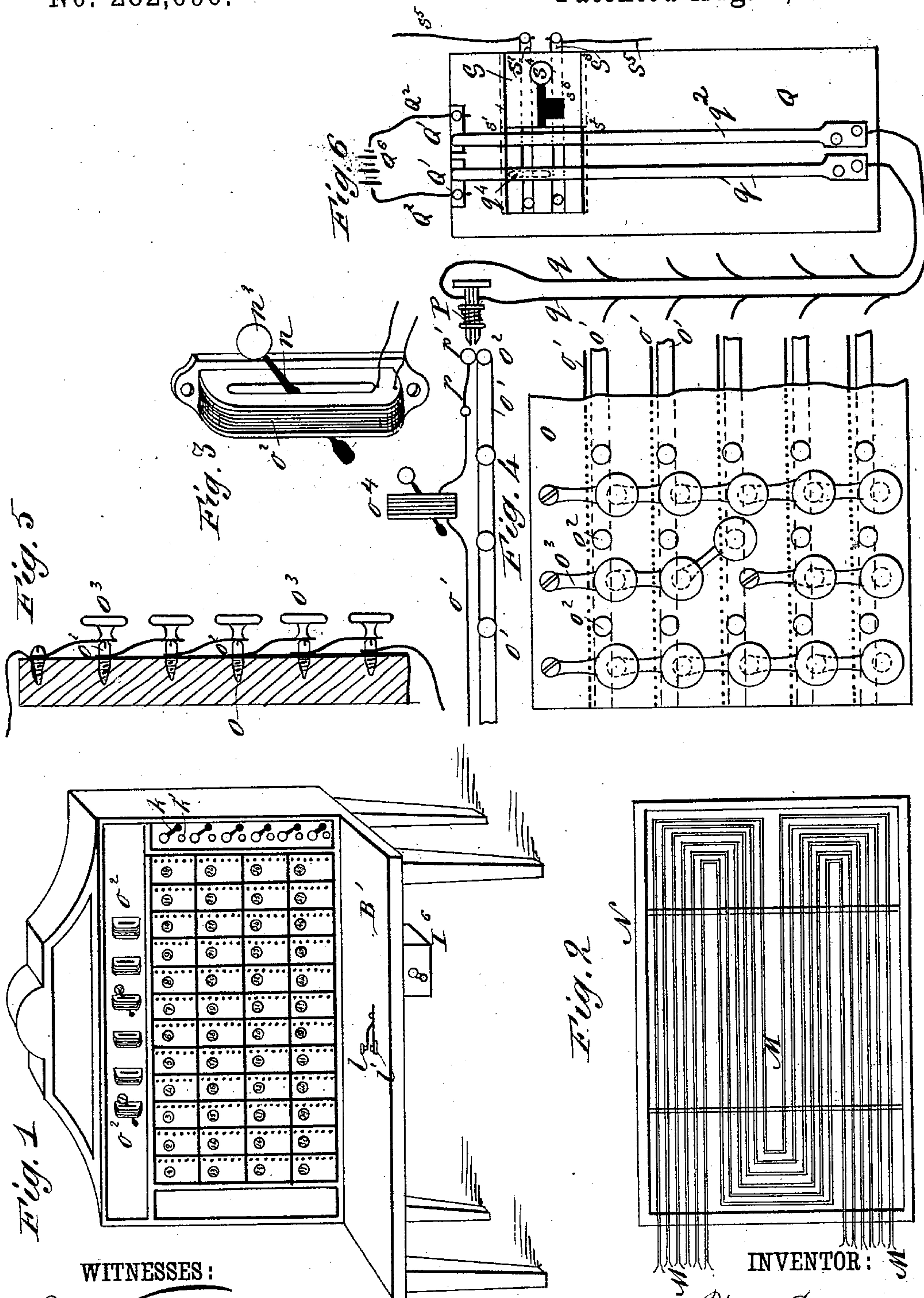


(No Model.)

5 Sheets—Sheet 1.

W. M. BROCK.
TELEPHONE CENTRAL OFFICE APPARATUS.
No. 282,699. Patented Aug. 7, 1883.



WITNESSES:

C. Saxeux

C. Sedgwick

INVENTOR:

W. M. Brock

BY

Munn & Co.

ATTORNEYS.

(No Model.)

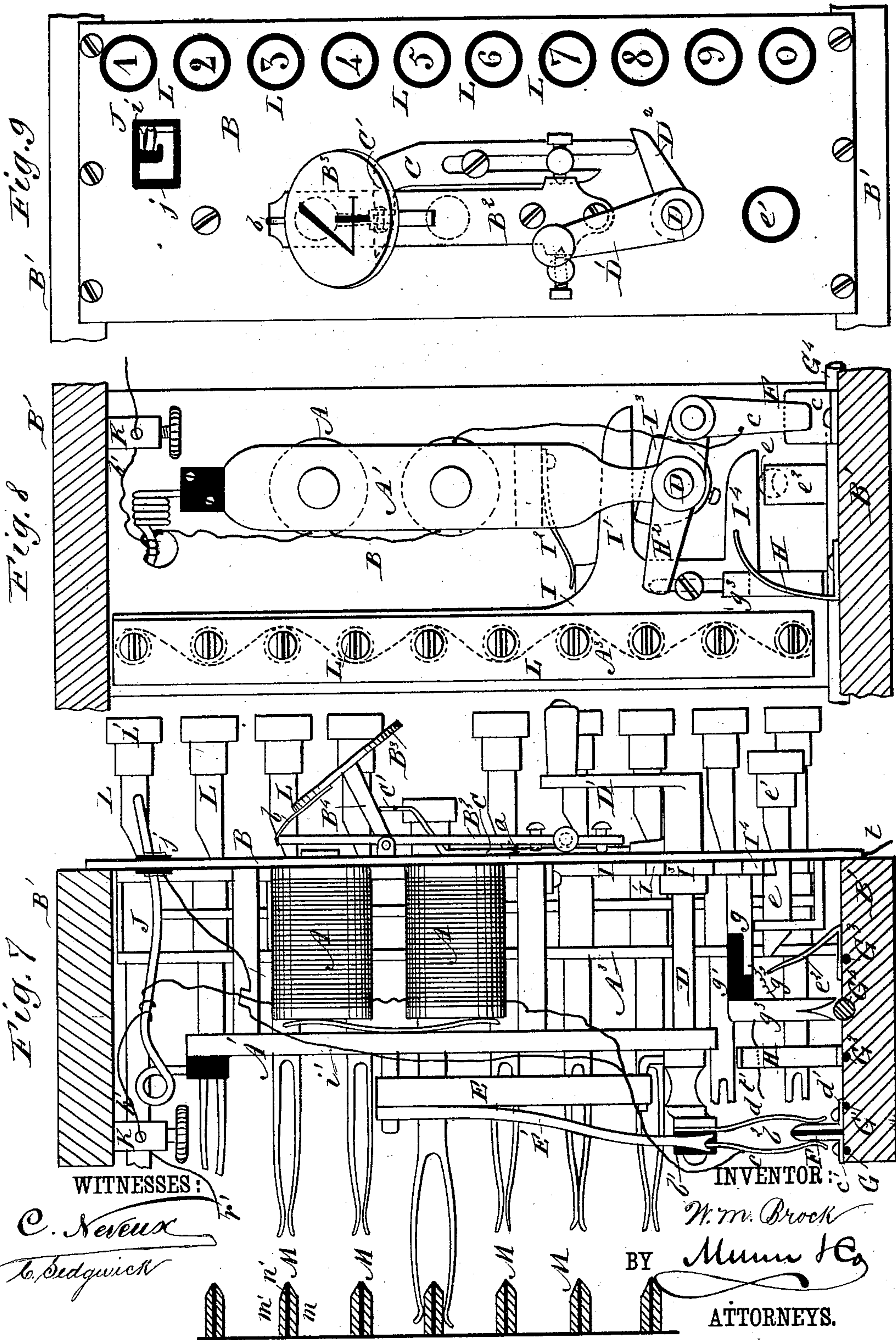
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W. M. BROCK.

TELEPHONE CENTRAL OFFICE APPARATUS.

No. 282,699.

Patented Aug. 7, 1883.



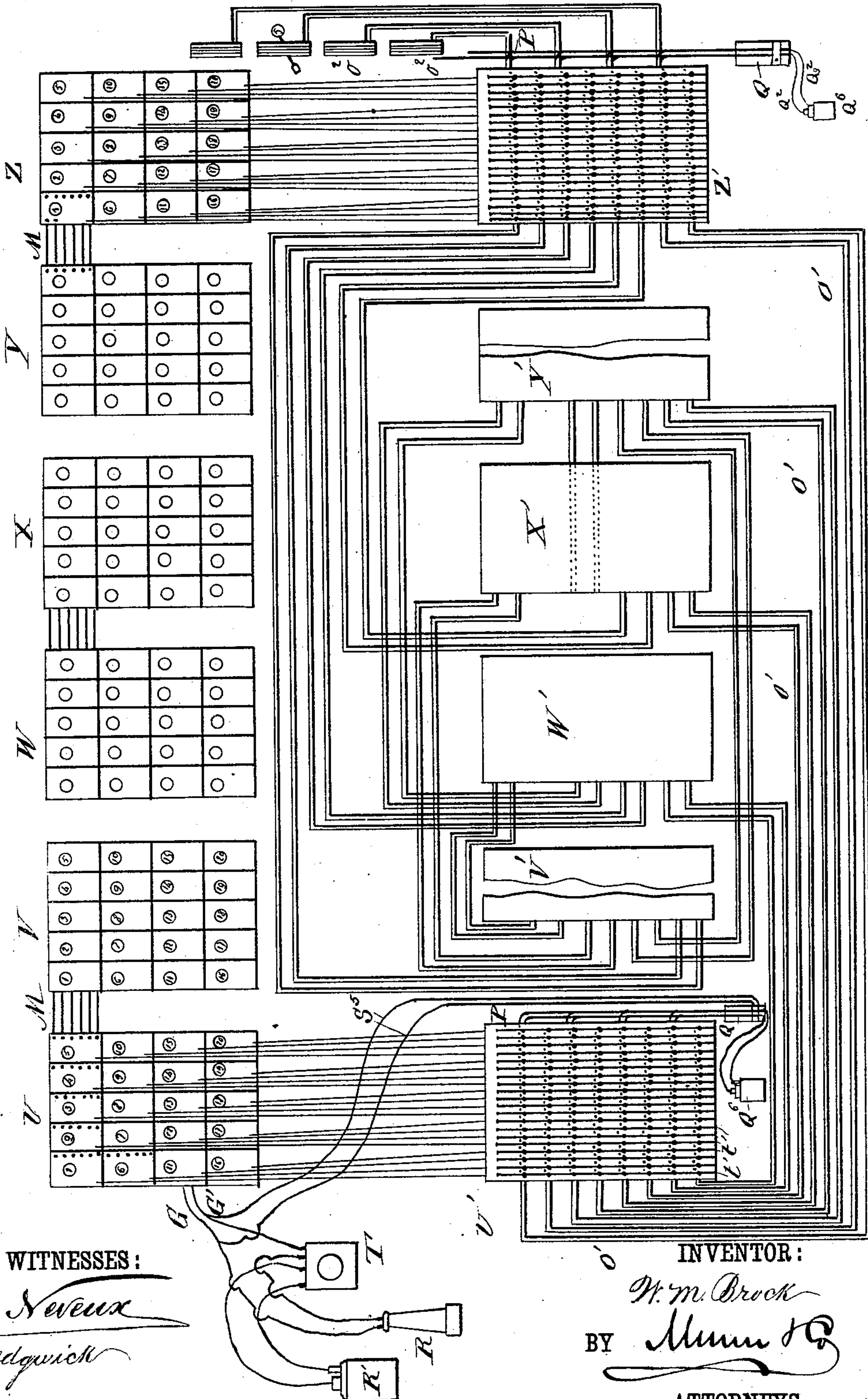
W. M. BROCK.

TELEPHONE CENTRAL OFFICE APPARATUS.

No. 282,699.

Patented Aug. 7, 1883.

Fig. 10



WITNESSES:

C. Neveu

L. Bedgwick

INVENTOR:

W. M. Brock

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Munn & Co

ATTORNEYS.

(No Model.)

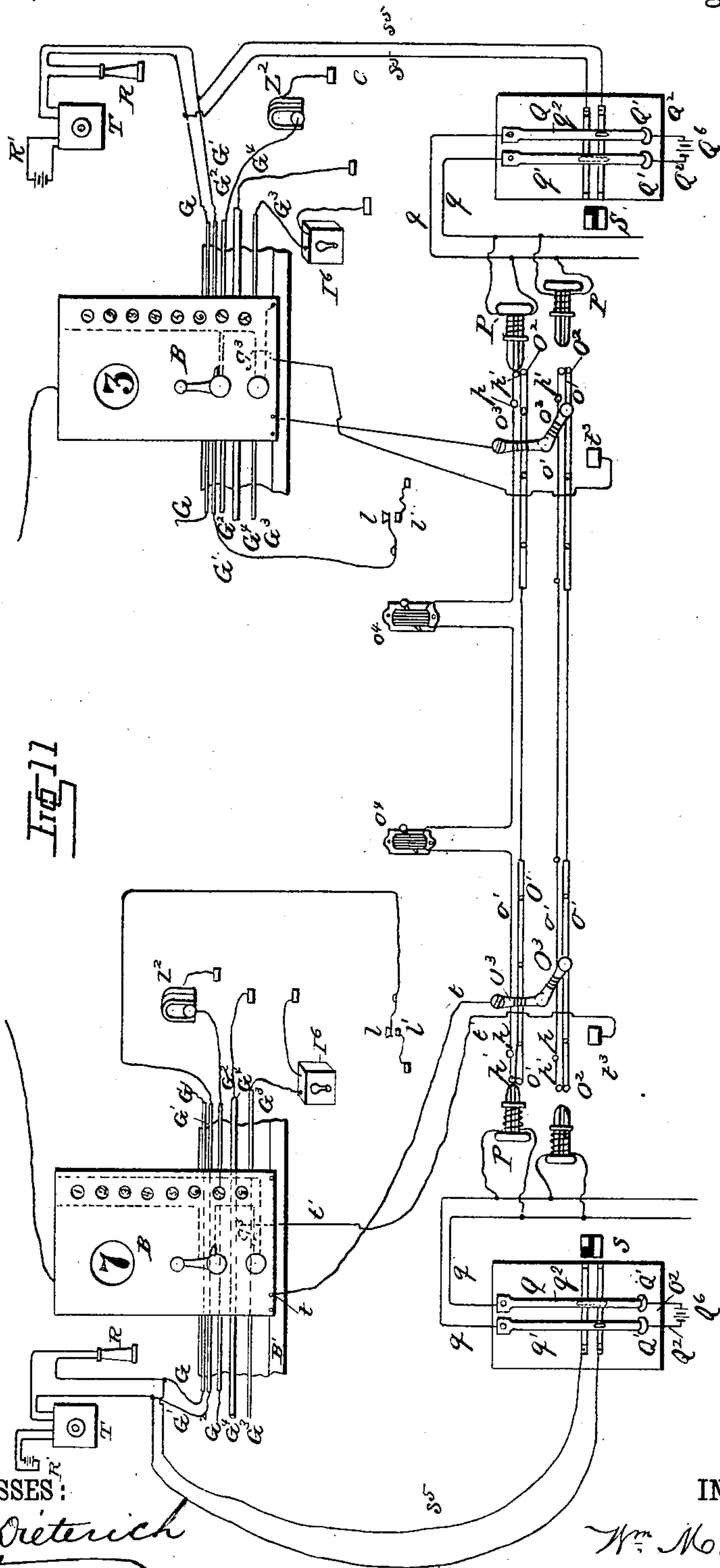
5 Sheets—Sheet 4.

W. M. BROCK.

TELEPHONE CENTRAL OFFICE APPARATUS.

No. 282,699.

Patented Aug. 7, 1883.



WITNESSES:

Fred. G. Dieterich
C. Sedgwick

INVENTOR:

Wm. M. Brock
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ATTORNEYS.

(No Model.)

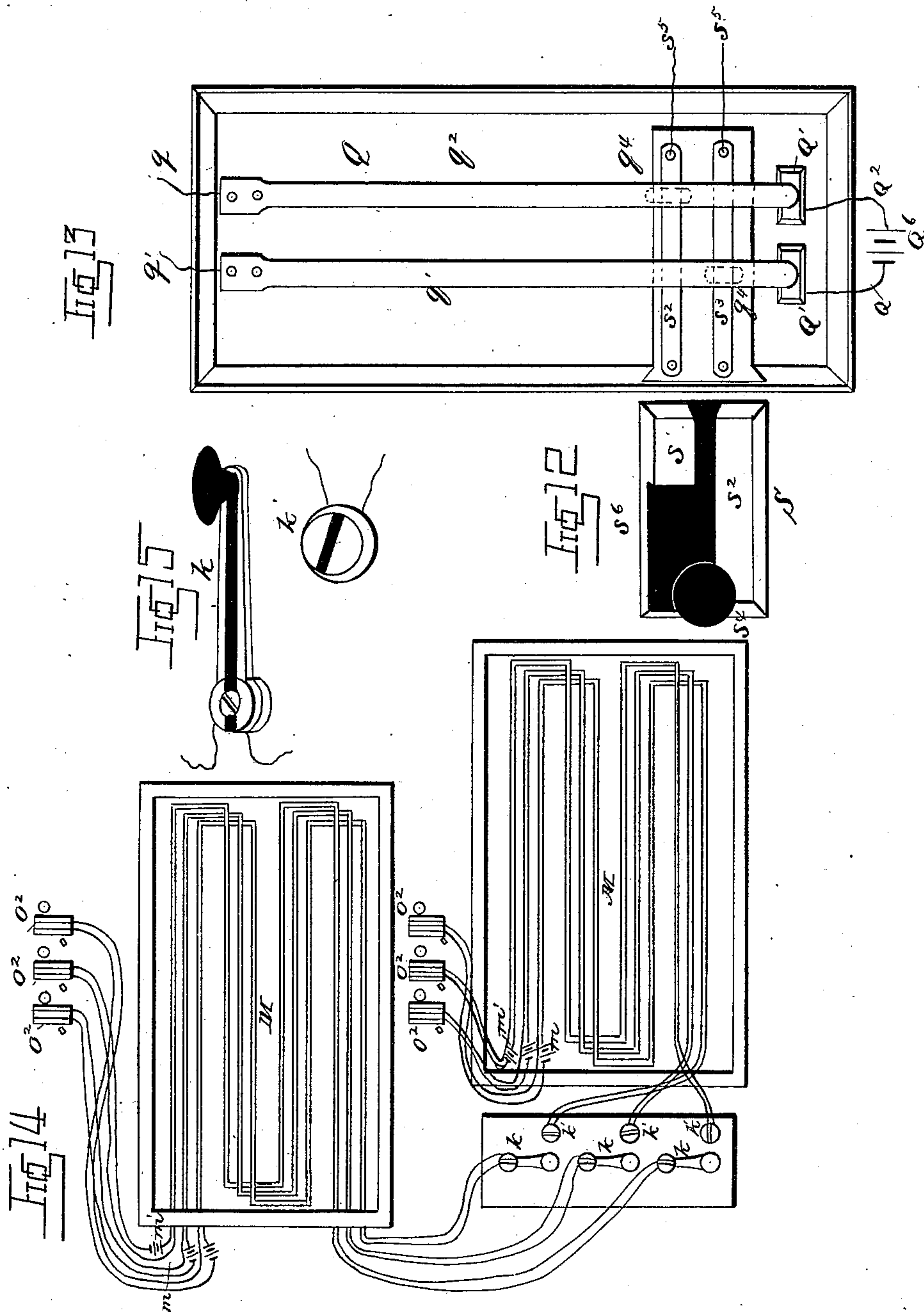
5 Sheets—Sheet 5.

W. M. BROCK.

TELEPHONE CENTRAL OFFICE APPARATUS.

No. 282,699.

Patented Aug. 7, 1883.



WITNESSES :

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Wm. M. Brock
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ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM M. BROCK, OF SHAMOKIN, PENNSYLVANIA, ASSIGNOR OF ONE-HALF
TO WILLIAM H. DOUTY, OF SAME PLACE.

TELEPHONE CENTRAL-OFFICE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 282,699, dated August 7, 1883.

Application filed November 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. BROCK, of Shamokin, in the county of Northumberland and State of Pennsylvania, have invented a new and Improved Telephone-Annunciator, Switch-Board, and Transfer-Table, of which the following is a full, clear, and exact description.

The object of my invention is to provide a new and improved telephone-annunciator, switch-board, and transfer-table for facilitating connecting two telephone-subscribers with each other in such a manner that they do not interfere with the other lines and are not disturbed themselves; and to this end it consists in the peculiar construction and arrangement of parts, as hereinafter fully described, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view of my improved switch-board, showing the same provided with forty-eight annunciator-drops. Fig. 2 is a front view of a connecting-wire arranged on the switch-board directly behind the annunciators. Fig. 3 is a perspective view of one of the indicators on the switch-board. Fig. 4 is a detail front elevation of part of a transfer-table. Fig. 5 is a cross-sectional elevation of the same. Fig. 6 is a plan view of the switch for the transfer-table. Fig. 7 is a detail cross-sectional elevation of the annunciator-drop. Fig. 8 is a rear elevation of the same. Fig. 9 is a front elevation of the same. Fig. 10 shows my improved transfer system for six switch-boards, with as many transfer-tables. Fig. 11 is a diagram showing two tables connected. Fig. 12 is a plan view of the slide removed. Fig. 13 is an elevation of the ebonite switch-plate. Fig. 14 is a diagram of the connecting rods or wires of two switch-boards. Fig. 15 is a perspective view of the switch and contact-button.

An electro-magnet, A, is held in a metal frame, A', which is attached to the rear surface of an annunciator-plate, B, which is attached to a shelf, B', a series of the said annunciator-plates being arranged in a box or case

to form a group of forty-eight annunciators, which represent forty-eight subscribers, as shown in Fig. 1. The armature B² of the said magnet is pivoted at its lower end to the front of the plate B in such a manner that it stands vertically. At its lower end the said armature is pressed from the plate B by a small spring, a. A disk or target, B³, is attached to an arm, B⁴, which passes through a vertical slot in the armature B², and is pivoted to the front of the plate B. A bent finger, b, projects from the upper end of the target, and is arranged to catch on the upper end of the armature B². A number or other character is painted, printed, stamped, or otherwise produced on the outer surface of the disk B³. A slide, C, provided at its upper end with a rectangular arm, C', is held to slide vertically on the front surface of the plate B.

A horizontal shaft, D, is journaled in the plate B and in the lower part of the frame A' in such a manner that the said shaft D will be at right angles to the plate B. At its outer end the said shaft is provided with a crank-handle, D', and with an arm, D², which, when the crank-handle is turned toward the left, is adapted to strike against the lower end of the vertical slide C and push the same upward, whereby the arm C' of the slide C strikes against the arm B⁴ of the target B³ and pushes the same upward, thus causing the finger b to catch on the upper edge of the armature B². At its inner end the shaft D is provided with an arm, at the end of which two spring-jaws, c and d, are held, of which the jaw c is insulated from the shaft D by means of a piece of ebonite, b', or other suitable insulating material.

A spring, E, attached to an arm of the frame A', is also attached to a crank-arm of the shaft D, and holds the shaft D in such a position that the spring-jaws c d will be raised from a knife-edge, F, and if the crank has been turned in such a manner that the spring-jaws c d are pressed against the knife-edge F the said spring E will raise the said spring-jaws again. A spring, E', which has its lower end forked or provided with prongs or a claw to adapt it to slide on the edge of the jaw c, is attached to or connected with the frame A' in some suitable manner. When the jaws c and d are low-

ered and in contact with the knife-edge F, the lower end of the spring E' rests on the ebonite or non-conducting material b' , and when the jaws $c d$ are raised the lower edge of the spring E' is in contact with the edge of the jaw c . The knife-edge is composed of two strips of metal, c' and d' , separated by insulating material b^2 . The strip c' is connected with the wire G, and the strip d' is connected with a wire, G', both of which wires are connected with the secondary wire of a transmitter, and the wire G' is connected with a press-button, l , which will be described later.

A curved spring, H, on the shelf B', is connected with a wire, G², which is connected with the battery or electrical generator Z². An arm, H², at the inner end of the shaft D, is adapted to come in contact with the spring H when the crank D' is turned in such a manner that the jaws $c d$ are raised from the knife-edge F.

The ground-plate I, resting against the back of the plate B, is provided with two prongs, I' and I⁴, of which the lower edge of the former, I', rests on a cam-plate, I³, mounted on the shaft D. The lower arm, I⁴, rests on the plug e of a push-button, e' , which plug can be pushed inward through an aperture in the plate B. A spring, e^2 , is fastened on the shelf B' in such a manner that when the plug e of the push-button e' is pushed inward the said plug will come in contact with the said spring e^2 . The said spring e^2 is connected with a wire, G³, which is connected with a hand electric generator or battery, I⁶. A spring, I², presses the ground-plate I downward. An arm, g , projects from the ground-plate I on the inner side of the annunciator-plate B, and to its end is attached a piece of vulcanite, g' , to which, in turn, is attached a downwardly-projecting forked piece of metal, g^3 , which, if pushed downward, comes in contact with the ground-wire G⁴. A wire, l' , is connected with the ground-piece g^3 , as will be more fully described hereinafter.

A wire, g^2 , connects the pieces g and g^3 of the ground-connection attached to the ground-plate I. The said wire g^2 is only used to connect the pieces g and g^3 when the switch-boards are not provided with the transfer-tables. By turning the crank-handle D' in such a manner that the spring-jaws $c d$ come in contact with the knife-edge F the cam I³ will raise the ground-plate I and break the connection between the ground-piece g^3 and the ground-wire G⁴.

The lower terminal of the coil of the magnet A is connected with the spring-jaw c , as shown in Fig. 7, and the upper end is attached to a shunt-spring, J, which is connected by a wire, h' , with a binding-post, K, with which a wire, v' , from the subscriber's transmitter is connected. The shunt-spring J is insulated from the frame A', to which it is attached, and passes through an opening in the plate B, which opening has its edges covered with a

layer of rubber or other insulating material, j . On part of the rubber a metal strip, i , is secured, which is connected by a wire, i' , with the spring-jaw c , or with the magnet-coil wire connected with the said jaw c . When the free end of the shunt-spring J rests against the metal strip i , the current will be short-circuited; but when the free end of the shunt-spring J rests against the insulated edge j of the opening in the plate the current will pass from the binding-post K through the spring J, the electro-magnet, &c.

A series of plugs, L, project through the annunciator-plate B, at right angles to the same, and are guided by a plate, A³, behind the plate B. At the outer ends the said plugs L are provided with insulated heads or buttons L', each of which is provided with a number, and at the inner ends they are provided with spring-forks, which are adapted to be pressed on connecting-rods M, formed of two strips of metal, $m m'$, and an intermediate layer of paper or other insulating material, n' . If one of the said rods L is pushed inward, its spring-prongs catch on the top and bottom pieces, $m m'$, which are thus brought in electrical contact with the rod.

On a board, N, at the back of a casing containing several annunciator-plates, a series of rods, M, are arranged in the manner shown in Fig. 2—that is, running longitudinally across the board, then down vertically back again longitudinally, and so on, until each wire crosses the board in the direction of its length four times—that is, as many times as there are horizontal rows of annunciator-plates. As many rods M must be attached to the board N as there are plugs L in each annunciator. It is natural that if the buttons of the plugs L in the uppermost row are numbered from one to ten downward those in the second row must be numbered from ten to one downward, those in the third from one to ten downward, and those in the fourth from ten to one downward, and so on. The switch-board is provided with six transfer-switches, k , and six contact-buttons, k' , as shown in Fig. 1, the said switch-levers and buttons being formed of two pieces of brass insulated from each other, as shown in Fig. 15.

On a panel over the group of annunciators a number of indicators, o^2 , are arranged, each indicator being composed of a coil, within which is pivoted a needle, n , which has its lower end weighted, and is provided with the target n^2 on its upper end, as shown in Fig. 3. The target bears the number of its corresponding connecting-rod M and plug L. One terminal of the indicator-coil o^2 is connected with one of the upper terminals, m , of the rod M, and the other terminal of the said coil is connected with one pole of a small cell of an open-circuit battery, the other pole of which battery is connected with the other terminal, m' , of one of the rods M. The lower terminals of the rods M of one switch-board are connected

to the switches k , while the lower terminals of the rods M of the next switch-board are connected with the buttons k' , as shown in Fig. 14. As the rods M consist of two strips, $m m'$, and the switch-levers and contact-buttons are made double, I will have a double line through-

A spring press-button, l , on the table in front of the switch-board is connected with the lower terminal of the secondary wire G' of a Blake transmitter. The contact-plate l' under the spring-button l is connected with the ground. The object of the button l is, when the crank D' of the annunciator is turned to the left, so as to cut in the listening-telephone, the plate or piece g^3 is lifted from the ground-rod, thereby breaking the connection; and it is necessary to establish a temporary ground-connection in order to enable the attendant at the office to converse with the subscriber. By pressing on the button l , I have a circuit from the binding-post K to the magnet, the jaws c along the wire G , to the transmitter T , then back over the wire G' , throughout its entire length, to the button l , and then to the ground.

Under the table of each switch-board is arranged a series of rods, O' , parallel with each of which a wire, o' , runs. From each rod O' metal studs or pegs O^2 project from the surface of the transfer-table, and between the said buttons or pegs O^2 switch-levers O^3 are pivoted, which are connected with the rods O' , and are of such length that they can be brought in contact with the buttons O^2 of the next lower rod, O' . The ends of each wire o' are connected with the ends of the wires of an indicator-coil, o^4 , provided with a pivoted needle, similar to the coil o^2 . By means of the wire o' one end of the coil o^4 is connected with the corresponding rod, O' , and the other end of the wire o' is connected with a spring, p , terminating in a button, p' , which is pressed by the said spring p against the end button, O^2 , of the corresponding rod, O' .

A plug, P , is composed of two insulated metal strips, each of which is connected by a wire, q , with the spring-strips $q' q^2$, which extend across the ebonite table Q , and have their free ends resting on metal strips Q' , which are connected with an open-cell battery, Q^6 , by wires Q^2 . A slide, S , is contained in a transverse groove in the ebonite plate Q , which slide is composed of two brass strips, $s' s^2$, which are separated by a piece of ebonite or other insulating material, s^6 , and a piece of ebonite, s^6 , also covers a portion of the slide S , as shown in Fig. 12. Two strips, $S^2 S^3$, are situated in the bottom of a groove in the ebonite plate Q , and their ends are connected by the wires S^5 with the secondary wires of the Blake transmitter.

The slide S is provided with a handle or knob, S^4 . To strips $q' q^2$ small strips of metal q^4 are riveted. If the slide S be pushed in the groove of the base Q , the two strips $q' q^2$ will be raised from their contact with the battery-

blocks Q' and the said strips brought into electrical connection with the strips $s' s^2$ of the slide S and the wires $S^5 S^5$ leading to the transmitter. When the said slide is in the groove of the block Q , the piece s' rests on the strip S^2 , the piece s^2 on the strip S^3 , the strip q' on the piece s^2 , and the block q^4 of the strip q^2 on the piece s' . The block q^4 prevents the strip q^2 from touching the piece s^2 , and a piece of ebonite, s^6 , of the slide S prevents the strip q' , when resting on piece s^2 , from electrical contact with piece s' .

Referring to Fig. 10, each annunciator-plate of each switch-board is connected with the uppermost switch-lever, O^3 , of a vertical row of switch-levers on top of one of the transfer-tables. In the example shown in Fig. 10 six switch-boards, U, V, W, X, Y , and Z , are shown, and each is provided with a corresponding transfer-table, U', V', W', X', Y' , and Z' . I have shown only the end switch-boards and the end transfer-tables connected.

The switch-boards U and V, W and X , and Y and Z are connected with each other in pairs by means of the rods M . The different connecting rods and wires running to different tables will be termed "groups." Thus a group of two or three rods and wires will connect one table with another, another group of two or more connect a third table with the second, and so on. The transfer-table U' is connected by means of two rods, O' , and two wires, o' , with the transfer-tables W', X', Y' , and Z' , but not with the transfer-table V' , as the switch-board U can be connected directly with the board V . The transfer-table V' is connected in the same manner with the transfer-tables W', X', Y' , and Z' . The transfer-table W' is connected with the tables U', V', Y' , and Z' . The transfer-table X' is connected with the transfer-tables U', V', Z' , and Y' . The transfer-table Y' is connected with the transfer-tables X', W', V' , and U' , and the transfer-table Z' is connected with all but the transfer-table Y' .

The wire G connects the first transfer-table, U' , with the receiver R , and the receiver is connected with the transmitter T , which in turn is connected with the battery R' . The wire G' is connected to the transmitter T . The wires $S^5 S^5$ from the ebonite switch-plate Q are connected to the wires $G G'$, and said wires $S^5 S^5$ are connected with an open-cell battery, Q^6 , by means of the strips $q' q^2$ and wires Q^2 , and the rods O' and the wires o' by means of the wires q . The wires o' and the rods O' are connected with the indicator-coils o^4 , the said wires o' and rods O' being connected with the table-switch O^3 .

As soon as the button P is pushed in between the button p' and the button O^2 , as shown in Fig. 4, the circuit will be closed and the current in the coil o^4 will deflect the needle n and will cause the same to leave the recess in the coil, so that the disk n^2 will be visible, thus showing that the circuit of the said rod O' and wire o' is closed, or, in other words, indicate that

an operator at another table desires communication. For instance, if the operator at V wants the operator at Z, the operator at V pushes in the button P of the rod that runs through the table Z, and thereby connects the battery Q⁶ with the indicator, the needle of which swings outward.

There are two distinct sets of indicators used in two distinct circuits independent of each other and for distinct purposes. In one case they are used in a local circuit arranged in each of the connecting-rods M. They automatically indicate when one of the said rods M is in use, as when two annunciators are connected together by said rod, the said local circuit being closed when one of the plugs L is pushed in over one of the said rods M. In the second case the indicators are arranged in the wire circuits of the transfer-tables. If one of the annunciator-plugs be pushed in so as to spring over the connecting-rod, the circuit of that rod is closed, and it causes the target or disk of the said indicator to be exposed. When the plug is withdrawn the target or disk falls back.

The operation is as follows: I will first describe the operation with one or two switchboards which are not provided with transfer-tables. The current from the subscriber's generator passes over the line and enters the binding-post K, Fig. 7, passes to the shunt-spring J, the free end of which is so adjusted that it rests against the rubber part j. From there the current passes through the magnet A to the spring-jaw c, from the same up the spring E', as it cannot pass into the knife F, as the jaws c d are raised from the said knife to the frame A' to the ground-plate I, the arms g g' to the ground-wire G⁴, and from there to the ground. As the current passes through the magnet A the armature B² will be drawn toward the magnet-head and from under the finger b of the target B³, permitting the said target to drop, which indicates a call for the central office. The operator then turns the crank D' of that annunciator toward the right, which movement causes the cam I³ to raise the ground-plate I, and thus break the normal ground-connection, and at the same time the arm H² at the end of the shaft D is brought in contact with the spring H, which is connected with the wire G², leading to the battery or generator. The current is then from the ground and generator over the wire G², the spring H, the arm H², over the frame-work A', down the spring E', along the wire to the magnet, then to the post K and out over the line. Having answered the call, the crank D' is turned to the left, whereby the spring-jaws c d will be forced down on the knife F, that is in contact with the strip c' d'. Then the button l is depressed and the circuit is as follows: From the line and post K to the shunt-spring J, the magnet A, the jaw c, the strip c' of the knife F, the wire G, to the transmitter, back over the wire G' down to the button l, with which the said wire G' is connected, and from there to the

ground, for the regular ground-connection of the annunciator is necessarily broken when the telephones are cut in. Having now ascertained the wishes of the subscriber who is to be connected with some other line, the operator releases the button l and pushes in a certain plug of the annunciator—say, for instance, No. 5—as shown in Fig. 7. Then he calls the party desired, and pushes in the plug No. 5 of that annunciator also. The current then runs as follows: From the post K to the shunt-spring J, to the magnet A, the jaw c, the strip c' of the knife F, the wire G to the transmitter, and back over the wire G' to the strip d' of the knife F, through the jaw d, the frame A', the plug L, (No. 5,) which has been pushed inward to the rod M, and through the same to the plug No. 5 of the other annunciator, and then out.

If the crank D' and the spring-jaws c d are in the normal position, then the circuit in the last example may be from the magnet to the jaw c, to the spring E', to the frame A', and plug 5, and over the connecting-rod M, as described. By moving the crank D' to the left the slide C is moved upward by the arm D², and the arm C' of the slide C strikes against the arm B⁴ of the target B³ and raises and resets the target on the end of the armature. As soon as the plugs No. 5 have been pushed inward the needle n of the indicator-coil o², corresponding to the rod M, (No. 5,) swings out of the recess in the coil, and thus shows that the rod M (No. 5,) is being used.

When a plug, L, is in connection with a rod, M, the circuit is from one pole of open-circuit cell to one terminal of the indicator from the other terminal to one portion of the double connecting-rod M, and continuing to where the plug connects the portions m m' of the rod M together, from whence it returns to the pole of the battery, thus completing the circuit and causing the needle of the indicator to swing outward, and to remain so as long as the plug is in contact with the connecting-rod.

It will thus be seen that by pushing in any one of the plugs the ground-connection is broken, the line connected with one of the connecting-rods and the local circuit closed.

Whenever the crank D' of the annunciator is turned to the left for the purpose stated above and to cut in the listening-telephones, the ground-plate I is lifted from the ground-wire G⁴ by the cam I³, thus breaking that connection, and it is now necessary to establish a temporary ground with the line to enable the operator to converse with the subscriber. By pressing down the button l the current runs as follows: from the line binding-post K, the shunt-spring J, the magnet A, the jaw c, and the strip c', and along the wire G to the transmitter, and back over the wire G', throughout its length, to the press-button, and from there to the ground.

The auxiliary hand-generator I⁶, Fig. 1, has one pole connected with the spring e² by the

wire G^3 , Fig. 7, and the other pole connected with the ground. If the power-generator—that is to say, a generator driven by some suitable motive power—should fail, the hand-generator may be thrown in circuit with any annunciator by simply pushing in the plug e , the end of which comes in contact with the spring e^2 , and at the same time the plug lifts the ground-plate I, breaking that connection and establishing a new connection with the ground through the hand-generator as follows: the post K, the magnet A, the spring-jaw c , the spring E' , the frame A' , the plug e , the spring e^2 , the wire G^3 , the hand-generator I^6 , and from there to the ground.

When the shunt-spring J rests against the rubber edge of the opening in the annunciator-plate, the line-circuit continues its regular course, as above described; but if the shunt-spring is moved so as to come in contact with the metal piece i the circuit is then from the post K, the shunt-spring J, the metal piece i , the wire i' , to the jaw c , and thus the annunciator-coil is cut out, and does not interfere with cutting in the listening-telephones.

If the switch-boards are provided with transfer-tables, the operation is as follows: The current will be from the post K to the magnet A, the jaw c , the spring E' , the frame A' , the annunciator-plate B, through the wire t , to the transfer-button on the transfer-tables, the wires t' , the piece g^3 , Fig. 7, and thence to the ground over the wire G^4 . If, for instance, a subscriber of the annunciator No. 7 on the switch-board U wishes to be connected with a subscriber of annunciator No. 12 on the board Z, the operator presses the button P of the rods O' , connecting the transfer-tables U' and Z' , in between the button O^2 and the button p' . A current then passes from the battery Q^6 , over the strips $q' q^2$, the rod O' , and wire o' , to the wire and rod which leads from the transfer-table U' to the transfer-table Z' . The target n^2 of the indicator o^2 of the corresponding line swings outward, thus showing the operator at the switch-board Z that a subscriber of the switch-board U desires connection with the switch-board Z. Both operators then push the slides S under the strips $q' q^2$, whereby the telephones connected with the switch-board U will be connected with the telephones connected with the switch-board Z, the current passing through the secondary wires, the wires S^5 , the strips S^2 , the slide S, the stripes $q' q^2$, the button p' , and over the rod O' and wire o' . The line connecting the transfer-table U' with the transfer-table Z' connects with the button P on both boards, and on this line the signaling is done between the two boards. When the operator at the switch-board Z cuts in his telephone to the transfer-rod he also presses upon the button P of that rod. The operator of the switch-board Z, having called the desired subscriber of the annunciator-board 12, and received an answer, moves the third button in the inner vertical row of

buttons in the transfer-table Z' to the right, whereby it comes in contact with a pin of the connecting-rod which connects the transfer-tables U' and Z' . The third button of the second vertical group of four of the switch-buttons of the transfer-table Z' corresponds with the annunciator No. 12 of the switch-board Z. The operator at the switch-board U moves the button No. 2 of the second vertical group corresponding to annunciator No. 7 of the switch-board U, so that the said switch-lever also comes in contact with the button on the rod O' , connecting the transfer-tables U' and Z' . The annunciator No. 7 of the switch-board U and the annunciator No. 12 of the switch-board Z will thus be connected.

If two of the pairs of tables—for instance, U' and V' , W' and Y' , or X' and Z' —are to be connected—for instance, to connect No. 3 of U' with No. 9 of V' —the plugs L, No. 4 of the annunciators 3 and 9, respectively, of the switch-boards U and V are pushed inward, and then the transfer switch-lever k , corresponding to the rod M, No. 4, is turned to rest on the corresponding contact-button, k' .

The system shown in Fig. 10 is only to be used when there are three or more boards, and even then it is not used in connections between the transfer-tables U' and V' , W' and Y' , X' and Z' . The system shown in Fig. 10 may be extended as much as may be desired.

It is evident that by means of my system of switches and transfer-tables the most remote subscriber can be connected in a very short time, and much delay, which is very disagreeable to subscribers, is avoided.

By means of the switch-board shown in Fig. 1 I am enabled to connect any number of subscribers of one annunciator group with any number of subscribers of another annunciator group. Thus one subscriber does not control the entire annunciator.

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

1. The combination, with a series of telephone switch-boards connected in pairs and a corresponding number of transfer-tables connected therewith, of a transmitter connected with one switch-board, the wire S^5 , connected with the secondary wire of the transmitter and with the switch-plate Q, the wires q , connected with the said switch-plate, and the push-button P, for connecting the wires q with the rods and wires $O' p$ on the transfer-table, substantially as herein shown and described, and for the purpose set forth.

2. The combination, with a series of telephone switch-boards united in pairs, of a series of a corresponding number of transfer-tables, each connected with its corresponding switch-board, the said transfer-tables being connected with each other, substantially as herein shown and described, and for the purpose set forth.

3. In transfer-tables, the combination, with the table O, of the rods O' , the wires o' , the

buttons O^2 , and the switch-lever O^3 , substantially as herein shown and described, and for the purpose set forth.

4. The combination, with the table O , of the rods O' , the wire o' , the buttons O^2 , the switch-levers O^3 , the coil o^2 , connected with the wire o' , the needle n , pivoted within the coil o^2 , and the target n^2 on the end of the needle n , substantially as herein shown and described, and for the purpose set forth.

5. The combination, with a rod, O' , and a wire, o' , of a coil, o^2 , containing a pivoted needle, the buttons O^2 , the spring p , the button p' , and the push-button P , connected with wires which are brought in electrical contact with the rod O' and the wire o' , substantially as herein shown and described, and for the purpose set forth.

6. The coil o^4 and the pivoted needle n , provided with a target, n^2 , in combination with a transfer-table, and means for connecting it with the rods and wires of said table, substantially as herein shown and described.

7. In an electrical transfer-table, the combination, with a series of rods, O' , of the wires q , the switch-plate Q , the strips $q' q^2$, connected with the wires q , the plates Q' , connected with the battery, the strips S^2 , connected with the secondary wires of the transmitter, and the slide S , formed of two strips of brass separated by an insulator, substantially as herein shown and described, and for the purpose set forth.

8. In an electrical transfer-table, the combination, with a series of rods, O' , of the wires q , the switch-plate Q , the strips $q' q^2$, connected with the wires q , the plates Q' , connected with the battery, the strips $S^2 S^3$, connected with the secondary wires of the transmitter, the slide S , formed of two strips of brass separated by an insulator, and of the strip q^4 , secured on one of the spring-strips $q' q^2$, substantially as herein shown and described, and for the purpose set forth.

9. A switch-board for telephones divided into a series of annunciator-plates, each provided with a like number of plugs, combined with as many wires or rods as there are plugs in each annunciator-section, which wires or rods are attached to the back of the switch in such a manner that the like plugs of each annunciator-section can come in contact with the same wire or rod, substantially as herein shown and described, and for the purpose set forth.

10. In a telephone switch-board, the combination, with annunciator-plates having push-plugs with forked inner ends, of the connecting-rods M , formed of insulated strips $m m'$, substantially as herein shown and described, and for the purpose set forth.

11. In a telephone switch-board, the combination, with annunciator-plates having push-plugs with forked inner ends, of the connecting-rods M , formed of insulated strips $m m'$, and of the indicator-coils o^2 , having their terminals connected with the strips $m m'$, sub-

stantially as herein shown and described, and for the purpose set forth.

12. In a telephone switch-board, the combination, with annunciator-plates having push-plugs with forked inner ends, of the connecting-rods M , formed of insulated strips $m m'$, the indicator-coils o^2 , having their terminals connected with the strips $m m'$, and of switches for connecting the said rods M with the corresponding rods of an adjoining switch-board, substantially as herein shown and described, and for the purpose set forth.

13. In a telephone-switch board, the combination, with annunciator-plates having push-plugs with forked inner ends, of the connecting-rods M , formed of insulated strips $m m'$, the switches k , formed of two insulated metal strips connected with the strips $m m'$ of the rod M , and of the contact-buttons k' , formed of two insulated metal strips, which are connected with the strips $m m'$ of a rod, M , of an adjoining switch-board, substantially as herein shown and described, and for the purpose set forth.

14. The combination, with a telephone-annunciator, of the push-plug e , the spring e^2 , and the wire G^3 , connected with the hand-generator, substantially as herein shown and described, and for the purpose set forth.

15. The combination, with an annunciator-plate, of the shaft D , having an arm, H^2 , the spring H , and the wire G^2 , connected with the main generator, substantially as herein shown and described, and for the purpose set forth.

16. In a telephone-annunciator, the combination, with a magnet, A , of the shaft D , the spring-jaws $c d$, of which one is connected with the magnet, the knife F , formed of the strips $c' d'$, and the spring E' , forming a connection between the spring-jaw c and the frame A' , substantially as herein shown and described, and for the purpose set forth.

17. In an annunciator, the combination, with the magnet A , of the shaft D , the spring-jaws $c d$, the strips $c' d'$, the spring E' , and the wires G and G' , substantially as herein shown and described, and for the purpose set forth.

18. In an annunciator, the combination, with the magnet A , of the shaft D , the spring-jaws $c d$, the strips $c' d'$, and the shunt-spring J , substantially as herein shown and described, and for the purpose set forth.

19. In an annunciator, the combination, with a magnet, A , of the shaft D , the spring-jaws $c d$, the strips $c' d'$, the shunt-spring J , the rubber j , and the metal i , connected by a wire, i' , with the spring e , substantially as herein shown and described, and for the purpose set forth.

20. In a telephone-annunciator, the combination, with the magnet A , of the shaft D , the jaws $c d$, the strips $c' d'$, the spring E' , and the spring E , substantially as herein shown and described, and for the purpose set forth.

21. In an annunciator, the combination, with the ground-plate I , having arms $I' I^4$, of the shaft D , having a cam, I^3 , the ground-wire G^4 , and

an arm adapted to form communication between the ground-plate and the ground-wire, substantially as herein shown and described, and for the purpose set forth.

5 22. In an annunciator, the combination, with the ground-wire G^4 , of the metal pieces g and g^3 , the vulcanite piece g' , and the connecting-wire g^2 , substantially as herein shown and described, and for the purpose set forth.

10 23. In an annunciator, the combination, with the ground-wire G^4 , of the metal pieces g and g^3 , the vulcanite piece g' , the connecting-wire g^2 of the wire t' , connected with the piece g^3 and with the corresponding transfer-table,

substantially as herein shown and described, 15 and for the purpose set forth.

24. The combination, with a telephone-annunciator, of the press-button P , connected with the transmitter, and of a button, l , connected with the ground and adapted to be 20 brought in contact with the press-button that is connected with the transmitter, substantially as herein shown and described, and for the purpose set forth.

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Witnesses:

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