the same by operating his annunciator. If two other subscribers of the board should wish to communicate at the same time that the lines 5 and 6 are connected, they may be connected through the top bar of switch A, and if still two others desire to communicate they may be connected through the top bar of the lower switch by transferring the plugs from the lower to the upper sides of the disks and removing the plug from the end of the upper bar of said switch. Each board may also have an extra switch for connecting its own subscribers. Suppose a call comes on line 5 of board A for line 4 of board B. Ascertain as before what is wanted on A 5 and put up annunciator, press the key for announcing connection to B, transfer the plug on A 5 from ground-bar at bottom of switch to the upper bar leading to B, and remove plug from end of bar leading to B and place it in a hole in the wood at the end of the bar. This completes the operation at board A. At B, when A annunciator falls, remove plug from the end of lower bar marked "A" to No. 1 disk, connect in telephone on No. 1 line, and ask "who is wanted?" After ascertaining this, call the desired party on B 4, as before described; connect the telephone on his wire to ascertain when he replies. When a reply is obtained transfer plug from B 4 ground-bar to the bar

leading from A and remove the plug from No. 1 disk to a hole in the wood at the left of bar for A. Put up annunciators immediately. To disconnect, put the pins back in the ground-bar at the bottom of the switch and at the end of the bar.

If anything goes wrong or is not understood, call the desired switch by plugging the disk bearing its letter in the upper row of disks and second upper bar and signal by No. 1 key and telephone.

Put up the annunciators at once after answering or making a call and before the connection is completed, as by this means the subscriber can signal again if the connection is forgotten or is incorrectly made. Be sure that the ground plugs are put in at the ends of the bars when the bars are not in use, and that these plugs are placed in the wood at the ends of the bars when the bars are occupied. The upper bar of any line-switch is always to be used in connecting a first calling line with a switch on another board, and at said other board the lower bar is to be used in completing the connection. A second calling line on the same board will be connected from the lower bar to the upper bar of the desired switch. A third connection may be made through the lower bars of the top switches.

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

1. In a telephone central-office system, a series of switch-boards provided with line-switches, each of which is composed of two metal plug-bars and an intermediate series of metal plug disks or plates arranged for plug-connection with said bars, the bars of the switches on one board being electrically connected respectively with bars on the opposite sides of the disks of switches on other boards, substantially as described.

2. A series of telephone switch-boards provided with switches composed of two metal plug-bars and a series of intermediate metal disks adapted for plug-connection therewith and connected electrically in rows transverse to the bars, one of which bars is provided with a ground-connection, each board having a metal plug-bar, E, arranged transversely to the ends of its switch-bars and adapted for connection with the ground, and any desired number of the switch-bars of each board, exclusive of the switch-bar connected with the ground, being in permanent electrical connection with switch-bars of one or more other boards, substantially as described.

3. In a telephone central office, a series of switch-boards, each provided with switches composed of metal plug-bars *a* and *a'* and intermediate metal plug-disks, *c*, the metal bar E, arranged for plug-connection with the ends of all said switch-bars, the line and local annunciators for indicating connections to be made, keys, and electrical connections, substantially as described.

4. In a telephone central-office system, the combination, with a series of line switch-boards, each provided with terminal points, arranged in pairs, and means for connecting one terminal point of one board with an opposite terminal point on another board, as described.

5. In a telephone central-office system, the combination, with a series of line switch boards provided with terminal points, arranged in pairs, and connecting-lines, of means for connecting the points with the ground, so that after the calling subscriber is connected with the board of the called subscriber the calling subscriber can still signal to the operator of the board with which he is connected, as described.

6. In a telephone central-office apparatus, a series of switch-boards, each provided with line-switches, transfer or board-connecting conductors connecting the switches of each board with those of other boards, and local telephone-circuits connecting the boards independently of the said transfer or board-connecting conductors, substantially as described.

7. In a telephone central-office apparatus, a series of switch-boards, each provided with line-switches, in combination with a series of transfer-lines connecting each switch of each board permanently with a corresponding switch of another board, local telephone-lines connecting all the boards—one line for each board—and independent local annunciators and annunciator-circuits connecting each board with every other board in the system, substantially as described, and for the purpose set forth.

8. In a telephone central-office system, the combination, with the series of switch-boards, each provided with line-switches and line-annunciators, of the local telephone-circuits—one for each board—a local annunciator connected in the local telephone-circuit at each board, the local telephone-circuit plug-switch at each board, the local telephone-switch I at each board, constructed substantially as described, the wire *n'*, connecting said switch with the lower bar of the local telephone-circuit switch, the key H of said switch, the upper stop, *h*, of the said key, the wire *g'*, connecting said stop with ground-connections, and the lower stop of said key, connected with an electric generator, the local annunciator being connected with one of the disks of the local telephone-circuit switch at each board, and said disks being adapted for connection with adjacent bars by means of metal plugs, substantially as set forth.

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