

No. 686,272.

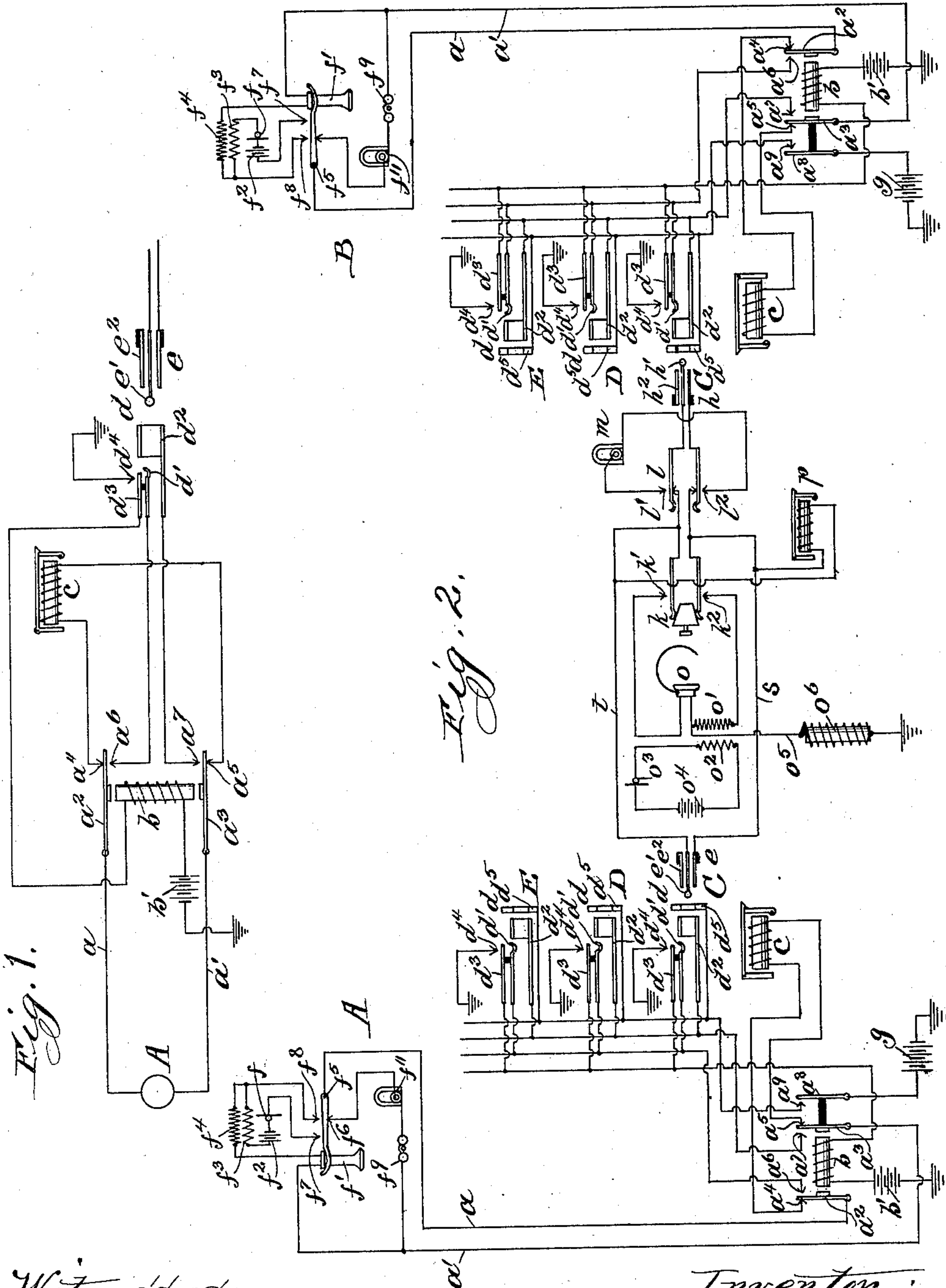
Patented Nov. 12, 1901.

F. W. DUNBAR.
TELEPHONE SWITCHBOARD SYSTEM.

(Application filed Aug. 17, 1900.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses:
R. J. Jaeger,
May R. Rochford.

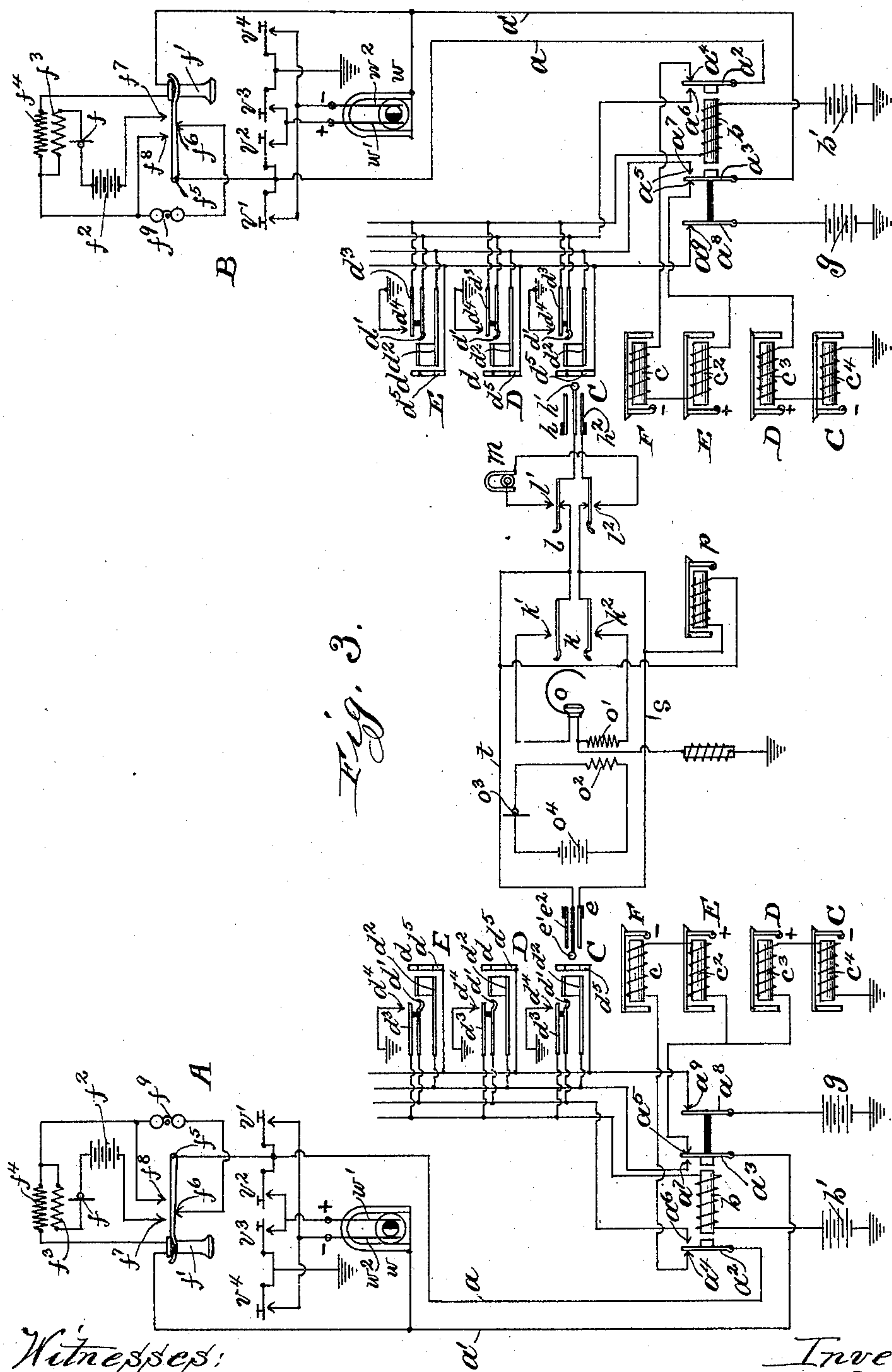
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TELEPHONE SWITCHBOARD SYSTEM.

(Application filed Aug. 17, 1900.)

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3 Sheets—Sheet 2.



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3 Sheets—Sheet 3.

Fig. 4.

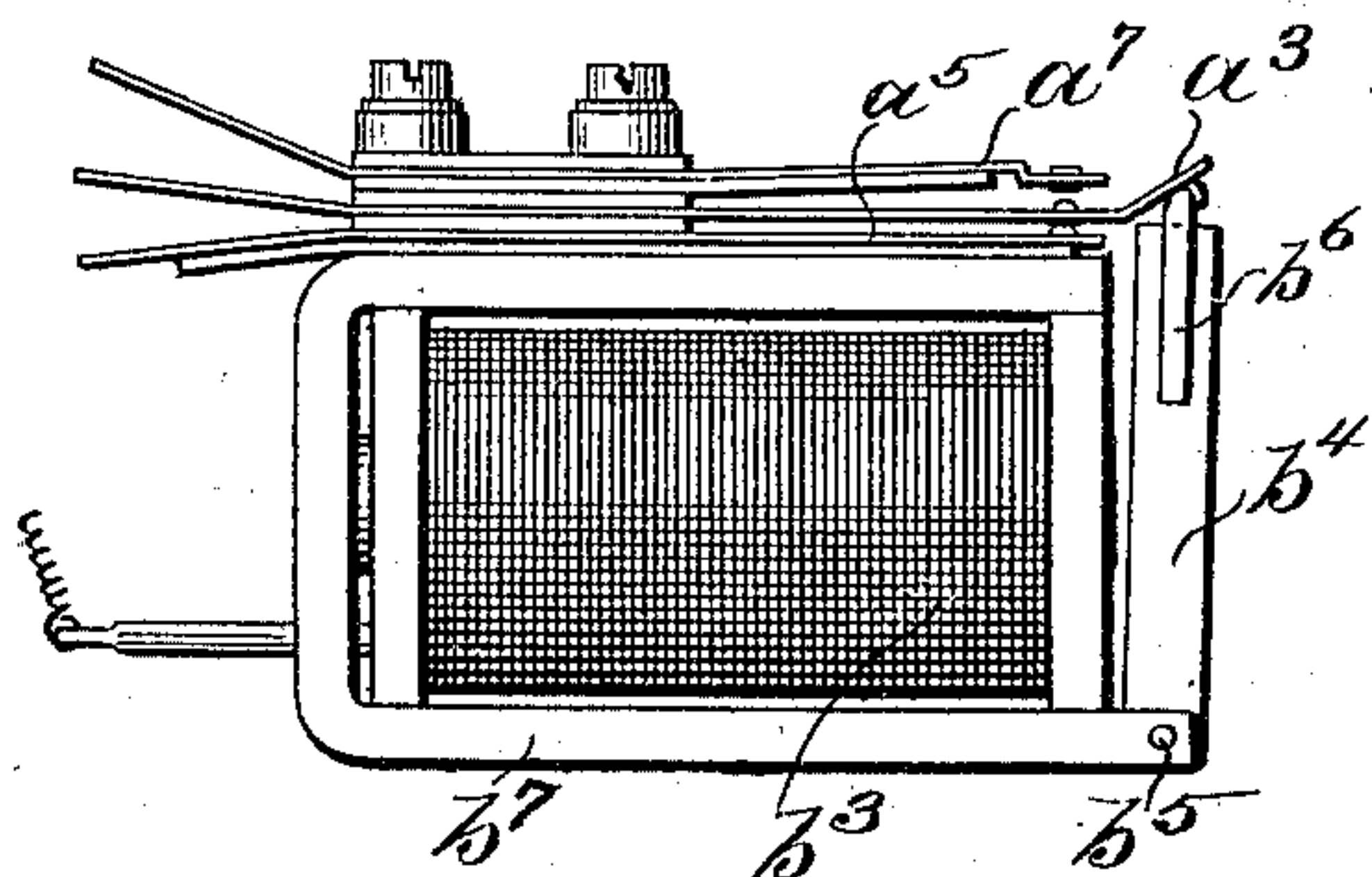


Fig. 5.

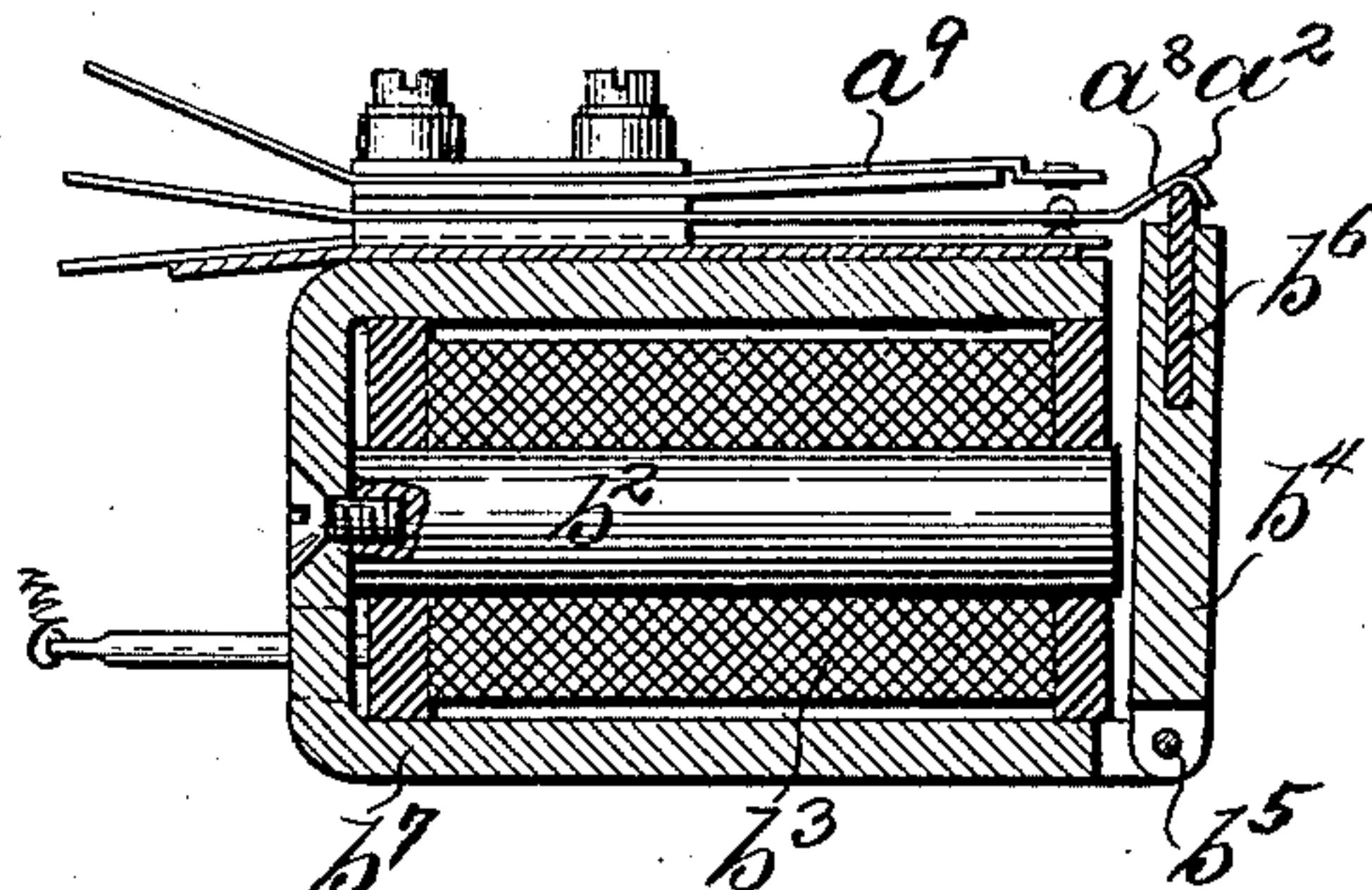


Fig. 6.

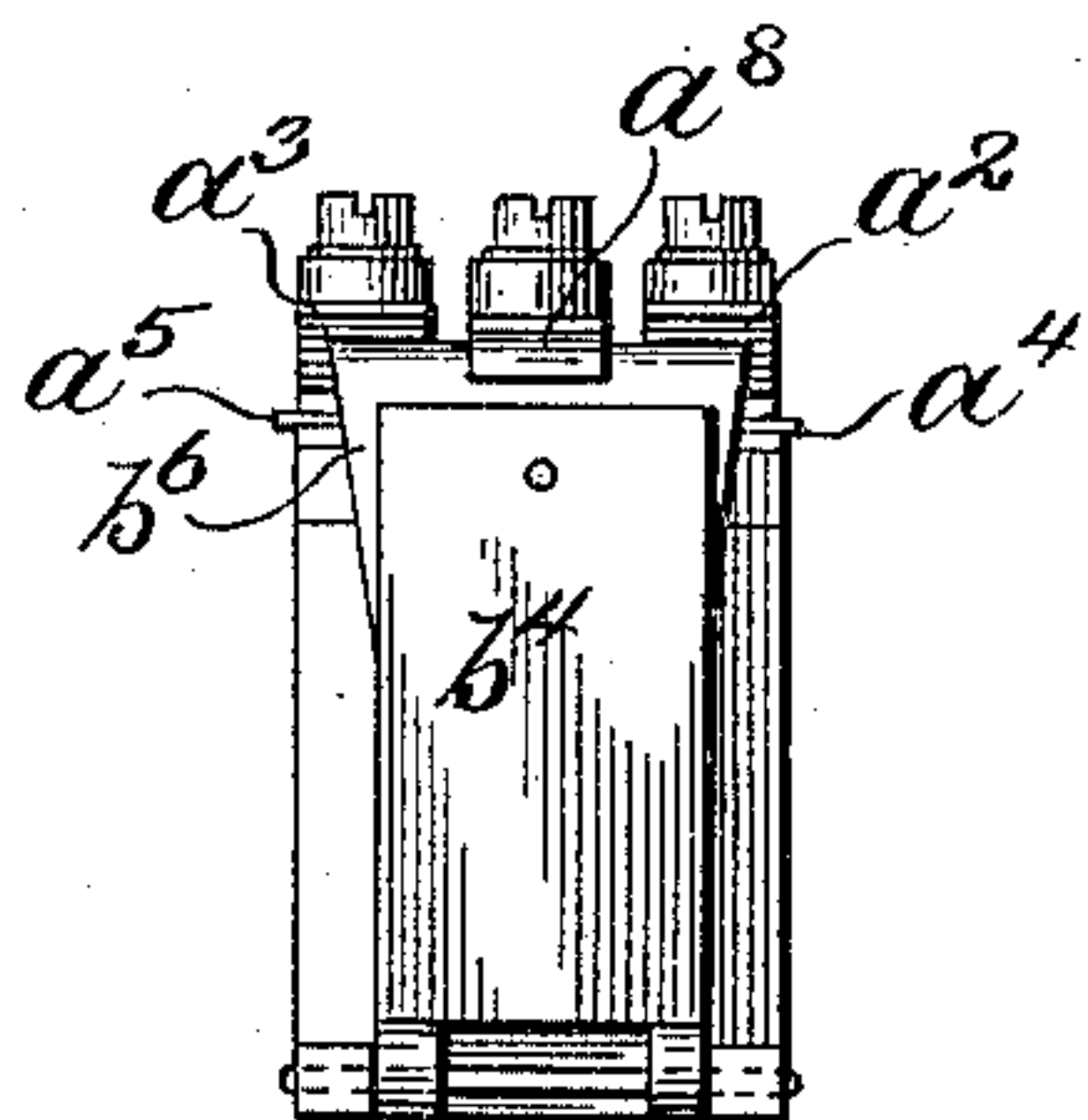
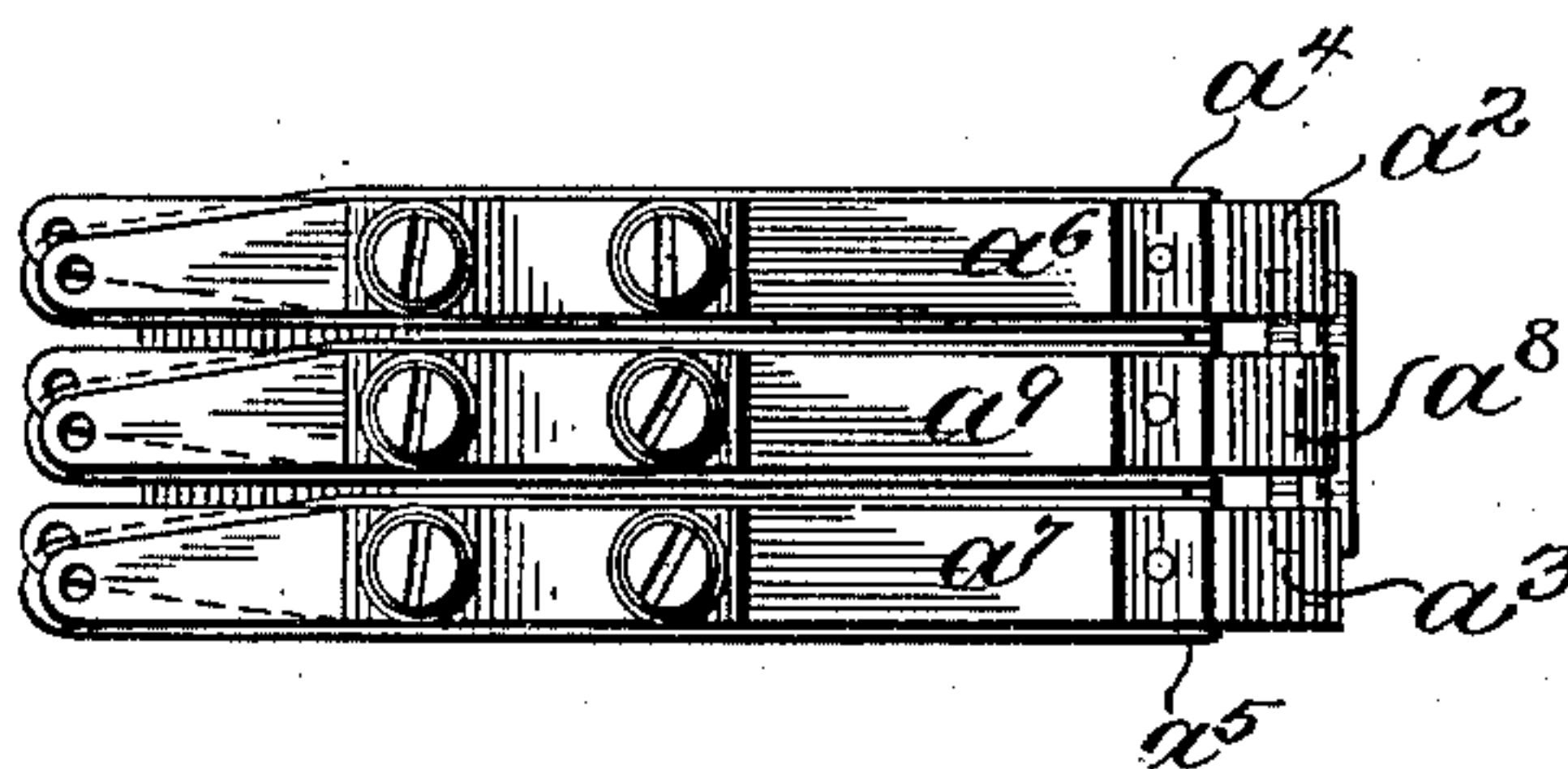


Fig. 7.



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UNITED STATES PATENT OFFICE.

FRANCIS W. DUNBAR, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

TELEPHONE-SWITCHBOARD SYSTEM.

SPECIFICATION forming part of Letters Patent No. 686,272, dated November 12, 1901.

Application filed August 17, 1900. Serial No. 27,131. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS W. DUNBAR, 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 Telephone-Switchboard Systems, (Case No. 7,) 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 a telephone-switchboard system, my object being to provide an improved system of circuits and improved form of telephone apparatus at the central station.

In telephone-switchboards as usually constructed heretofore the telephone-line is normally connected with one or more spring-jacks or connecting terminals at the central station, the telephone-line usually being connected with a single connecting terminal in the case of a single or divided board and with a plurality of connecting terminals, one upon each of the several sections, in the case of a multiple switchboard. These spring-jacks or connection terminals are individual to the respective telephone-lines—that is, each line is connected with a connection terminal or terminals which belong to that line alone. In these exchanges of the prior art the spring-jacks or connecting terminals have been permanently connected with the telephone-line. The individual annunciator or call device by means of which the subscriber attracts the attention of the operator at the central station has been connected either permanently with the telephone-line or has been arranged so that the act of making a connection with the telephone-line at the central station serves to disconnect the individual annunciator. Since the individual annunciator and the spring-jack or connecting terminal are both normally connected with the line when the same is not in use for conversation, it frequently happens that the insertion of a connecting-plug serves to accidentally actuate the annunciator at the time when the same should remain inert, and this fact leads to difficulty in many telephone systems, and, moreover, the fact that the individual an-

nunciator and the connecting terminal are both normally connected with the line at the time when the same is not connected for conversation limits the number of different circuit arrangements which may be employed. In accordance with the present invention the spring-jack or connecting terminal individual to each line is normally disconnected from the telephone-line and is adapted to be connected therewith when connection is made with the line. I preferably provide means whereby the act of inserting the plug in the spring-jack or connecting terminal serves to automatically connect the spring-jack or connecting terminal with the telephone-line. The act of removing the plug at the end of the conversation serves to automatically disconnect the spring-jack or connecting terminal from the telephone-line. In practice I employ a relay adapted when energized to actuate the switch which serves to connect the spring-jack with the telephone-line, the circuit through the relay-magnet being closed by the act of inserting the connecting-plug in the spring-jack, the removal of the plug from the spring-jack serving to deenergize the relay-magnet to disconnect the spring-jack from the telephone-circuit. In the case of multiple switchboards the plurality of spring-jacks may be controlled by a single relay, whereby the same may be connected with the telephone-circuit when connected for conversation and disconnected therefrom at the termination of the conversation. I also associate the individual or calling annunciator with the apparatus which controls the circuit through the spring-jack, whereby the act of making connection with the line serves to disconnect the individual annunciator. I preferably arrange the circuit so that the individual annunciator is disconnected from the line at approximately the same time that the spring-jack is connected therewith and so that the disconnection of the spring-jack from the telephone-line is accompanied by the practically simultaneous connection of the individual annunciator therewith. The individual annunciator thus being disconnected from the spring-jack when the plug is inserted therein, the danger of inadvertently

actuating the individual annunciator is entirely removed. Moreover, since the spring-jack is entirely disconnected from the telephone-circuit when the connecting-plug is inserted in the spring-jack the danger of inadvertently actuating any apparatus connected with the telephone-line is removed. This feature of my invention is equally applicable and advantageous in systems of the central-energy type and systems of that class in which the energy for the talking-currents is supplied from the substations. For multiple switchboards I preferably arrange the relay which controls the circuit through the spring-jacks so that the same will control the testing-circuit. For the purpose of the busy test I usually employ a source of electricity adapted to be connected with test-rings on the several spring-jacks or switch-sockets. If the busy condition of a line is to be denoted by a click, the source of electricity is connected with the several test-rings when connection is made with the line, while if a silent test is desired the source of electricity is disconnected from the test-rings when connection is made with the line. In the former case the operator hears a click in her telephone if the line is busy when she touches the plug to the test-ring. In the latter case the telephone remains silent when the line is busy. By employing the relay which controls the circuit through the connection terminal for also controlling the testing-circuit the act of making connection with the line serves to operate the relay, which thereupon connects the terminal with the line and at the same time connects the testing-circuit in condition to give the proper test-signal.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a diagram illustrating my invention as applied to a telephone-line having a single connecting terminal at the central station. Fig. 2 is a diagram illustrating two telephone-lines connected with a multiple switchboard at the central station. Fig. 3 is a diagram illustrating two telephone-lines connected with a multiple switchboard at the central station, the telephone-line being provided with selective signaling apparatus whereby the subscriber may in a well-known manner select the division of the switchboard at the central station at which connection is to be made. Fig. 4 is a side view of the relay which I preferably employ. Fig. 5 is a sectional view thereof. Fig. 6 is an end view thereof. Fig. 7 is a plan view thereof.

Like letters refer to like parts in the several figures.

As shown in Fig. 1, the line of subscriber A extends in two limbs a a' to the central station, where the same are connected, respectively, with the springs a^2 a^3 , carrying armatures and adapted to be actuated by the relay-coil b . The spring a^2 normally rests against back contact a^4 , and the spring a^3 normally rests against back contact a^5 . Between the

contacts a^4 and a^5 the coil of the individual annunciator c is connected. The spring a^2 is adapted when the relay-magnet is actuated to engage the front contact a^6 , which is connected with the terminal d' of spring-jack d . The spring a^3 is likewise adapted to engage the front contact a^7 , which is connected with the line-terminal d^2 . Moving with the terminal d' , but insulated therefrom, is a contact-terminal d^3 , adapted when the connecting-plug e is inserted in the spring-jack to engage the contact-plate d^4 , which is connected with the ground. The contact d^3 is connected through the winding of relay b and through the battery b' to ground.

It will be noted that the spring-jack d is normally disconnected from the telephone-line a a' , while the individual annunciator c is normally connected therewith. When the subscriber desires to be connected for conversation, he sends current in the usual manner over the limbs a a' and through the individual annunciator c , thereby actuating the same and calling the attention of the operator at the central station, who thereupon inserts the answering-plug e in the spring-jack d . The tip e' of the plug e engages spring d' , and the sleeve e^2 thereof engages the terminal d^2 . The spring d' is thus moved laterally, thereby carrying contact d^3 into contact with contact d^4 , and the circuit of battery b' is thus closed from ground through relay-magnet b , contacts d^3 d^4 , to ground. The relay is thus energized, thereby attracting the armatures carried upon springs a^2 a^3 and moving the same out of contact with their respective back contacts a^4 a^5 and into contact with their respective front contacts a^6 a^7 . The individual annunciator c is thus disconnected from the telephone-line a a' , and the spring-jack d is connected with the said telephone-line. When the conversation is completed and the operator removes the plug e , the circuit through battery b' is opened and the relay-magnet is deenergized, thereby permitting the springs a^2 a^3 to return to the back contacts to thereby connect the individual annunciator with the telephone-line and to disconnect the spring-jack from said telephone-line.

In Fig. 2 I have illustrated two telephone-lines extending from the substations to the central office and adapted to be associated with the several spring-jacks of a multiple switchboard, three sections of the switchboard being shown for the purpose of illustration and description. Each of the subscribers is provided with a microphone f and a receiver f' , the microphone being included with a battery f^2 in a local circuit with the primary f^3 of an induction-coil, the secondary f^4 of which is connected in circuit with the receiver f' and the limb a' of the line. The limb a of the line is connected with the switch-hook f^5 , which normally rests against contact f^6 , and which when the receiver is removed is adapted to engage contacts f^7 and f^8 . The

bell f^9 is included in circuit between the contact f^6 and the limb a' . The calling-generator f^{11} is included in the usual manner in circuit with the bell f^9 . The limb a terminates, as in Fig. 1, at the spring a^2 , while the limb a' terminates at the spring a^3 . The spring a^2 vibrates between the contacts a^4 and a^6 , while the spring a^3 vibrates between the contacts a^5 and a^7 . The individual annunciator c is connected in circuit between the contacts a^4 and a^5 , while the contacts a^6 is connected with the springs d' d' of the plurality of spring-jacks d . I have illustrated three sections, C, D, and E, and one of the spring-jacks d of each of the telephone-lines A and B is mounted at each section of the switchboard. The contact a^7 is connected with the terminals d^2 of the several spring-jacks, and associated with the spring d' at each spring-jack and insulated therefrom is the contact d^3 , adapted to make contact, when the plug is inserted, with the contact d^4 .

Mounted to move with the spring a^3 and insulated therefrom is a spring a^8 , adapted, when the relay is energized, to engage contact a^9 , which is connected with a test-ring d^5 at each spring-jack. A battery g has one pole connected to ground and the other pole connected to spring a^8 . The winding of relay b is connected on one side to the ground through battery b' and on the other side to the springs d^3 of the several spring-jacks. Instead of employing the two batteries b' and g a single battery may be employed. I have lettered the circuits and apparatus of the telephone-lines A and B with the same reference-letters, since the telephone-lines, as illustrated, are in every respect alike.

The tip e' of the answering-plug e is connected to the tip-strand t of the cord, and the sleeve e^2 of the plug is connected with the sleeve-strand s . The tip-strand t is likewise connected with the tip h' of the calling-plug h , and the sleeve-strand s is connected with the sleeve h^2 of the connecting-plug. A key k is adapted when depressed to connect the operator's telephone set between the strands, and the key l when depressed is adapted to disconnect the answering-plug from the calling-plug and to connect the calling-generator in circuit with the calling-plug. The calling-generator m is connected between the back contacts l' l^2 of the ringing-key l . The operator's telephone-receiver o and the secondary o' of the induction-coil are connected between the back contacts k' k^2 of the listening-key k and the primary o^2 . The microphone o^3 and the battery o^4 are included in a local circuit. A ground-leg o^5 , including an impedance-coil o^6 , is connected between the receiver o and the secondary o' . The clearing-out annunciator p is connected between the tip and sleeve-strands t and s .

The operation of the system is as follows: Supposing that subscriber A desires to converse with subscriber B, he removes his telephone-receiver from its hook and operates his

generator, thereby sending current over limb a' , spring a^3 , contact a^5 , individual annunciator c , contact a^4 , spring a^2 , back to the generator over limb a . The individual annunciator c is thus actuated to notify the operator at the central station. The operator thereupon inserts the answering-plug e in the spring-jack at the section of the switchboard at which she is located, thereby moving spring d^3 into contact with the contact d^4 . The circuit of battery b' is thus closed through winding of relay b , spring d^3 , contact d^4 , to ground, and back to battery b' . The relay b is thus actuated, thereby moving the springs a^2 and a^3 out of contact with the back contacts a^4 and a^5 , respectively, and moving said springs into contact, respectively, with contacts a^6 and a^7 . The individual annunciator is thus removed from circuit and the spring-jack is connected with the telephone-line a a' . The spring a^8 is at the same time moved into contact with contact a^9 , thus connecting battery g with the test-rings d^5 d^5 of the several spring-jacks. The operator then depresses key k to bridge her telephone set in circuit and receives from subscriber A the number of the called subscriber. Learning that connection is desired with subscriber B the operator lifts the connecting-plug h , which is the companion to the answering-plug e , and touches the tip thereof against the test-ring d^5 of the spring-jack belonging to subscriber B and situated at section C of the switchboard at which the operator is located. If the line of subscriber B is connected with another subscriber, the battery g of subscriber B will be connected with the test-rings d^5 , and when the tip of plug h is touched to this test-ring circuit will be closed from battery g through springs a^8 , contact a^9 , test-ring d^5 , tip h' , contact k' of the listening-key, through receiver o and ground-leg o^5 back to battery g . The operator will thus hear a click in her telephone when the tip of the plug is touched to the test-ring, and will thus know that the line is busy. If the operator hears no click, she will know that the line is not busy and will insert the plug h in the spring-jack of subscriber B, thereby actuating the relay b of subscriber B to connect the spring-jack with the line of subscriber B and to disconnect the individual annunciator. The operator then depresses the ringing-key l and sends current through the bell of subscriber B. When subscriber B removes his telephone from the hook, the subscribers are connected for conversation. The talking-circuit may be traced from limb a of subscriber A through spring a^2 , contact a^6 , spring d' , tip e' , strand t , tip h' of plug h , spring d' of spring-jack belonging to subscriber B, contact a^6 , spring a^2 , limb a of subscriber B through his talking apparatus, thence by limb a' through spring a^3 , contact a^7 , terminal d^2 , plug-sleeve h^2 , strand s , plug-sleeve e^2 , terminal d^2 , contact a^7 , spring a^3 to limb a' , and thence through the talking apparatus of subscriber A. When the sub-

scribers have finished their conversation, they hang up their receivers and one or both of the subscribers actuate the generators at the substations, thereby sending current through the clearing-out annunciator p in a well-known manner to convey the signal of disconnection to the operator at the central station. Thereupon the operator removes the plugs e and h , and the circuit of batteries $b' b'$ being opened the relays $b b$ are deenergized, thereby disconnecting the spring-jacks and connecting the individual annunciators $c c$ in circuit to respond to another call for connection.

In Fig. 3 I have illustrated my invention as applied to a telephone system of that class known as the "divided multiple," in which means are provided whereby the subscriber may select the division of the multiple switchboards at which connection will be made. With the exception of the individual annunciators and the test-circuit at the central station and the calling apparatus at the substation the apparatus shown in this figure is the same as that illustrated in Fig. 2, and like parts have been indicated by the same reference-letters as those employed in Fig. 2. Each subscriber is provided with a plurality of individual annunciators at the central station, in the present instance four, $c c^2 c^3 c^4$, one being located at each division C D E F of the boards. The coils of annunciators c and c^2 are connected in series and are placed between the back contacts a^4 and a^5 of relay b . The annunciators c^3 and c^4 are connected in series in a grounded leg from that side of annunciator c^2 which is connected with back contact a^5 . At the substation a generator w is provided which is adapted to send current of positive or negative polarity, as desired. Generators of this class are well known, and I have illustrated the same diagrammatically. One side of the armature-winding of the generator is connected with the limb a' of the line, and two brushes $w' w^2$ are provided for the generator, one connected with keys v^2 and v^3 , while the other is connected with keys v' and v^4 . When the key v' is depressed, the generator w is connected between the two limbs $a a'$ of the telephone-line, so as to send current of negative polarity thereover to thereby actuate annunciator c , which is polarized to respond to current traversing the coil in a negative direction only. When key v^4 is depressed, the generator w is connected between limb a' and ground, thereby actuating annunciator c^4 , which also responds to current of negative polarity. Likewise the depression of key v^2 will connect the generator between the two limbs of the line to send current of positive polarity, thereby actuating annunciator c^2 , while the depression of key v^3 will connect the generator between limb a' and ground to send current of positive polarity thereover to actuate annunciator c^3 . The several annunciators are mounted upon the respective divisions C, D, E, and F

of the switchboard, and the subscriber is thus enabled to select the division at which the connection is to be made. In this figure the testing system instead of giving a click in the operator's receiver when the telephone is busy will remain quiet when the telephone-line is busy and will give a click when the line is idle. It will be noted that the spring a^8 instead of normally resting out of engagement with the contact a^9 , as shown in Fig. 2, normally rests in engagement therewith, so that the battery g is normally connected with the test-rings and is adapted to be disconnected therefrom when the relay-magnet b is energized. When the operator therefor touches the tip of the plug to the test-ring, she will hear a click if the line is idle, while if it is busy she will fail to hear the click. It is obvious that either system of testing—that is, silence or a click to indicate a busy line—may be used, according to whether the contact a^9 is on the back or front side of the spring a^8 . This system illustrates the manner in which circuits may be employed in accordance with the present invention which could not be employed were the spring-jack or connecting-terminal permanently connected with the telephone-line, as has been the usual practice heretofore. Thus it will be noticed that when the plug e is inserted in the spring-jack the sleeve e^2 of the plug serves to momentarily connect together the test-rings d^5 and the sleeve or terminal d^2 of the spring-jack. In the absence of the relay b and the contacts controlled thereby the circuit of battery g would flow to the test-ring d^5 , thence through the sleeve of the plug to the terminal d^2 of the spring-jack, thence over the line connected therewith through contacts a^7 and a^5 , which would in that case form a continuous conductor, and thence through the grounded annunciators $c^3 c^4$ back to the battery. One of these annunciators would thus be actuated, depending upon the direction of the battery-current, and a signal would be inadvertently conveyed to the operator at another board by the act of making the connection with the line. By the employment of the present invention, wherein the spring-jack is normally disconnected from the individual annunciator c through the agency of the contacts at the relay, this inadvertent actuation of the annunciator is avoided.

While I have illustrated my invention in connection with substation and central-station apparatus of specific character, it will be understood that I have done so merely for the purpose of fully describing my invention and that the essential features of my invention are equally applicable to substation and central-station apparatus of other construction and design.

The relay, as shown in detail in Figs. 4 to 7, inclusive, is provided with a core b^2 , upon which is mounted the winding b^3 . The core is mounted upon the shell b^4 , which completes the magnetic circuit, and the armature b^4 is

pivoted at b^5 and carries in the free end a block of insulation b^6 , adapted to engage and actuate the contacts when the armature is attracted. Upon the shell b^4 and insulated therefrom are two contact-plates a^4 a^5 , carrying on the upper faces contact-points normally engaged by contact-points upon the springs a^2 a^3 , respectively. The ends of the springs a^2 a^3 are adapted to be engaged by the end of the block b^6 on the armature, and when the armature is attracted to move this block inward the spring a^2 is moved into contact with the spring-plate a^4 and spring a^3 into contact with spring-plate a^5 . The central spring a^8 is adapted when the armature is attracted to be moved into contact with spring-plate a^9 . The end of the spring a^8 is bent down over the end of block b^6 to limit the outward movement of the armature. The several contacts and springs are connected in circuit, as shown in Figs. 2 and 3.

While relay-springs have been referred to herein and are preferred, it will be understood that levers or any movable part actuated by a magnet may be employed.

Throughout this specification I have referred to "spring-jacks," "connection-terminals," and "switch-sockets." Where these terms are used in the following claims, I desire it to be understood that they refer to such organizations as a whole rather than to their individual parts; but wherever in the said claims a portion only of the spring-jack is meant such distinction is clearly pointed out.

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

1. The combination with a calling telephone-line, of an individual connection-terminal for the line normally disconnected therefrom and means for automatically connecting said terminal with the line when a connection is established therewith in response to the call, substantially as described.

2. The combination with a telephone-line, of an individual connection-terminal for the line, means for connecting the same with the line, and means for automatically disconnecting the same from the line when not in use, substantially as described.

3. The combination with a telephone-line and an individual connection-terminal for the line, of means for automatically connecting the terminal with the line when in use, and for automatically disconnecting the same therefrom when not in use, substantially as described.

4. The combination with a calling telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of means actuated by the act of making connection with the line in response to the call for connecting said terminal with the line, substantially as described.

5. The combination with a telephone-line and an individual connection-terminal for the

line normally disconnected therefrom, of means actuated by the act of making connection with the line for connecting said terminal with the line, and means actuated by the act of unmaking connection with the line for disconnecting said connection-terminal from the line, substantially as described.

6. The combination with a telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of a line-signal, a relay distinct from said signal for connecting said terminal with the line, and means actuated by the act of making connection with the line for operating said relay, substantially as described.

7. The combination with a telephone-line and a plurality of individual connection-terminals for the line situated at the several sections of a multiple switchboard and normally disconnected from said line, of a signal for said line, a relay distinct from said signal, and means actuated by the act of making connection with the line at any one of said connection-terminals for operating said relay to connect said connection-terminals with the line, substantially as described.

8. The combination with a telephone-line and an individual connection-terminal for the line normally disconnected therefrom, of a signal for said line, a local circuit, a relay distinct from said signal and a source of current therein, and means actuated by the act of making connection with the line for closing said local circuit to actuate said relay and thereby connect said terminal with the line, substantially as described.

9. The combination with a telephone-line and a connection-terminal in the form of a spring-jack or switch-socket, of a connecting-plug, means actuated by the insertion of said plug in the socket for connecting said terminal with the line, and means actuated by the withdrawal of the plug for automatically disconnecting said terminal, substantially as described.

10. The combination with a telephone-line and a connection-terminal in the form of a spring-jack or switch-socket, of a connecting-plug, a relay for controlling the circuit to said connection-terminal, a local circuit including said relay, normally-separated contacts at the switch-socket, and means for closing said contacts by the insertion of the connecting-plug in said switch-socket, substantially as described.

11. The combination with a telephone-line and an individual connection-terminal for the line, of a signaling device, and means for automatically connecting the terminal with the line and disconnecting the signaling device therefrom, and vice versa, substantially as described.

12. The combination with a telephone-line, of an individual connection-terminal for the line and a signaling device, and means for automatically connecting one of said elements

with the line and simultaneously disconnecting the other therefrom, substantially as described.

13. The combination with a telephone-line, of an individual connection-terminal for the line normally disconnected therefrom, a signaling device normally connected therewith, and means actuated by the act of making connection with the line for connecting said terminal with the line and for disconnecting said signal device therefrom, substantially as described.

14. The combination with a telephone-line, of a connection-terminal, a signaling device, and means actuated by the act of making connection with the line for connecting said terminal therewith and for disconnecting said signaling device therefrom, and means actuated by the act of unmaking connection with the line for disconnecting said terminal therefrom, and for connecting said signaling device therewith, substantially as described.

15. The combination with a telephone-line, of a connection-terminal and a signaling device, and means for automatically connecting said elements with, and disconnecting the same from, the line so that both of said elements are never in connection with the line at the same time, substantially as described.

16. The combination with a telephone-line, of a connection-terminal normally disconnected therefrom, a signaling device normally connected therewith, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line and to disconnect said signaling device from the line, substantially as described.

17. The combination with a telephone-line, of an individual connection-terminal for the line, a relay for connecting the same with and disconnecting the same from the line, and a test-circuit controlled by said relay, substantially as described.

18. The combination with a telephone-line, of an individual connection-terminal for the line normally disconnected therefrom, a relay, and means actuated by the act of making connection with the line for operating said relay to connect said terminal with the line, and a test-circuit controlled by said relay, substantially as described.

19. The combination with a telephone-line, of a relay having a winding included in a local circuit including contacts at a connection-terminal, a pair of springs or other movable parts actuated by said relay, and connected respectively with the limbs of said telephone-line, back contacts against which said springs or parts normally rest and a signaling device connected between said back contacts, front contacts with which said springs or parts engage when the relay is energized, and the line-contacts of a connection-terminal connected with said front contacts, substantially as described.

20. In a divided-multiple telephone system,

a metallic circuit-line, a plurality of line-signals normally connected with said line, one at each division of said system, a plurality of spring-jacks normally disconnected from said line, a connecting-plug, a relay adapted when said plug is inserted in any of said jacks to disconnect said signaling devices from said line and to connect said spring-jacks with said line, and means connected with said line for selectively displaying any one of said signals when said line is in its normal condition, substantially as described.

21. In a telephone system, a line having two limbs extending to a central office, a relay having a movable contact member for each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit including the coil of said relay controlled at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, substantially as described.

22. In a telephone system, a line having two limbs extending to a central office, a relay having a movable contact member for each limb of said line, a signal included in circuit between the back contacts of said members, a spring-jack normally disconnected from said line and having its talking contacts included between the front contacts of said relay members, and a local circuit controlled by additional contacts at the spring-jack, whereby said signal is disconnected from said line and said jack is connected with said line when a connection is made at the jack, substantially as described.

23. In a telephone system, a line having two limbs extending to a central office, a relay having movable contact members in which said limbs terminate, a signal included in circuit between the back contacts of said members, a plurality of spring-jacks normally disconnected from the line arranged at the several sections of a switchboard, said jacks having their respective talking contacts connected together and to the front contacts respectively of said relay members, and a local circuit including the coil of said relay having branch connections terminating in additional contacts at each jack, whereby said signal is disconnected from said line and said jacks are connected with said line when a connection is made at any of said jacks, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

FRANCIS W. DUNBAR.

Witnesses:

KEMPSTER B. MILLER,
CHAS. C. BULKLEY.