

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,309.

Patented Oct. 26, 1897.

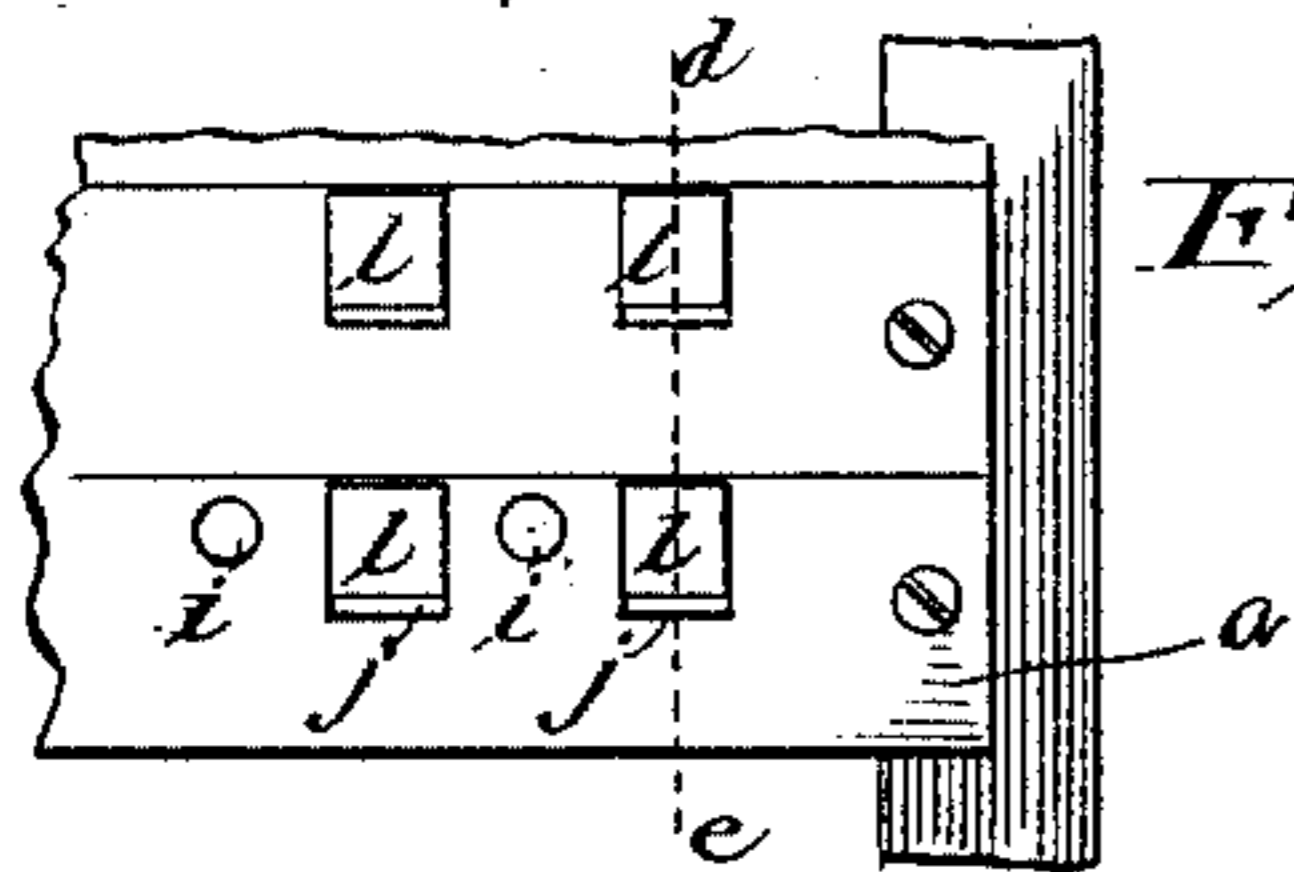


Fig. 1^a

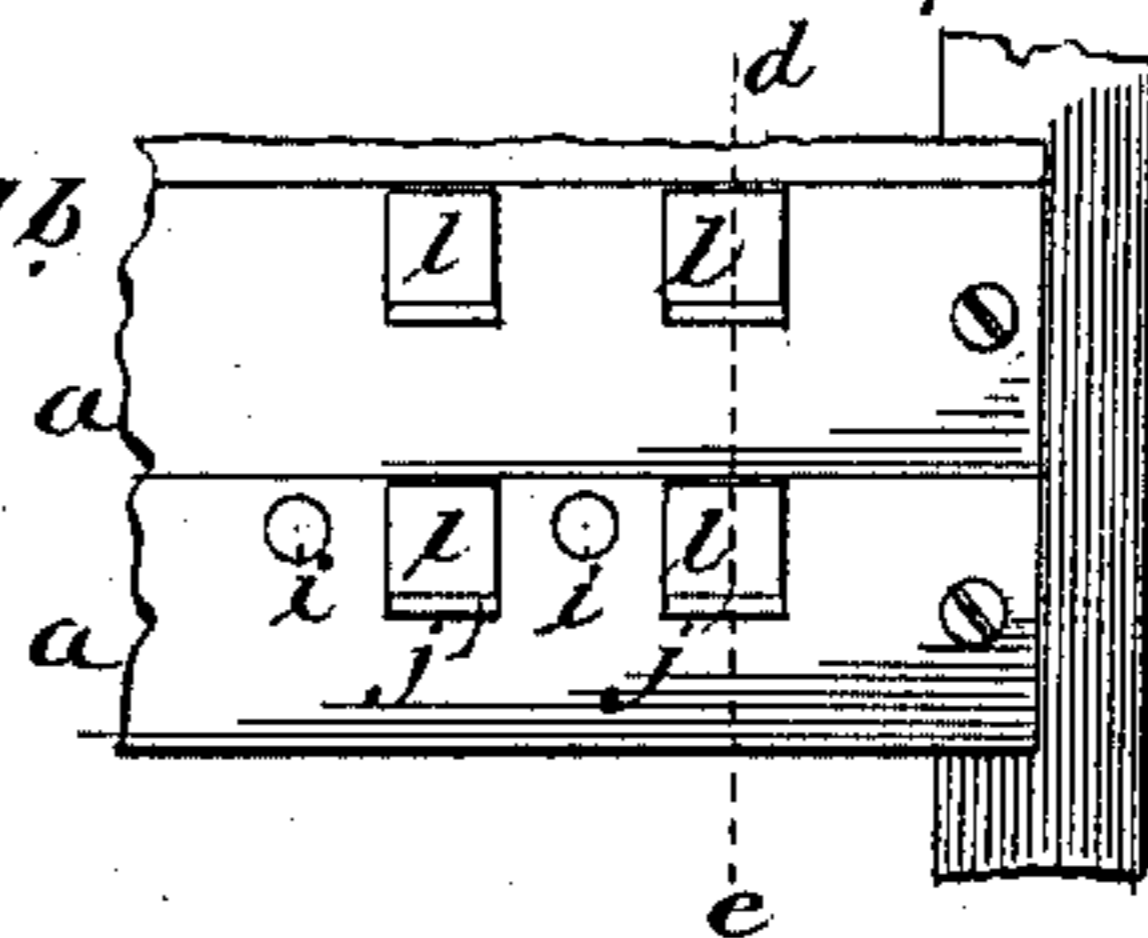


Fig. 1^b

Fig. 2.

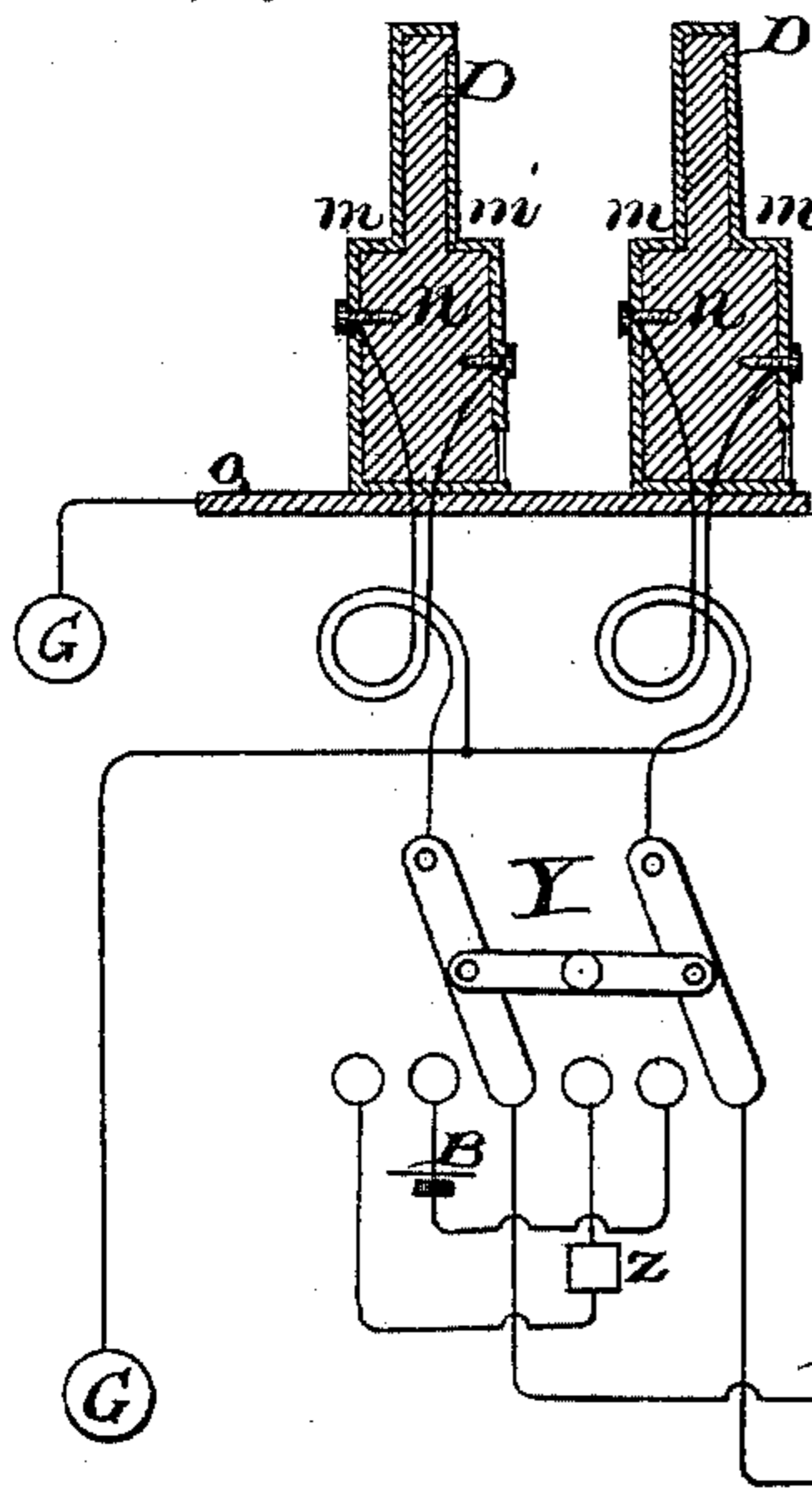
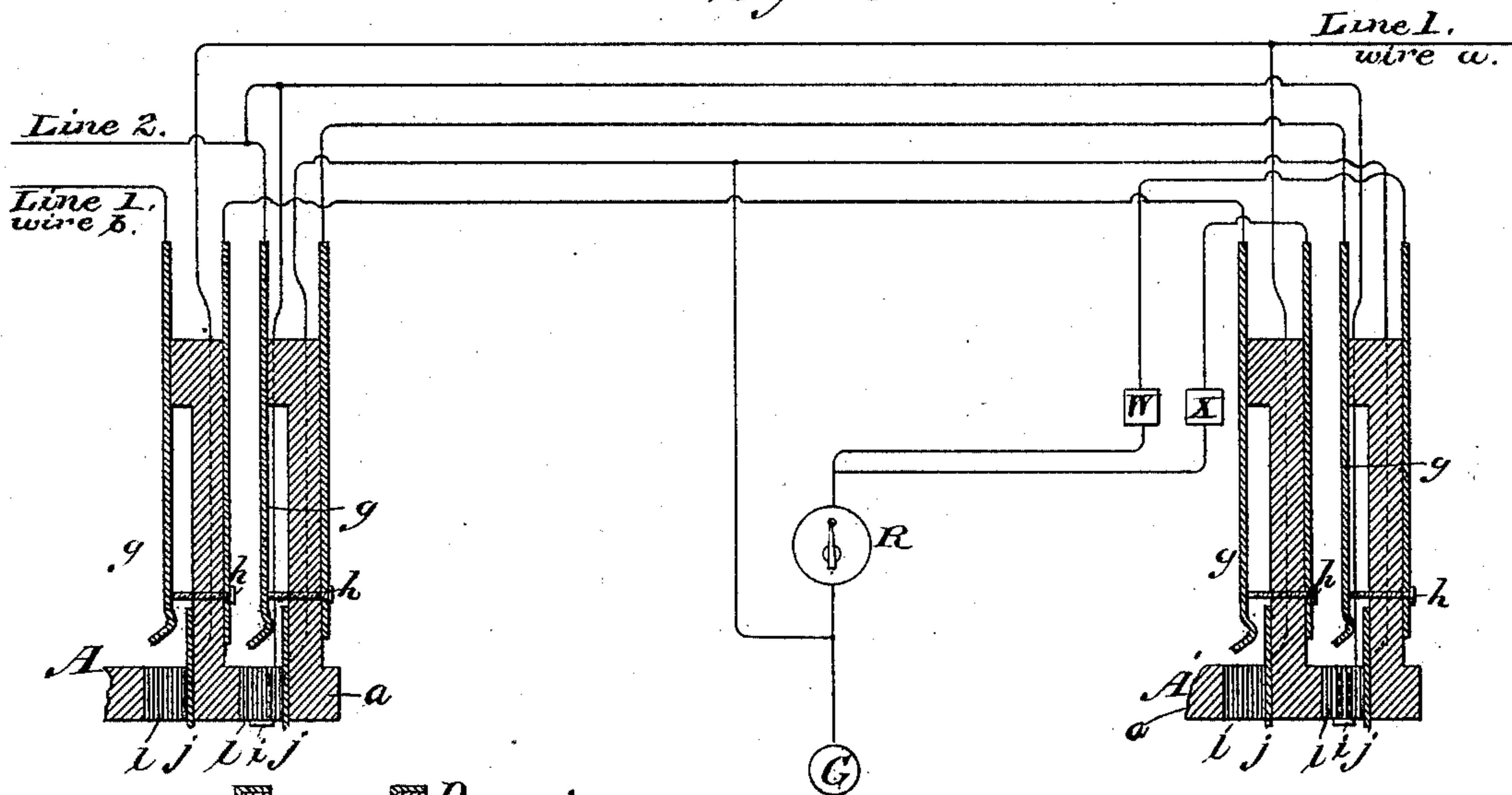
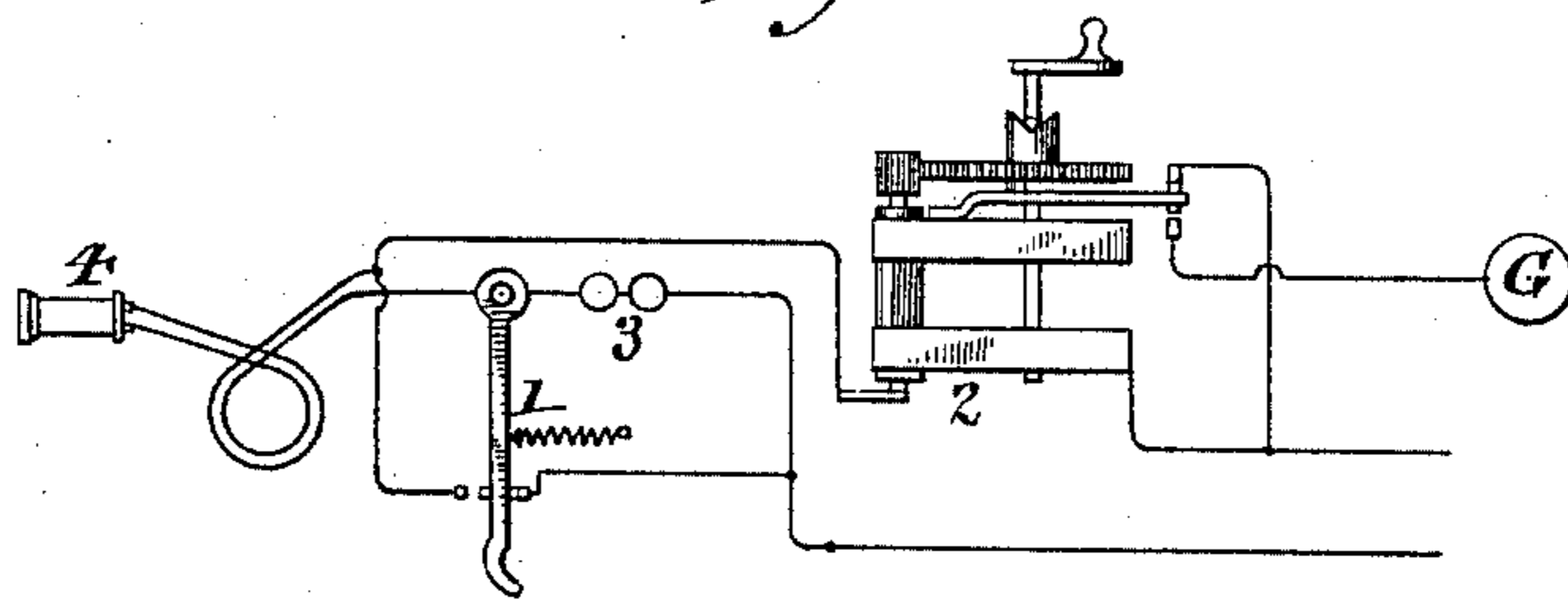


Fig. 3.

Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF SAME PLACE.

MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,309, dated October 26, 1897.

Application filed October 11, 1889. Serial No. 326,685. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, Illinois, temporarily residing at Stuttgart, in the Empire of Germany, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, 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-exchange system in which part of the subscribers' lines are single or ground circuit lines and part of the lines are metallic-circuit lines; and it consists of apparatus and a system of testing such lines to determine at one board whether a line is in use at another board and a system of switching such lines.

In the drawings illustrating my invention, Figures 1^a and 1^b represent sections of two multiple switchboards of the exchange to which the same lines are connected. Fig. 2 shows a complete diagram of the boards with all the main-line apparatus, circuits, and connections necessary to operate them according to my invention. Fig. 3 shows an operator's cord system adapted to be used with said boards, and Fig. 4 shows a diagram of the subscriber's-station apparatus adapted for use on the metallic-circuit lines of the system.

In Fig. 2, A is a sectional view of the switchboard shown in Fig. 1^a, and A' is a sectional view of the switchboard shown in Fig. 1^b, each as indicated by the line *d e*.

I place as many boards in the central office as are found necessary or desirable in order to properly answer the calls and make the connections. On each board is a suitable switch for each line. Each switch has a contact-spring which normally bears on an insulated contact-point and has a contact-piece insulated from the rest of the apparatus (except by the connections as indicated) and is adapted to receive a loop-switch plug and, when the plug is inserted, to disconnect the spring from the contact-point (on which it normally bears) and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively.

In Fig. 2, *g g* represent the springs of the different switches, *h h* the contact-points on

which the springs normally rest, and *j j* the insulated contact-pieces of the switches. *l l* are the switch-holes, and *a a* are the rubber strips on which the spring-jack parts are mounted, as shown, and through the fronts of which are the switch-holes *l l*. These holes are adapted to receive the switch-plugs, (shown in Fig. 3 and marked D D,) and when a plug is inserted into a switch it operates the switch, as above described.

The insulated contact-pieces *j j* of the switches which are used for metallic-circuit lines should be so placed that a test-plug or other switch testing device may be readily applied to them. For the single-circuit lines I use test contact-pieces separate from the line-switch contact-pieces and the holes, but which may be adjacent to the holes. I use one such test contact-piece on each board for each of such lines, and they are marked *i i* in the drawings.

R in Fig. 2 is a mechanical rheotome and contains a clockwork-movement actuated by a spring and an oscillating bar fixed to the verge-shaft and standing at right angles to it. A pair of contact-points is connected with the bar or with the shaft in such a way that their connection is alternately made and broken with the oscillations. On the bar is a sliding weight by which the rapidity of the oscillations may be regulated. The pair of contact-points are properly insulated and are connected into the circuit, as indicated for the rheotome. Instead of the rheotome shown any usual form of mechanical or electrical rheotome may be used.

w and *x* are calling-annunciators, one for each line shown and each located in the circuit of its line at the board where its calls are to be answered.

In the subscriber's-station apparatus for metallic-circuit lines, (shown in Fig. 4,) 1 is the telephone-switch. 2 is the calling-generator. 3 is the receiving-bell, and 4 is the subscriber's telephone. These parts may be the usual forms of apparatus and are connected as shown or in other known ways. The calling-generator is, however, modified, as I shall now indicate.

The generator has an automatic device (shown in the figure) by which when the

crank is not in motion the wire of the armature is shunted and the line is disconnected from the ground at the subscriber's station, and when the generator is turned or operated the shunt is automatically removed and the line is connected to the ground. The automatic device shown is a modification of a form very generally used, the modification being substantially in the arrangement of the contact-points and the circuits connected therewith. It contains a V-shaped attachment to the hub of the driving-wheel, a pin in the shaft, which engages in the V-shaped arrangement, and a spring which presses against the wheel and brings the pin normally in the center of the V arrangement. The contact-points are substantially as shown and as will produce the switching operations described above. G in each case in the drawings represents a ground connection.

Two lines, with their connections, are shown in Fig. 2, one a metallic-circuit line and marked line 1 and the other a single-circuit line and marked line 2. The two sides or branches of the metallic-circuit line are marked wire *a* and wire *b*.

The circuit of the single-circuit line is as follows: from the subscriber's ground through his station apparatus, which may be of the usual style for such lines, through the pairs of contact-points successively of its switches on the several boards, going in each case to the spring first, thence through its line-annunciator to a common ground wire or connection for the lines of the exchange, in which are the contact-points of the rheotome. All the contact-pieces *j j* of the switches of a single-circuit line are connected direct together and are connected to the ground, but the rheotome R should not be in the circuit between them and their ground connection. All the test contact-pieces *i i* of a single-circuit line should be connected together and to the line, their connection to the line being between its switches and the subscriber's station. In Fig. 2 the connections of a single-circuit line and its switch parts and apparatus are as described above.

The circuit of a metallic-circuit line is as follows: One side or branch of the line, say wire *a*, is connected with all the contact-pieces *j j* of its switches on the different boards. The other side or branch of the line passes successively through the pairs of contact-pieces *g h* of its switches on the different boards, going in each case to the spring *g* first, thence through its line-annunciator to the common ground wire or connection for the lines of the exchange, in which are the contact-points of the rheotome. The two sides or branches of the line unite at the subscriber's station, and the subscriber's station apparatus is so connected into the circuit that when the generator is operated the ground connection thereby established is between the wire of the armature and the contact-pieces *j j* of the switches of the line.

In the operator's cord system shown in Fig. 3, D D are a pair of loop-plugs with the double flexible conducting-cords attached to them. Y is a looping-in switch for the pair of plugs with cords, said switch having three pairs of contact-pieces on which its levers may successively be placed in contact by the operator. *t* is the operator's telephone. B is her calling generator or battery, and *z* is a clearing-out annunciator for the pair of cords. *o* is a metal plate connected with the ground, on which the contact-pieces at the ends of the plug-handles rest normally or when the plugs are not in use for switching.

Weights or similar devices may be used to bring the plugs to their normal positions on the plate *o*.

The plugs D D each consist of a strip or bar *n* of insulating material, as hard rubber, and two insulated contact-pieces *m m'*, mounted on opposite sides thereof.

The plugs are made to fit the switch-holes, and when a plug is inserted into a hole to separate the contact-pieces of the switch which are normally in contact and connect the contact-piece *m* of the plug with the spring-lever *g* and the contact-piece *m'* with the switch contact-piece *j*.

Each contact-piece *m* has an extension along the outer end of the insulating-strip or bottom of the switch-plug handle that serves to ground the contact when the plug is in its normal position on the ground-connected plate *o*, and also an extension along the opposite end of the plug that is adapted to be inserted into the switches, by means of which an operator may readily bring contact-piece into contact with the test contact-pieces *j j* of the metallic-circuit switches and the pieces *i i* of the single-circuit lines for testing.

The two contact-pieces *m m* of a pair of plugs are connected through one conductor of each of their double cords to the two levers, respectively, of the looping-in switch. The other contact-pieces *m' m'* of the pair of plugs are connected through the other conductors of the cords.

B' is a testing-battery in the loop-circuit with the operator's telephone.

The operator's telephone and the testing-battery are in one loop-circuit, the calling-generator is in another loop-circuit, and the clearing-out annunciator is in a third loop-circuit, and by means of looping-in switch Y the operator can at will loop either of these loop-circuits into circuit with the two plug contact-pieces *m* and *m* of the pair.

I have only shown one pair of plugs and cords and one looping-in switch and clearing-out annunciator with them. To each operator will be given as many pairs of plugs with their corresponding switches and annunciators as will be found necessary or convenient. Their connection with her telephone and calling-generator will be evident to those skilled in the art.

The operation of the system is as follows:

When an operator receives a call on the annunciator of a line, she places one of a pair of plugs in the switch of the line, and the looping-in switch being placed so that her telephone is in circuit with the pair of cords belonging to the plugs the telephone is in a complete circuit with the subscriber's station apparatus, and on listening she finds out what subscriber's line is wanted. She then places the contact-piece m of the other plug of the pair in connection with the test-piece of the line wanted, (j of the line-switch for a metallic-circuit line and the test-bolt i of a single-circuit line.) If the line tested is not in use, by being switched at another board a complete testing-circuit is established, as will be hereinafter described, in which is the rheotome, the operator's telephone, and her testing-battery, and she hears the make and break of the rheotome in the telephone and knows that the line is free. She then places the plug in the switch of the line, and moving the looping-in switch so that her calling battery or generator is in circuit calls the subscriber wanted. She then moves the looping-in switch so that the clearing-out annunciator is in circuit and the two lines are connected for conversation. Should she on testing not get the vibrations of the rheotome, she knows that the line is in use. If on the test being made, as above described, the calling-subscriber's line is a single-circuit line, the circuit is from the subscriber's ground of the calling-line through the circuit of the line to contact-piece m of the switch-plug inserted into the line-switch, thence through the cord conductor, operator's telephone, and testing-battery then in circuit with said pair of cords to contact-piece m of the other plug, and thence to the line tested (either to piece j of a metallic-circuit line or piece i if the line is a single-circuit line) and to ground through the rheotome and she gets its make and break.

In the case of a metallic-circuit line tested the circuit to ground through the rheotome is through the line by way of the subscriber's station and back to the central office, and through the contacts $g h$ of the switches of the line to the rheotome, and thence to ground. In the case of a single-circuit line the circuit to ground through the rheotome is to the line in the central office and thence through the contacts $g h$ of the switches of the line to the rheotome and thence to ground. If, however, the line tested is in use, this ground connection through the rheotome is broken at the pair of contacts $g h$ of the switch used and she does not get its operation.

If the calling-subscriber's line is a metallic-circuit line, the test-circuit is from the ground connection of the pair of cords used to contact m' of the plug inserted into the line-switch, thence through the line by way of the subscriber's station to contact m of that plug, and thence through the cord connected with the contact-piece, the telephone, and the test-bat-

tery to the line tested, and thence to ground through the rheotome, as heretofore described for the tested line.

The switching-circuits may be traced as follows when a pair of plugs are in the switches of two lines: When the lines are single-circuit lines, the circuit is from the subscriber's ground of one line through the line and the plug-pieces $m m$ and the cord conductor connected to them to the other line and thence to its ground. When one line is a single-circuit line and the other a metallic-circuit line, the circuit is from the ground of the single-circuit line, through the line, the plug-pieces $m m$, and the cords connected to them, and the contact-spring g of the switch of the metallic-circuit line used, thence through the line and back to contact-piece j of the switch, and direct to ground.

When both lines are metallic-circuit lines, the circuit is, say, from one branch of one line to contact-piece m of the plug in its switch to contact-piece m of the plug in the switch of the other line, thence through the circuit of this line to contact m' of the plug in its switch and to contact m' of the other plug, and to the other branch of the first-mentioned line.

The object of the ground connection or plate o and the construction of plugs by which the pieces $m m$ are grounded when the plugs are not in use is to obtain a complete circuit through the operator's telephone when only one of the switch-plugs is in a line-switch, either single or metallic-circuit switch, and thereby enable the operator to hear any order which may be given on a line which has called.

It is evident that when a switch-plug is in the switch of any line, the line is disconnected from the common ground wire or connection in which is the rheotome, and that when the plug is withdrawn from the switch the line is connected to such ground connection.

It is also evident that when a metallic and a ground circuit line are connected together, thus forming a complete circuit, of which the ground is a part, the connection at the central office is direct to ground—that is, it is not through a rheotome or a resistance-coil or through other form of apparatus which retards or impedes the telephone-currents which are sent over the circuit.

I claim as my invention and desire to secure by Letters Patent—

1. In a telephone-exchange system, multiple switchboards, a single-circuit line grounded at its outer end, a switch on each board for said line, each switch containing a pair of contact points or pieces normally in contact, and a third contact-piece insulated from the rest (except by the circuit connections) the line passing successively through said pairs of contact-points of its switches, and thence to a ground wire or connection in which is a rheotome, said normally-insulated contact-pieces of its switches being also connected to ground but not through a rheotome, and a loop-plug, the two contact-pieces of which are

connected to the two sides or branches of a metallic-circuit line, said plug being adapted to be inserted into one of the switch-holes and when inserted to disconnect the pair of
5 contact-points which are normally in contact and connect the two contact-pieces of the plug, one with said normally-insulated contact-piece of the switch and the other with that contact-piece of the pair which is then
10 connected with the line, in combination with test-bolts for the line, one on each board, each apart from the switch-hole of the line and connected to the line, test receiving instruments, one at each board, each instrument being grounded on one side but not
15 through a rheotome and connected on its other side to a switch testing plug or device adapted to be brought into connection with the test-bolt at its board, and a battery in
20 the test-circuit thereby established, substantially as set forth.

2. In a telephone-exchange system, multiple switchboards, a telephone-line, a spring-jack switch on each board for said line, each
25 switch containing a pair of contact-points

which are normally in contact and a third contact-piece which is placed along the surface of the switch-hole, said line passing, successively, through said pairs of contact-pieces of its switches and to a ground wire or connection in which is a rheotome, and said third
30 contact-piece being also connected to the ground but not through a rheotome, in combination with test-bolts for each line on each board, each bolt being placed apart from and
35 to one side of the switch-hole of the line and connected to the line, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a test plug or device, adapted, at the will
40 of the operator to be brought into connection with the test-bolt at its board, and a battery in the test-circuit thereby established, substantially as set forth.

In testimony whereof I have hereunto subscribed my name. 45

MILO G. KELLOGG.

Witnesses:

FRANCES D. KELLOGG,
LEROY D. KELLOGG.