

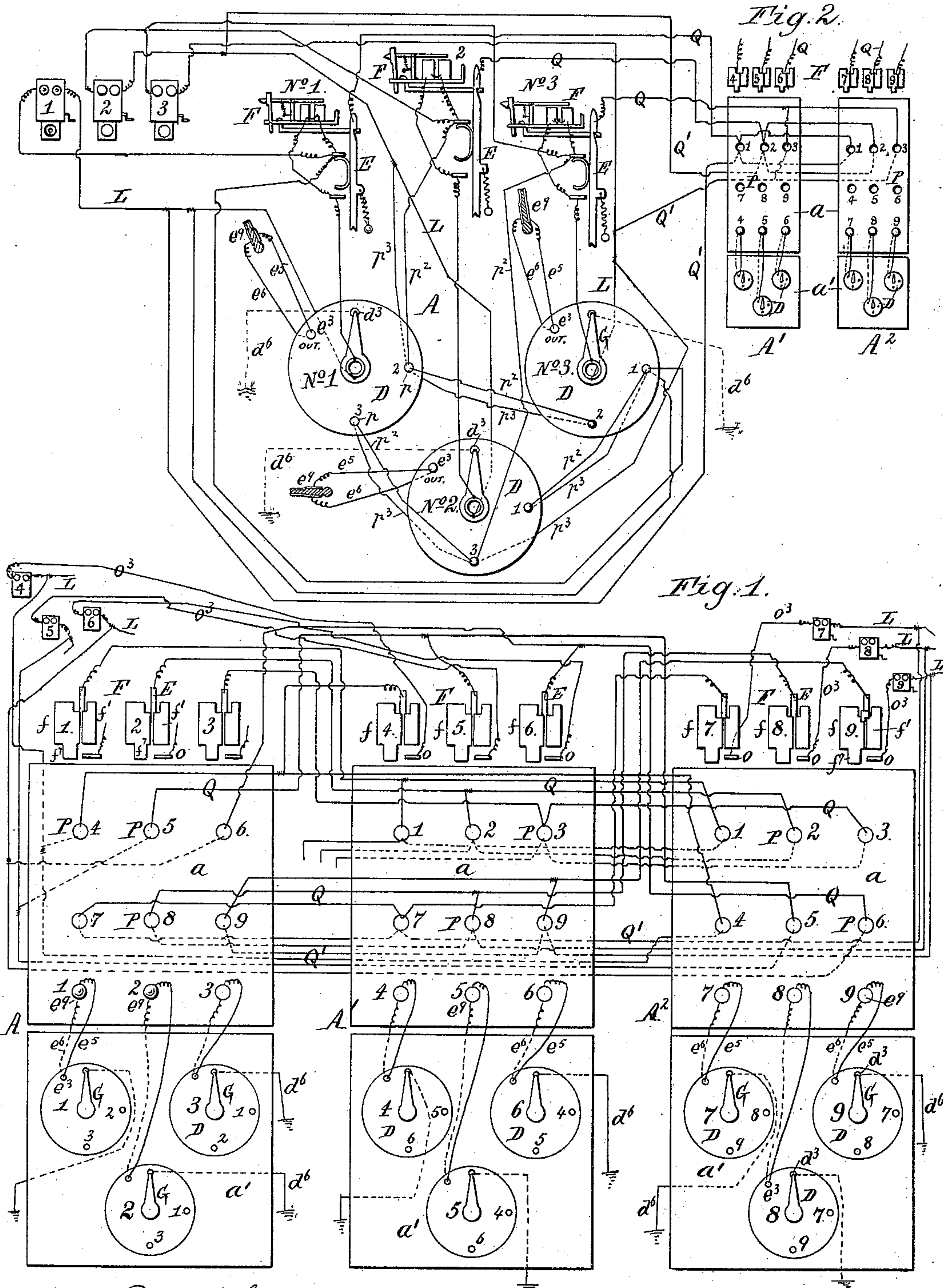
(No Model.)

3 Sheets—Sheet 1.

C. C. GOULD & W. SMITH.
TELEPHONE SWITCH SYSTEM.

No. 355,929.

Patented Jan. 11, 1887.



Chas. Buchheit.
Geo. J. Buchheit } witnesses.

Claude C. Gould.
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By Wilhelm R. Bomer atty.

3 Sheets—Sheet 2.

No. 355,929.

Patented Jan. 11, 1887.

Fig. 3.

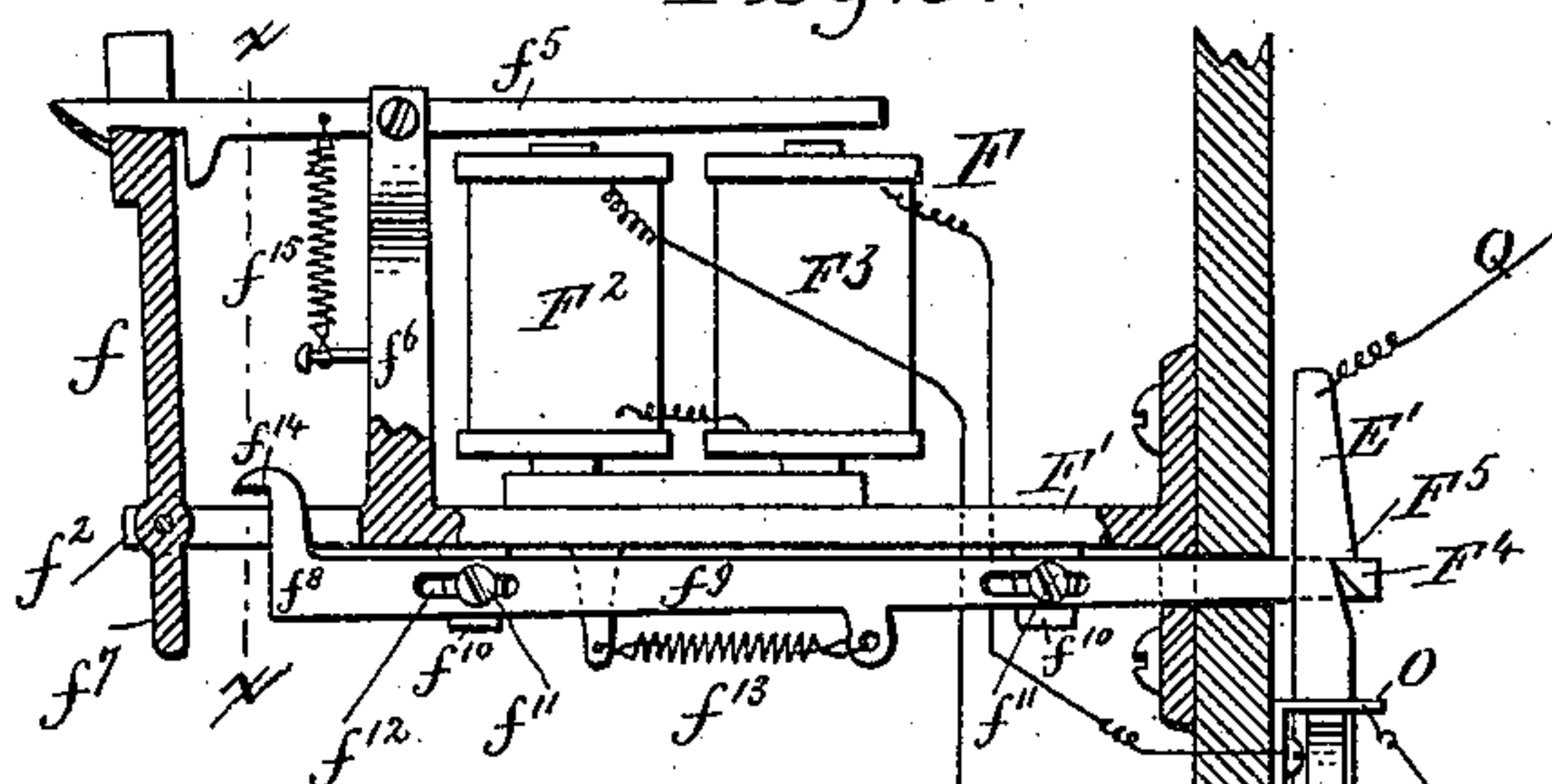
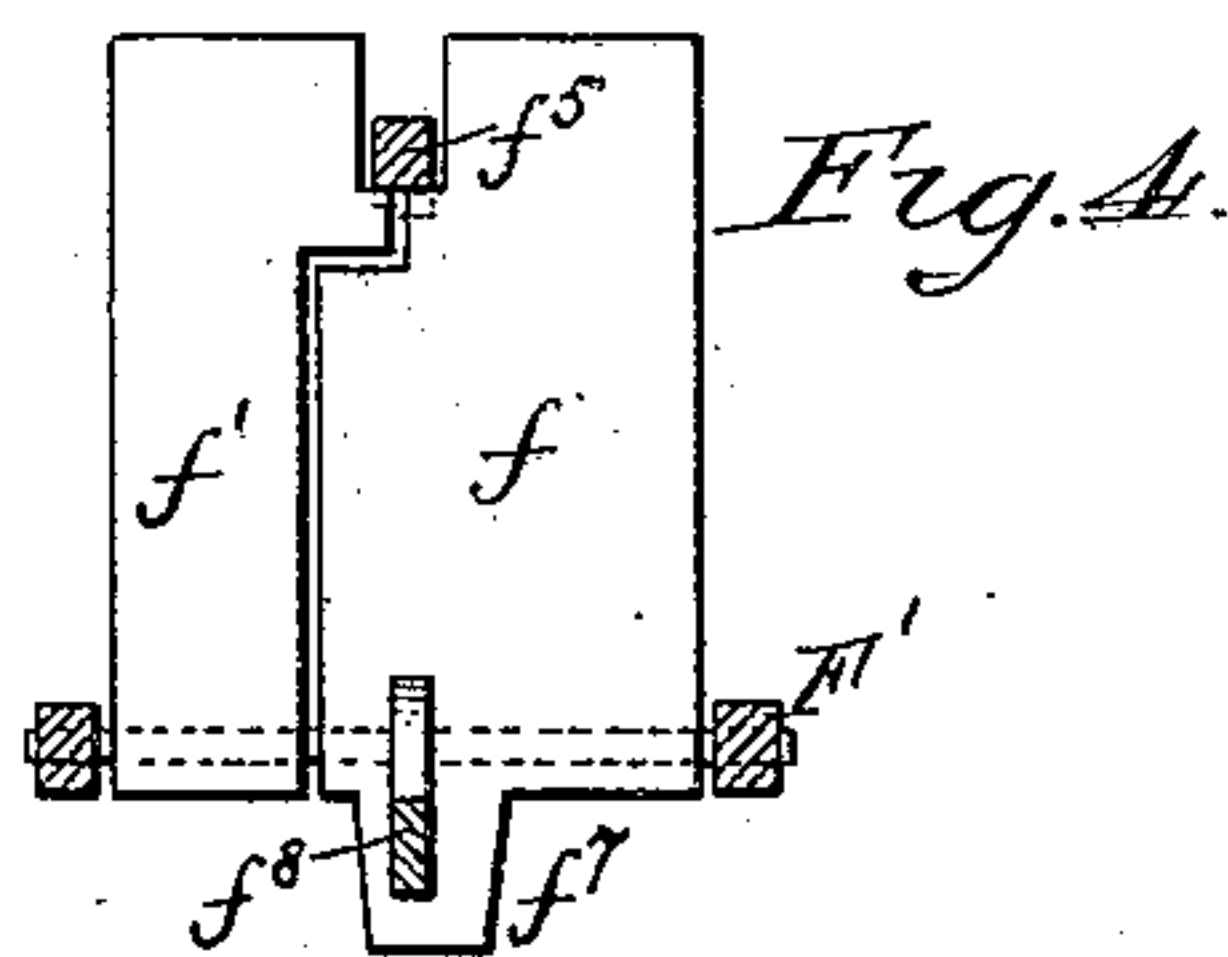


Fig. 5. Fig. 6.

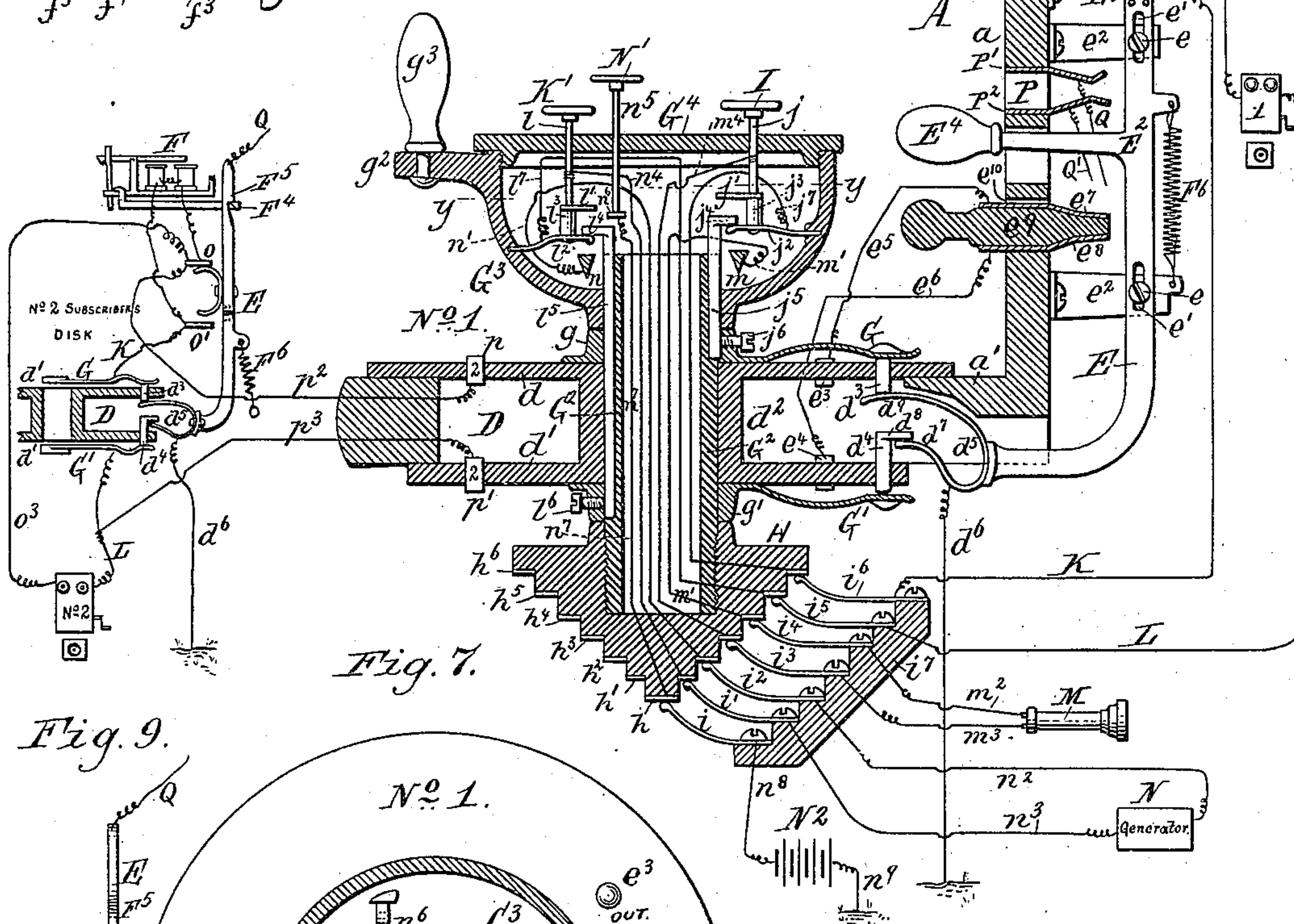
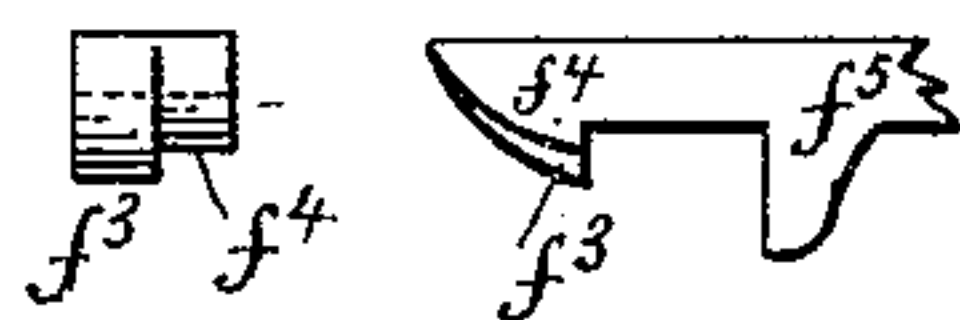


Fig. 7.

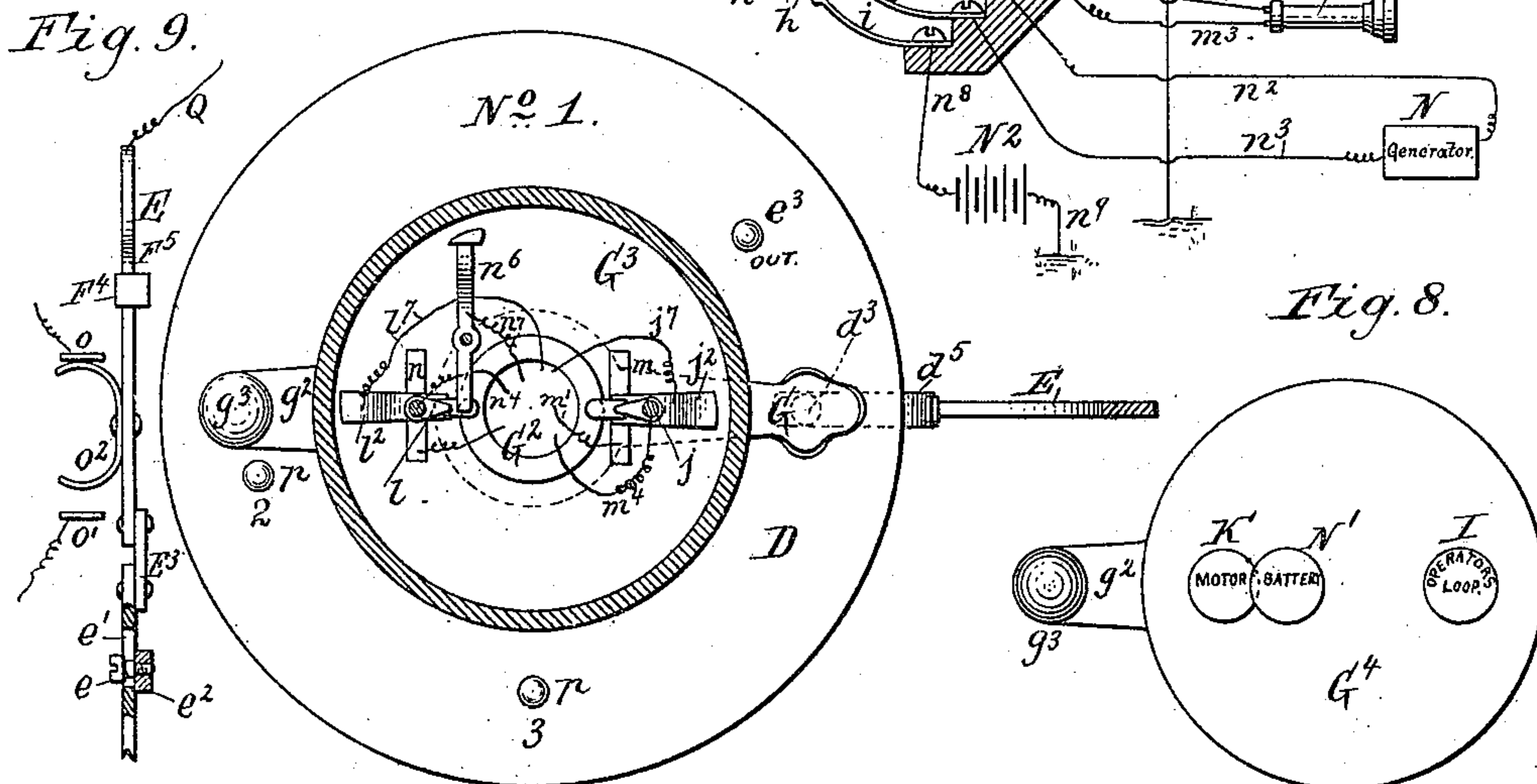


Fig. 8.

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(No Model.)

3 Sheets—Sheet 3.

C. C. GOULD & W. SMITH.
TELEPHONE SWITCH SYSTEM.

No. 355,929.

Fig. 10. Patented Jan. 11, 1887.

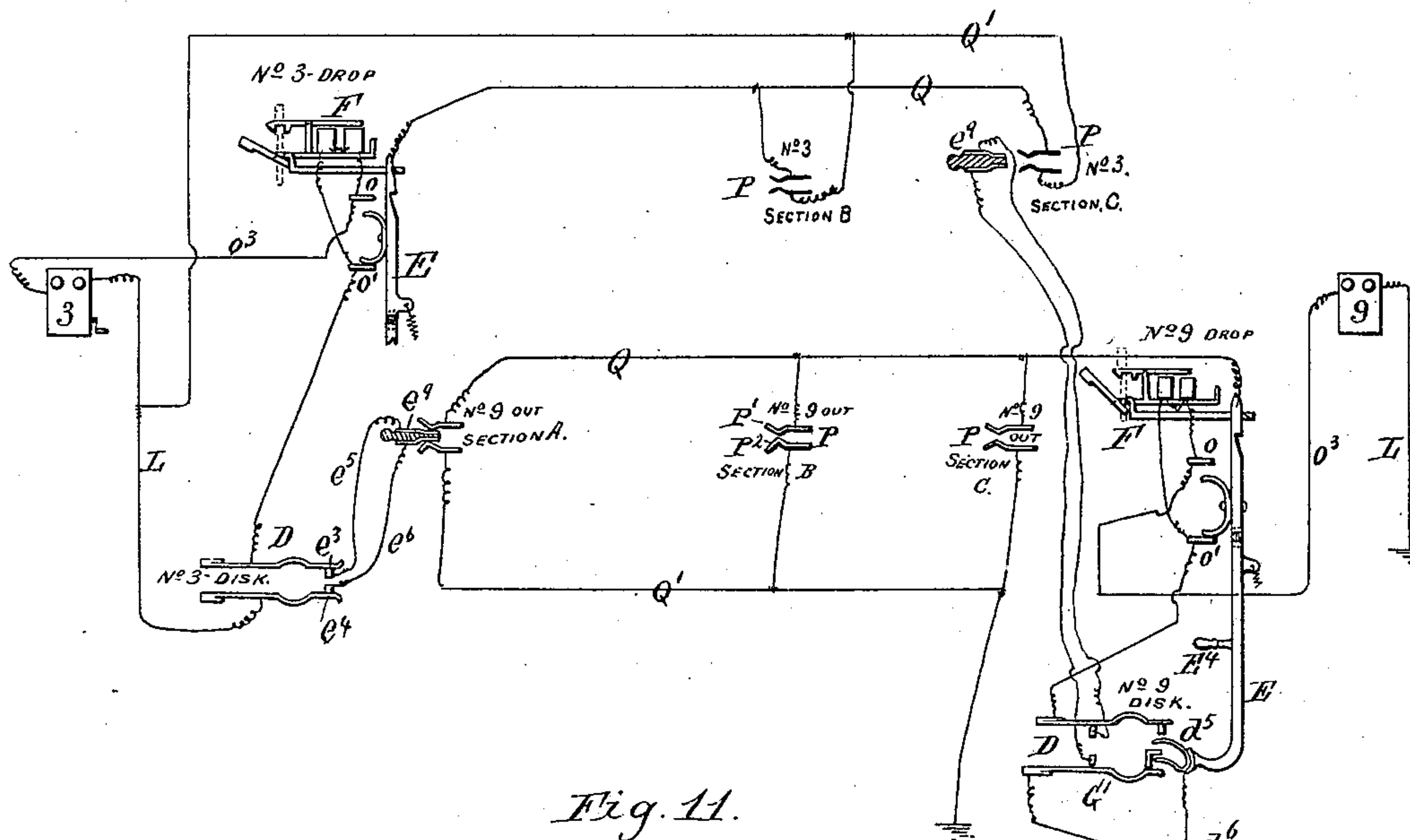
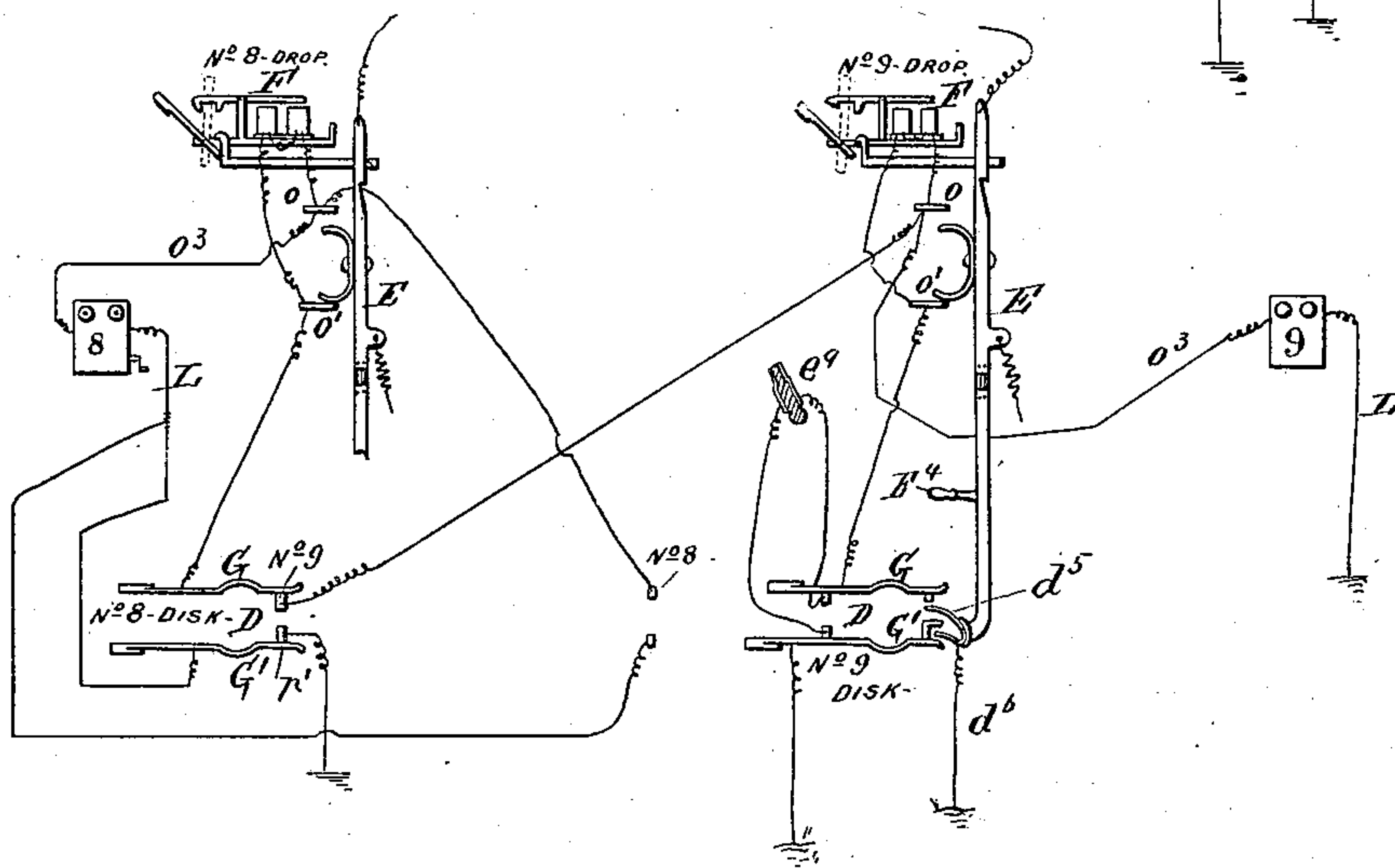


Fig. 11.



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UNITED STATES PATENT OFFICE.

CLAUDE C. GOULD AND WALTON SMITH, OF BATAVIA, ASSIGNORS OF ONE-FOURTH TO PHILIP W. SCRIBNER, OF TONAWANDA, NEW YORK.

TELEPHONE SWITCH SYSTEM.

SPECIFICATION forming part of Letters Patent No. 355,929, dated January 11, 1887.

Application filed September 2, 1886. Serial No. 212,450. (No model.)

To all whom it may concern:

Be it known that we, CLAUDE C. GOULD and WALTON SMITH, of Batavia, in the county of Genesee and State of New York, have invented new and useful Improvements in Telephone Switch Systems, of which the following is a specification.

This invention relates to a switch-board system in which each main or subscriber's line is provided in the central office with a movable terminal, which is automatically moved out of its normal position so as to break the connection with the ground upon sending a current through the line. A switch-board system of this kind is described and claimed in another application for patent in the United States filed by us February 23, 1886, Serial No. 192,755. In our former application for patent the automatically-movable terminal is applied to a system of ground-circuits.

The principal object of our present invention is to render the automatically-movable terminal applicable to a system containing metallic circuits.

Our invention consists of the improvements, which will be hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, consisting of three sheets, Figure 1 is a diagram representing three sectional switch-boards of a central office provided with our improved system. Fig. 2 is a diagram representing the manner of connecting the subscribers on one section each with the other, and also how said subscribers are reached from either of the other sections. Fig. 3 represents a sectional elevation of one of the switch-levers, annunciators, and connecting parts on an enlarged scale. Fig. 4 is a sectional elevation in line *xx*, Fig. 3, looking forward. Fig. 5 is a front elevation of the vibrating lever. Fig. 6 is a side elevation of the front portion of the same on an enlarged scale. Fig. 7 is a horizontal section in line *yy*, Fig. 3. Fig. 8 is a top plan view of one of the levers. Fig. 9 is a fragmentary rear elevation of the switch-lever. Fig. 10 is a diagram representing a through connection between a metallic-circuit subscriber and a ground-circuit subscriber. Fig. 11 is a diagram representing a local connection between

a metallic-circuit subscriber and a ground-circuit subscriber.

Like letters of reference refer to like parts in the several figures.

A A' A² represent three sectional switch-boards, arranged side by side, the upper portions, *a*, of which are preferably arranged vertically, or at right angles to the lower or table portions, *a'*. Each table portion *a'* of the sections A A' A² is provided with a number of disks or rings, D. These disks are preferably constructed of gutta-percha, wood, or other suitable non-conductive material, and are firmly secured in openings formed in the table portions *a'* in any suitable manner. Each disk is composed of two parallel parts, *d d'*, arranged one above the other, and are connected by a central hub, *d²*, as clearly shown in Fig. 3. The upper part, *d*, of each disk is provided with a contact-point, *d³*, and the lower part, *d'*, with a contact-point, *d⁴*, arranged below the point *d³*. The points *d³ d⁴* are connected by a metallic bow-spring, *d⁵*, which is connected with the ground by a wire, *d⁶*. The spring *d⁵* engages with its lower portion, *d⁷*, against the under side of a nose, *d⁸*, formed in the point *d⁴*, and with its upper portion, *d⁹*, against the lower end of the point *d³*, whereby both points *d³* and *d⁴* are connected with the ground when the parts are in the position shown in Fig. 3. The bow *d⁵* practically forms a movable connecting terminal between the two contact-points *d³ d⁴* of the main circuit. The contact-spring *d⁵* is secured to the front end of the lower forwardly-bent portion of a vertically-movable switch-bar, E, arranged in rear of the vertical portion *a* of the sections. The bar E is guided in its movement by screws *e*, passing through slots *e'*, which are secured in brackets *e²*. The latter are secured to the rear side of the vertical portion *a*.

e³ e⁴ represent two out or dead contact-points arranged one above the other in the disks *d d'*, respectively. The points *e³ e⁴* are connected by means of cords *e⁵ e⁶* with metallic contact-surfaces *e⁷ e⁸*, formed on the opposite sides of a non-conductive plug, *e⁹*, which latter is seated in an opening, *e¹⁰*, formed in the vertical portion *a* of the section.

F represents the annunciator; F', the base

thereof, which is secured at its rear end to the vertical portion *a* of the section, as clearly shown in Fig. 3. Each annunciator is provided with two aprons or drops, *f f'*, which are pivoted side by side at their lower ends to the front bifurcated portion, *f²*, of the base *F'*, and which engage, respectively, with their upper recessed portions over hooks or noses *f³ f⁴*, formed on the front end of a vibrating armature, *f⁵*. The armature *f⁵* is pivoted in the usual manner to a bifurcated standard, *f⁶*, formed in the base-plate *F'*, and is arranged above two coils, *F² F³*. The lower portion of the apron *f* is provided with a downwardly-projecting lip, *f⁷*, which engages, when released, against the front vertical portion, *f⁸*, of a horizontal sliding bolt, *f⁹*, arranged underneath the base *F'* of the annunciator *F*. The bolt *f⁹* is suspended on hangers *f¹⁰* by screws *f¹¹*, passing through slots *f¹²*.

F⁴ represents a hook formed on one side of the bolt *f⁹*, at the rear end thereof, and engaging in a notch or recess, *F⁵*, formed in the rear side of the movable switch-bar *E*, near its upper end, to retain the bar in an elevated position. The bolt *f⁹* is held in engagement with the bar *E* by a spring, *f¹³*.

Upon vibrating or slightly tipping the armature *f⁵* by a light current—such as a battery-current—the small apron *f'* alone is allowed to fall by being released from the hook *f⁴*, thus notifying the operator upon whose table the apron *f'* has fallen that an operator on some other section or table is about to connect with said subscriber. When this occurs, the operator on whose table the apron has fallen does not loop in his telephone, and thus interfere with making a connection with the subscribers desired to be reached. By giving the armature *f⁵* a greater vibration, as by a generator, the apron *f* is disengaged from the hook *f³* and is permitted to fall. The lip *f⁷* of the apron *f* strikes the front portion of the sliding bolt *f⁹* and moves the latter backwardly and out of engagement with the switch-bar *E*, whereby the latter is released and enabled to be moved downwardly by its spring *F⁶*. This downward movement of the bar *E* breaks the connection between the contact-points *d³ d⁴*. Thus, if a subscriber rings, causing the armature *f⁵* to vibrate sufficiently to release the apron *f* to produce the above-described downward movement of the bar *E*, the circuit is broken between the points *d³ d⁴*, and he is thereby immediately notified that the call has been received at the central office from the fact that he can no longer ring his bell. The swinging movement of the apron *f* is limited by a nose, *f¹⁴*, formed on the upper front end of the bolt *f⁹*.

It is obvious that when both aprons are engaged with the armature *f⁵* and the latter is vibrated by a generator both aprons *f f'* will fall simultaneously. The armature *f⁵* is held in engagement with the aprons *f f'* by the usual spring, *f¹⁵*.

G represents a metal spring-finger arranged

above the disk *D*, and *G'* represents a similar finger arranged underneath the disk *D*. The fingers *G G'* bear in their normal position with their outer free ends against the ground contact-points *d³ d⁴*, as shown in Fig. 1. The inner ends of the fingers *G G'* are respectively provided with hubs *g g'*, which are secured to a vertical non-conductive tube, *G²*, seated centrally in an opening in the hub *d²* of the disk *D*.

G³ represents a cup secured to the upper end of the tube *G²* and provided with a screw-cap, *G⁴*.

g² represents an arm formed on one side of the cup *G³*, and provided with a handle, *g⁵*, whereby the tube *G²* and fingers *G G'* may be moved. The tube *G²* is held against vertical movement by the fingers *G G'*.

H represents a step-shaped disk of non-conductive material secured to the lower end of the tube *G²*, so as to turn therewith, and provided with a series of annular metal plates or rings, *h h' h² h³ h⁴ h⁵ h⁶*, secured to the lower sides of the steps in any suitable manner.

i i' i² i³ i⁴ i⁵ i⁶ represent stationary metal springs or contact-points secured to a step-shaped cross-piece, *i'*, underneath the table *a'*, and bearing with their free ends against the under sides of the rings *h h' h² h³ h⁴ h⁵ h⁶*, respectively. By this construction a uniform contact is maintained between the parts when the fingers *G G'* are moved on the disk.

I represents a push-button arranged above the cap *G⁴*, and provided with a downwardly-projecting metallic stem, *j*, moving in an opening in the cap *G⁴*. The button *I* is provided near its lower end with two metallic contact-points, *j' j²*, which are separated by a non-conductor, *j³*. The lower contact-point, *j²*, projects outwardly, and is secured to the inner side of the cup *G³*, and forms a spring to retain the push-button *I* in an elevated position, as shown in Fig. 3. The free end of the spring or contact-point *j²* bears against the under side of a projecting nose, *j⁴*, formed on the upper end of a metallic stem, *j⁵*, which latter is secured in an opening in the tube *G²* by a screw, *j⁶*. The latter also serves to form a communication between the finger *G* and stem *j⁵*. The point *j²* of the button *I* is connected with the line *K* of the main circuit by means of a wire, *j⁷*, ring *h⁶*, and contact-spring *i⁶*.

K' represents a generator push-button, which is provided with a metallic stem, *l*, moving in an opening in the cap *G⁴*, and provided at its lower end with two metallic contact-points, *l' l²*, which are separated by a non-conductor, *l³*. The lower contact-point is secured at one end to the inner side of the cup *G³*, to retain the push-button *K'* in an elevated position. The free end of the contact-point *l²* bears against the under side of a nose, *l⁴*, formed on the upper end of a metallic stem, *l⁵*, which latter is secured in an opening in the tube *G²* by a screw, *l⁶*, whereby a connection is made between the stem *l⁵* and the lower finger, *G'*. The lower point, *l²*, of the button *K'* is connected with the line *L* of the main circuit by means of a

wire, I', ring h^5 , and contact-spring i^5 . Thus it will be seen that the lines K and L of the main circuit are connected through the fingers G G', contact-points $d^3 d^4$, and spring d^5 , completing the circuit and enabling the subscriber to call the central office.

m represents a stationary metallic contact-point secured in the cup G^3 underneath the contact-point j^2 and in line with the same. The contact-point m is connected with the operator's listening-telephone M by a wire, m' , ring h^4 , spring i^4 , and a cord or wire, m^2 . The return-wire m^3 of the listening-telephone is connected with the contact-point j' of the stem j by means of a wire, m^4 , ring h^3 , and spring i^3 . It will thus be seen that upon depressing the push-button I, so as to form a contact between the point j' and nose j^4 and the spring-point j^2 and stationary contact-point m , the operator's listening-telephone M is looped in on the main circuit.

n represents a metallic contact-point arranged in the cup G^3 diametrically opposite the point m and underneath and in line with the lower contact-spring, l^2 , of the push-button K'. The contact-point n is connected with the generator N by a wire, n' , ring h^2 , spring i^2 , and wire n^2 . The return-wire n^3 of the generator is connected with the contact-point l' of the push-button K' by means of a wire, n^4 , ring h' , and spring i' . Upon pressing down the button K' so as to make a connection between the point l' and nose l^4 and the point l^2 and stationary contact n , the generator N is looped in on the main circuit.

N' represents the battery push-button, the metallic stem n^5 of which is provided with a contact-point, n^6 , which is connected with a battery, N', by means of a wire, n^7 , ring h , spring i , and wire n^8 . The opposite wire, n^9 , of the battery N' is grounded, as clearly shown in Fig. 3, and establishes a contact through the ground with the ground-wire of the bow d^5 .

$o o'$ represent two metallic contact-points secured to the rear side of the vertical portion a of the section, and arranged one above the other, as clearly shown in Figs. 3 and 9.

o^2 represents a bow-spring secured to one side of the upper conductive portion, E', of the switch-bar E, and which is arranged between the contact-points $o o'$ and bears against the under side of the contact-point o when the parts are in their normal position, as shown in Fig. 3. The upper portion, E', of the bar E is separated from the lower portion, E'', by a non-conductor, E', which connects the two portions of the bar. When the parts are in their normal position, as shown in Fig. 3, the subscriber's line o^3 enters the central office from one side of his instrument through the contact-point o , to and through the annunciator F, to the contact-point o' , line K, spring i^6 , metal ring h^6 , wire j^7 , contact-point j^2 , metallic stem j^5 , finger G, and contact-point d^3 , and returns through the contact-bow d^5 to the contact-point d^4 , finger G', metallic stem l^5 , to the contact-point l^2 , wire l^7 , ring h^5 , contact-spring

i^5 , and line L, to the opposite side of the subscriber's instrument.

$p p'$ represent a series of local contact-points secured to the disks $d d'$, the points $p p'$ being arranged in pairs one above the other in the two parts $d d'$ of each disk, so that when the fingers G G' are turned to engage with a pair of said points the finger G will engage with the upper point, p , and the finger G' with the lower point, p' , as shown in Figs. 2 and 3.

Each disk D is provided with as many pairs of local contact-points $p p'$ as there are subscribers on the table, less one, and each of these contact-points of one section is numbered to correspond with the number of the subscribers with which it is connected. For instance, the subscriber's disk D No. 1 is provided with two pairs of local contact-points, $p p'$, which are numbered 2 and 3. The subscriber's disk No. 2 has a similar number of contact-points, which are numbered 1 and 3, and the subscriber's disk No. 3 has its contact-points $p p'$ numbered 1 and 2. If No. 1 subscriber calls and thereby releases the apron f and switch-bar E, as above described, the operator raises the bar E by a handle, E', so as to again complete the circuit by connecting the points d^3 and d^4 by the bow-spring d^5 . The bar E, when lifted by the operator, does not engage with the hook of the sliding bolt f^9 , as the latter is held back out of engagement with the bar by the lip f^7 of the fallen apron f . He then loops in his listening-telephone by pressing on the button I and ascertains that the subscriber wants, for instance, No. 2. The operator again allows the bar E to descend and break the connection between the fingers G G'. The operator now turns the fingers G G' on the subscriber's disk No. 1 to the contact-points $p p'$ marked No. 2. The upper contact-point, p , (No. 2,) on disk D No. 1 is connected with the upper contact-point, o , of No. 2 subscriber's annunciator F by means of a wire, p^2 , and the lower point, p' , (No. 2,) disk No. 1, is connected with the return-wire L of No. 2 subscriber's instrument by a leg or wire, p^3 , as clearly shown in Fig. 3. The operator now presses the generator-button K' on No. 1 subscriber's disk, which causes the armature f^5 of No. 2 subscriber's annunciator to vibrate and release its aprons $f f'$ and the switch-bar E in the same manner as in the case of No. 1 subscriber's first call, thereby automatically breaking the circuit between the points $d^3 d^4$ and fingers G G' on No. 2 subscriber's disk D. This movement rings both subscribers' bells simultaneously, notifying them that the connection between them is completed. No. 1 is now connected with No. 2 by wire o^3 , annunciator F, contact-point o , line K, to and through finger G, as above described, to contact-point p , disk D, No. 1, to upper contact-point, o , of No. 2 subscriber's annunciator by wire p^2 , and to No. 2 instrument by wire o^3 , returning through instrument No. 2 to wire L, to leg p^3 , to contact p' , No. 2, on No. 1 disk, to and through finger G', as above described, to No. 1 subscriber's

instrument by line L. The operator now replaces the fallen aprons $f f'$ of both subscribers' annunciator F, leaving them ready to be rung off. By thus replacing the aprons $f f'$ the sliding bolt f^9 is released from the lip f^7 of the aprons $f f'$ and is moved forward by the spring f^{13} , ready to engage with the switch-bar E. When the subscriber rings off, causing the aprons of No. 1 annunciator to again fall, the operator again replaces the same, and lifts the switch-bar E by the handle E^1 of both annunciators until they are again in engagement with the sliding bolt f^9 . The operator also turns the fingers G G' on disk No. 1 back to the points $d^3 d^4$, whereby both subscribers' lines are again ready for another call. By connecting the various subscribers on one section in this manner we dispense entirely with the use of the usual plugs, cords, &c., for effecting a local connection, whereby the connection is made more rapidly and with greater certainty than heretofore. It will thus be seen that the connection between the two subscribers is entirely metallic, whereby the transmitted speech is rendered more audible and transmitted to a greater distance than when the usual ground or semi-metallic circuit is used.

P represents a series of duplex contact-points arranged in rows in the vertical portions a of each of the sections A A' A². The number of contact-points P on each section corresponds with the number of subscribers on every other section or table. For example, section A has numbers 4, 5, 6, 7, 8, and 9, as this section can reach Nos. 1, 2, and 3 locally. Section A' has numbers 1, 2, 3, 7, 8, 9, and section A² has numbers 1, 2, 3, 4, 5, 6, their own local numbers not being represented in the contact-points P. The contact-points P are provided at their upper and lower ends with separate metallic contact surfaces or springs P' P². The springs P' P² are adapted to form contacts with the metallic contact-points $e^7 e^8$, respectively, of the plug e^9 , also to securely hold the plug e^9 when the latter is inserted in the contact-point P. Each annunciator is connected with all of the contact-points P of the several sections bearing the same number as of the annunciator by a wire, Q, or other metallic connection, which is secured with one end to the upper conductive portion of the switch-bar E and connected with the upper contact-surfaces, P', of the several contact-points P.

Q' represents a similar wire or metallic connection, which connects the lower contact-surfaces, P², of the contact-points P in the same manner, and which is connected to the main or return wire L of the subscriber's instrument corresponding with the annunciator with which the wire Q is connected. For instance, the wire Q is connected with the upper contact-surfaces, P', of the contact-points No. 7 and with the switch-lever E of annunciator No. 7, and the wire Q' is connected with the lower contact-surfaces, P², of the contact-points No. 7 and with the wire or line L of subscriber's instrument

No. 7. Thus it will be seen that the various subscribers in a central office are practically grouped within reach of each operator on each of the sections A A' A², whereby we dispense with the use of checks, speaking-circuits, &c., between the various operators at the central office, and whereby all unnecessary delays are obviated.

The operation of our improved system for connecting the subscribers on one table or section with a subscriber located on any other section or table is as follows: For instance, subscriber No. 1 calls the central office through the line o^3 , annunciator F, line K, fingers G G', and line L, as above described. The operator raises the switch-bar E, presses the button I, loops in the listening-telephone M, and ascertains that subscriber No. 1 wants, say, No. 9. The operator again allows the switch-bar E to drop and break the connection between the two fingers G G'. He then turns the fingers G G' by means of the handle g^3 to the dead contact-points $e^3 e^4$ of the disk D, and inserts the plug e^9 of disk No. 1 in contact-point P No. 9 of the section A. The connection is now made with the contact-surfaces P' P² by the metallic contact-surfaces $e^7 e^8$ of the plug e^9 , and with the fingers G G' by the wires or cords $e^5 e^6$ and contact-points $e^3 e^4$. By thus inserting the plug e^9 the wires Q and Q' are connected with the fingers G G', respectively. The operator now presses the battery-button N' on disk D, No. 1, which causes just sufficient vibration of the armature to release the apron f' of annunciator No. 9, thereby notifying the operator on whose table annunciator No. 9 is located that an operator on some other section desires to connect with No. 9. He therefore does not interfere, and permits subscriber No. 1 to complete his call. The operator of section A now releases the battery-button N' and presses the generator-button K' on disk D No. 1, thus ringing through wire Q, finger G, to the upper contact, P', plug-contact e^7 , to switch-bar E of subscriber's annunciator No. 9, to the upper contact-point, o , of the same, to and through annunciator No. 9, to contact o' , to fingers G G', disk No. 9, returning by wire Q' to finger G' on disk D No. 1. This movement causes the apron f of subscriber's annunciator No. 9 to fall also and disengage the switch-bar E, thereby disconnecting the fingers G G' on disk D No. 9, as in the case of No. 1 subscriber's first call. This movement also rings the bells on the instruments of both subscribers, notifying them that the connection between them is completed. Subscriber No. 1 is now connected with subscriber No. 9 to and through the finger G, as above described, wire e^5 , contact e^7 , upper contact-surface, P', of point No. 9 on section A, wire Q, to switch-bar E and lower contact, o' , of annunciator No. 9, to and through said annunciator, to the upper contact, o , of said annunciator, to the instrument of subscriber No. 9, returning from said instrument through line L to the lower wire, Q,

to the lower contact-surface, P^2 , of point No. 9 on section A, to the lower plug-contact, e^8 , to wire e^6 , to lower finger, G' , to line L of the instrument of subscriber No. 1, thus completing the metallic circuit. The operators now replace the fallen aprons $f f'$ on annunciators 1 and 9, ready to be rung off. Any electrical disturbances—such as electric-light wires crossing the lines, lightning, or other electrical disturbances or currents which may influence the main line sufficient to vibrate the armature f^5 —will be instantly turned off by the bar E moving downward and breaking the connection between the fingers $G G'$, thus breaking the circuit, thereby insuring the system against fire.

Fig. 10 is a diagram showing a subscriber's line No. 3 having a metallic circuit connected with subscriber's line No. 9 having a ground circuit. Such a connection may become necessary when the same central office has subscribers with these different circuits, or when a subscriber in one place having one of these circuits is connected with a subscriber in another place having a different circuit. As shown in Fig. 10, the lower finger, G' , of the ground-circuit subscriber No. 9 is grounded. The metallic circuit of subscriber No. 3 is also grounded by a ground-connection made by the lower wire, Q' , as shown.

Fig. 11 is a diagram showing local connection between a subscriber's line No. 8 having a metallic circuit and a subscriber's line No. 9 having a ground circuit. In this case the lower contact-point, p' , No. 9 is grounded on disk D No. 8 and on any other disk on the same table on which it may appear.

The bow d^5 constitutes the automatically-movable contact-piece which is interposed in the central office between the two terminal points of the metallic circuit, and which completes the circuit through which the subscriber reaches the central office. This movable contact-piece, upon being automatically moved out of its normal position, leaves the line open and ready to be connected with the terminal points of another metallic circuit. The operator, by calling the line which is to be connected with the calling line, opens the called line automatically, whereby the called line is made ready for connection with the calling line. When the contact-piece d^5 is in its normal position, it connects the movable terminal fingers $G G'$ of the line by means of the contact-points $d^3 d^4$, and when the line has been opened by moving the connecting-bow d^5 out of its normal position the line is ready to be connected by the fingers $G G'$ with the terminals of another metallic circuit.

We claim as our invention—

1. In a switch-board system, the combination, with a metallic-circuit line having two contact-points connected with different portions of the line, of a movable contact-piece which connects both contact-points when in its normal position, thereby completing the circuit, and shifting mechanism, substantially as

described, connected with said contact-piece, whereby the latter is automatically separated from said contact-points by a current passing through the line, thereby opening the line, substantially as set forth.

2. In a switch-board system, the combination, with a metallic-circuit line, of a movable contact-bow, d^5 , connecting in its normal position the terminal points of the line, and mechanism, substantially as described, whereby the contact-piece is automatically moved out of its normal position by a current passing through the line, thereby opening the line, substantially as set forth.

3. In a switch-board system, the combination, with a metallic-circuit line, of a movable contact-piece which completes the circuit when in its normal position, an annunciator, and mechanism, substantially as described, whereby the annunciator and the movable contact-piece are operated simultaneously, substantially as set forth.

4. In a switch-board system, the combination, with a metallic-circuit line, of terminal fingers $G G'$, contact-points $d^3 d^4$, contact-piece d^5 , a bar, E, to which said contact-piece is attached, and mechanism, substantially as described, whereby the bar E is operated automatically, substantially as set forth.

5. The combination, with the main line and its terminals, of a bar, E, carrying a contact-piece, d^5 , a movable bolt, f^9 , an apron, f , an armature, f^5 , and coils $F^2 F^3$, substantially as set forth.

6. The combination, with the main line and its terminals, of a bar, E, provided with a portion, E^2 , carrying a contact-piece, d^5 , a portion, E' , carrying a contact-bow, o^2 , and a non-conductive portion, E^3 , between the portions E' and E^2 , contact-pieces $o o'$, arranged in the main line, and a locking-bolt, f^9 , whereby the bow o^2 is held in contact with the contact-point o , substantially as set forth.

7. The combination, with the bar E, carrying a contact-piece, d^5 , of the locking-bolt f^9 and an annunciator-apron, f , provided with a lip, f^7 , whereby the locking-bolt is operated to release the bar E when the apron drops, substantially as set forth.

8. The combination, with the bar E, carrying a contact-piece, d^5 , of an annunciator-apron, f , provided with a lip, f^7 , and a locking-bolt, f^9 , provided with a nose, f^{14} , whereby the drop of the apron is limited, substantially as set forth.

9. The combination, with the bar E, carrying a contact-piece, d^5 , and provided with a notch, F^5 , of a locking-bolt, f^9 , provided with a hook, F^4 , and a retracting-spring, f^{13} , substantially as set forth.

10. The combination, with the annunciator-coil, of two aprons and an armature-lever provided with locking-hooks of different lengths, whereby one apron is released by a short movement of the lever and the other apron by a longer movement of the lever, substantially as set forth.

11. The combination, with the annunciator-coil, of two aprons, pivoted side by side, and an armature-lever provided with two locking-hooks of different lengths, arranged side by side, whereby one apron is released by a short movement of the lever and both aprons are released by a long movement of the lever, substantially as set forth.

12. The combination, with the annunciator-coil, of two aprons, an armature-lever provided with locking-hooks of different length, and a battery producing a light current and a generator producing a strong current, both capable of being connected with the annunciator-coil, substantially as set forth.

13. The combination, with the disk D, of the terminal fingers G G', secured to a non-conductive carrier, G², and connected, respectively, to different portions, K L, of the main line, substantially as set forth.

14. The combination, with the disk D, provided with a pair of through contact-points, p p', of separate terminal fingers, G G', connected to different portions of the main line and adapted to be placed in contact with the points p p', substantially as set forth.

15. The combination, with the terminal finger G, of the stem j⁵, connected with the finger G, the button I, provided with contact-points j' j², a stationary contact-point, m, and a listening-telephone connected with the contact-points m and j', substantially as set forth.

16. The combination, with the terminal finger G', of the stem l⁵, connected with said finger, the button K', provided with contact-points l' l², a stationary contact-point, n, and a generator connected with the contact-points n and l', substantially as set forth.

17. The combination, with the separate terminal fingers G G', the battery N², and the battery push-button N', of the automatically-movable contact-piece d⁵, provided with a ground-connection, d⁶, substantially as set forth.

18. The combination, with the disk D, provided with dead contact-points e³ e⁴, of the terminal fingers G G', adapted to be placed in contact with the points e³ e⁴, a plug, e⁹, provided with two separate contact-surfaces, e⁷ e⁸, and wires e⁵ e⁶, connecting said surfaces with the points e³ e⁴, substantially as set forth.

19. The combination, with the disk D, provided with dead contact-points e³ e⁴, of the terminal fingers G G', adapted to be placed in contact with the points e³ e⁴, a plug, e⁹, provided with two separate contact-surfaces, e⁷ e⁸, wires e⁵ e⁶, connecting said surfaces, respectively, with the points e³ e⁴, and a contact-point, P, adapted to receive the plug e⁹, and provided with two separate contact-surfaces, P' P², and conducting-wires Q Q', substantially as set forth.

20. In a switch-board system, the combination, with two or more sections, each provided with a series of duplex local contact-points and a series of duplex through contact-points, P, numbered on each section to correspond with the local points on the other sections, and each having two contact-surfaces, P' P², of wires Q, connecting the contact-surfaces P' of the contact-points P having the same number on the several sections with the movable bar E of the corresponding annunciator, and wires Q', connecting the contact-surfaces P² of the contact-points P having the same number on the several sections with the corresponding subscriber's line, substantially as set forth.

Witness our hands this 25th day of August, 1886.

CLAUDE C. GOULD.
WALTON SMITH.

Witnesses:

JNO. J. BONNER,
OSCAR SCHAUB.