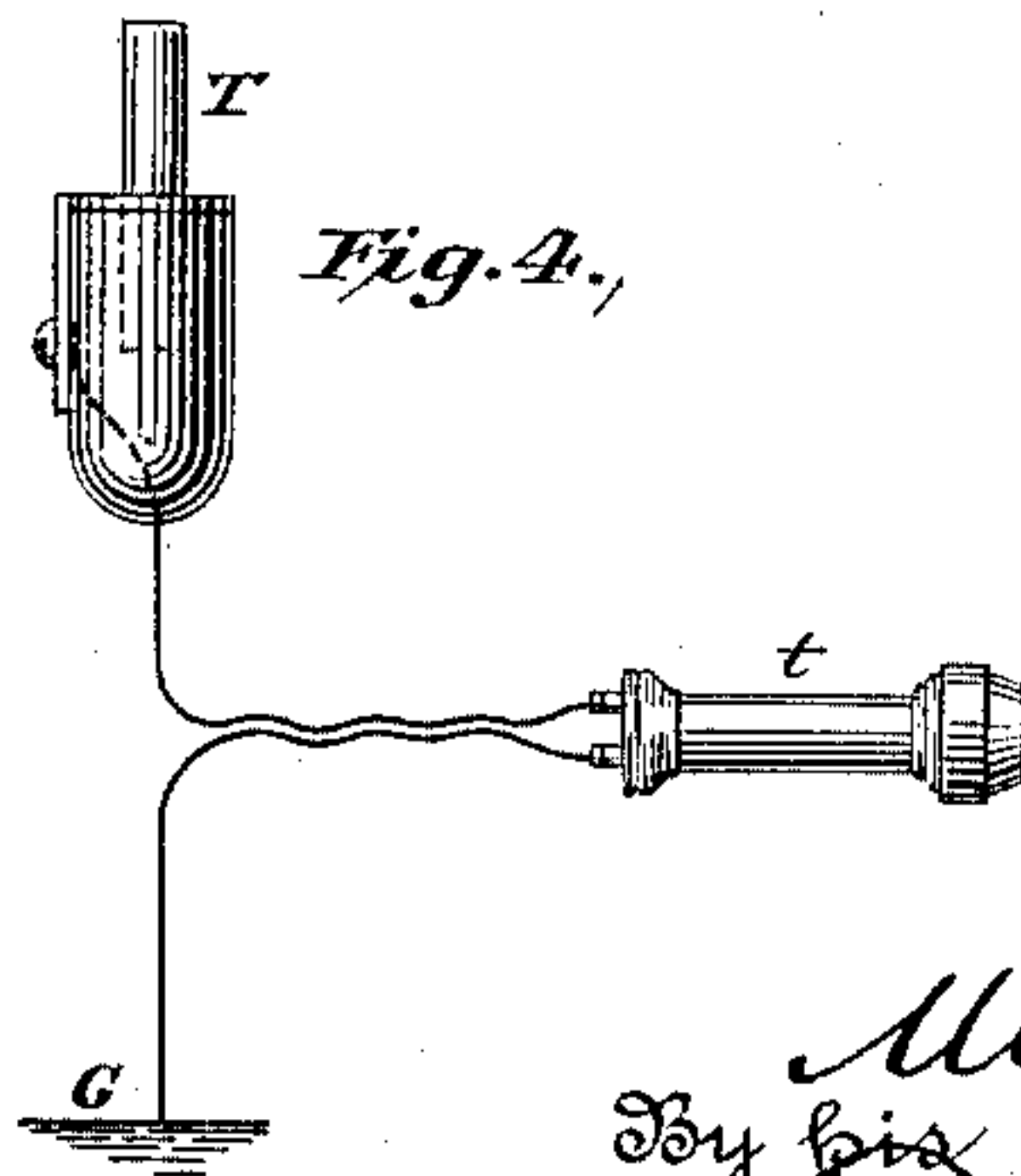
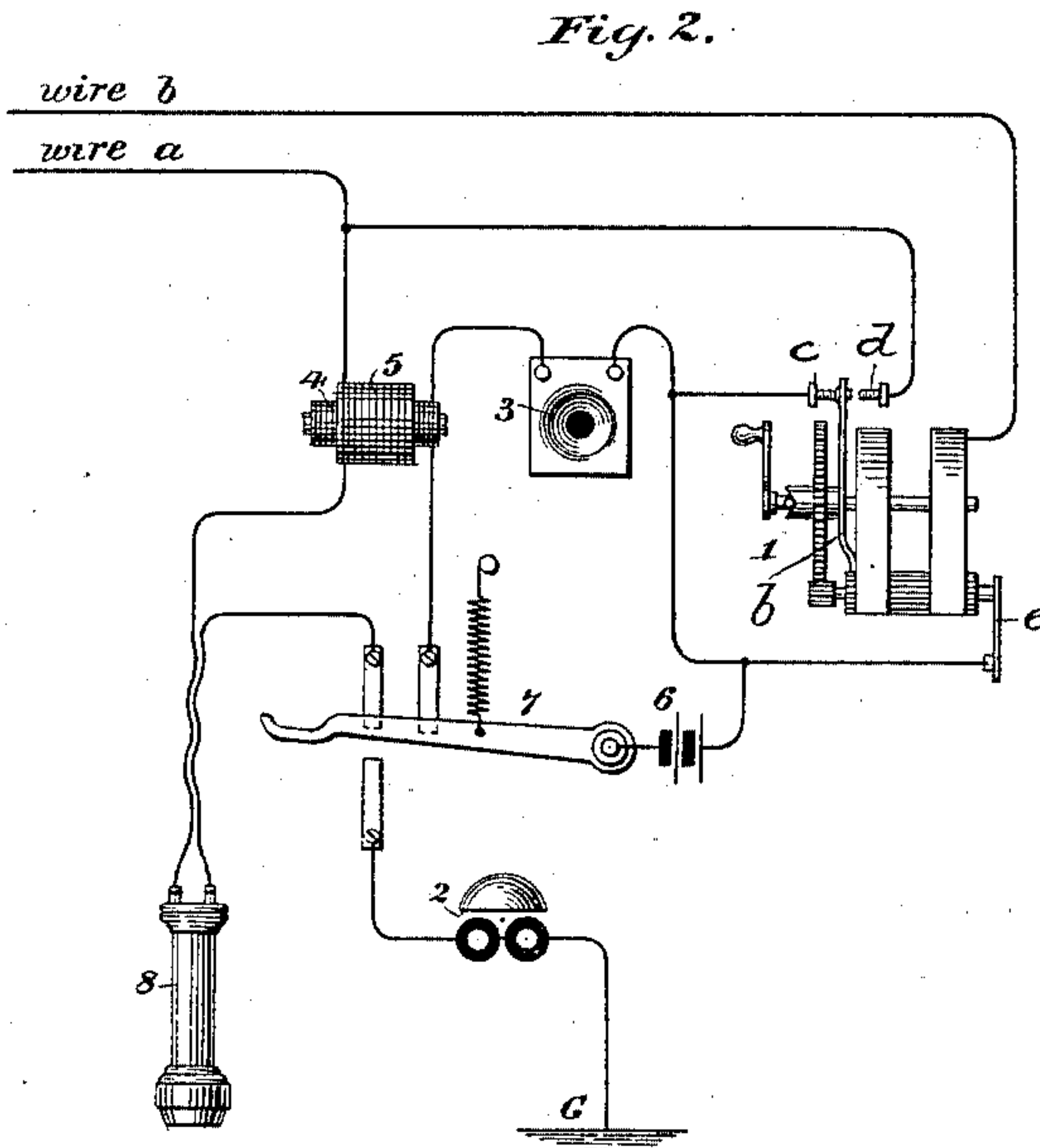
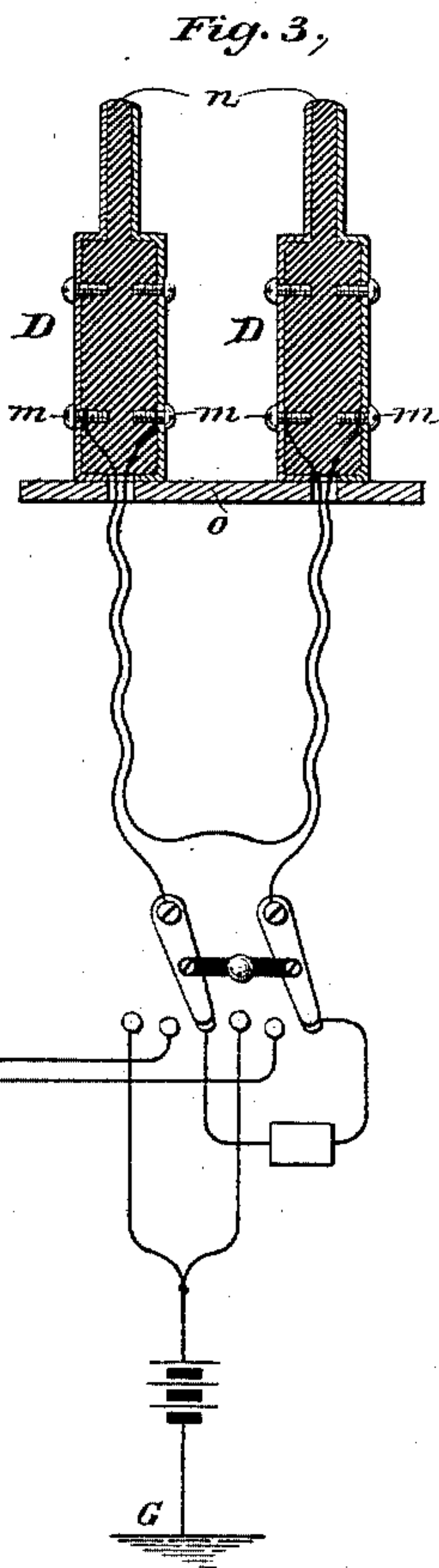
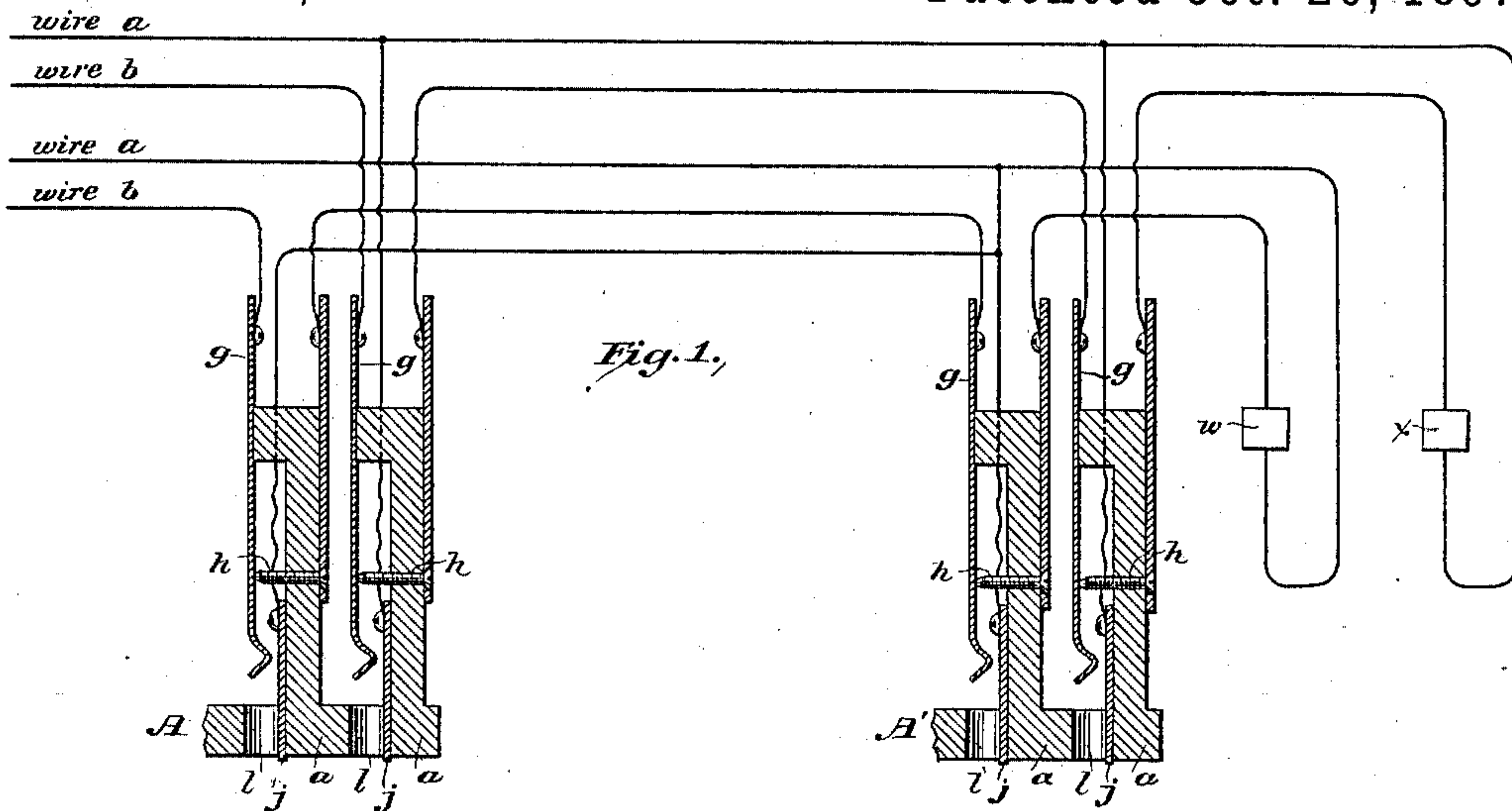


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,314.

Patented Oct. 26, 1897.



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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. 592,314, dated October 26, 1897.

Application filed November 29, 1889. Serial No. 332,017. (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 metallic-circuit telephone-exchange; and it consists of a system of calling, switching, and testing such lines to determine whether they are in use.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram illustrating the main-line central-office switching apparatus and circuits. Fig. 2 shows a diagram of a subscriber's-station apparatus and circuits necessary to illustrate my invention. Fig. 3 is a diagram of the operator's cord system for receiving and answering calls and clearing out subscribers' lines. Fig. 4 shows an operator's test system.

In Fig. 1, A is a sectional view of a section of one switchboard, and A' is a sectional view of a section of another switchboard to which the same lines are connected. I place as many boards in the central office as are found necessary or desirable in order to answer the calls and make the necessary connections. On each board is a spring-jack or similar switch for each line. Each switch has a contact-spring which normally bears on an insulated contact-point and has a third contact-piece insulated from the rest (except by the circuit connections) and is adapted to receive a switch-plug and, when a 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 contact-spring and said insulated contact-piece, respectively. In the figures, *g g* represent the contact-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. *a a* are the rubber strips on which the switch 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 it, as above described. The insulated contact-pieces *j j* should be so placed that a test-plug or similar device may be applied to them. *w* and *x* are calling-annunciators.

The connection of each main line to the central-office switchboards and apparatus is as follows: One of the branches of the line—say “wire *a*,” as indicated—is connected to all the contact-pieces *j j* of the switches of the line. The other branch of the line—say “wire *b*”—passes successively through the pairs of contact-points of its switches, which are normally in contact, passing in each case to the spring first, as indicated. This wire, after passing from the last contact-point of the switch connected farthest from the subscriber's station, is connected by a circuit-wire to wire *a* of the subscriber's line. In this circuit-wire thus connecting the two branches of the line is the line-annunciator.

In the subscriber's-station apparatus shown in Fig. 2, 1 is the calling-generator. 2 is the signal-bell. 3 is the transmitter. 4 is the primary, and 5 is the secondary, of the induction-coil. 6 is the transmitter-battery. 7 is the telephone-switch, and 8 is the hand-telephone. The circuits and contact-points are substantially as shown. The generator has an automatic device with contact-points as shown, constructed to remove the shunt from the armature-coil and connect together the two branches of the line when the generator is being operated. These two branches are otherwise open to each other at the subscriber's station when his telephone is on its switch.

The automatic device shown is a modification of a device very generally used in magneto-generators for telephone calls. The modification consists, essentially, in the contacts and arrangement of circuits. The hub of the driving-wheel of the generator has a V-shaped attachment which engages with a pin in the crank or driving shaft. The spring *b* normally, or when the generator is not in operation, presses against the point *c*. When the generator is being operated, the pin, acting on the V-shaped arrangement, presses the

driving-wheel toward the generator-magnets, and that carries the spring *b* away from point *c* and into contact with point *d*.

e is a contact-spring which remains in contact with an insulated piece on the armature-shaft, to which one end of the armature-coil is connected. The other end of the coil and also spring *b* are connected to the frame of the generator. The circuit of one side or branch of the line (marked *b*) is to the frame of the generator. Contact-spring *e* is connected through the subscriber's-station battery 6 to the lever of the telephone-switch 7. The circuit-wire which connects the battery with spring *e* is connected to point *c* and also through the transmitter 3 and the primary 4 of the induction-coil to one of the upper contact-points of the switch. The other side or branch of the line (marked *a*) is connected to point *d* and also through the secondary 5 of the induction-coil and the telephone to the other upper contact-point of the switch. The lower point of the switch is connected through the signal-receiving bell 2 to the ground.

It will be seen from the description above given and the drawings that when the subscriber's telephone is on the switch and the generator is not being operated the two sides or branches of the line are open to each other at the subscriber's station. The generator is in circuit with wire *b*, but is shunted or short-circuited, and wire *b* is grounded through the battery and signal-receiving bell; also, that when the generator is being operated the short circuit is opened and the two sides or branches of the line are closed to each other; also, that when the telephone is removed from the switch the ground connection through the bell is open, the two sides or branches of the line are closed to each other and the telephone and secondary of the induction-coil are in their circuit and the primary of the induction coil, the battery, and the transmitter are in a closed circuit with each other.

The transmitter-battery should be so placed in the apparatus that it is in circuit with wire *b* when the subscriber's telephone is on the switch, and it may be in circuit with it all the time.

Fig. 3 shows an operator's cord system with one pair of loop-switch plugs and their double cords, looping-in switch, and clearing-out annunciators and her telephone and calling-generator and circuits. *D D* are the switch-plugs. *n n* are their rubber insulations. *m m* are their contact-pieces, and *o* is a metal strip on which the plugs normally rest and which then connects the two contact-pieces of the plug. *G* is a ground connection. The method of operating the system in connection with the other apparatus will be apparent to those skilled in the art.

The operator's test system (shown in Fig. 4) consists, essentially, of a wire grounded on one side, (at *G*,) with a test receiving instrument *t* in its circuit, and connected on its other end to a flexible conducting-cord, to

which is attached a test-plug *T*, adapted, at the will of the operator, to be brought into connection with any switch contact-piece *j* at her board.

Each operator has one cord system (with as many pairs of cords as she may require) and one test system, and they should be so placed and connected at her board that she may readily perform the operations required of her.

It will be observed that in the operation of the system a subscriber, on operating his generator, sends a current through a closed circuit, in which is his line-annunciator; also that when a line is switched at the central office its annunciator is cut out of its circuit.

When an operator makes a test of a line, by placing her test-plug on a contact-point *j* of a switch of the line and the line is not switched at any board and the subscriber's telephone is on its switch, a complete circuit is established, in which is the test receiving instrument and the subscriber's transmitter-battery, and the instrument will sound, indicating that the line is "free." This circuit is from the subscriber's ground through his switch contact-points to his battery; thence through his battery and line and the several pairs of contact-points of its switches to contact-piece *j*, to which the test-plug is applied, and thence to ground through the test receiving instrument. If, however, when a test is made the line is in use, either by its being switched at some board and a pair of its switch-points being opened or by the subscriber's telephone being off its switch, there will be no complete circuit established and the instrument will not sound. The operator will therefore know that either the line is switched for use at the central office or that the subscriber's telephone is switched for use, and she will not connect to the line.

In multiple-switchboard systems an operator to whom certain lines are assigned to answer frequently receives several annunciator calls at practically the same time, and it may require some time before she can switch to a certain line and answer its call. In systems in which the test depends only on the switching of the line at some other board another operator may in the meantime test the line, and finding it to test "free" may switch it with another line and cause annoyance and confusion to the subscriber. In my system this trouble is obviated, because as soon as the subscriber takes his telephone from its switch the line will test "busy" whether or not it is switched at the central office. Again, in systems of testing which depend only on the subscriber's telephone being on and off the switch confusion frequently occurs from the fact that a subscriber places his telephone on his switch after finishing conversation without sending in a clearing-out signal and his line will test "free" and be "connected to" when it is already switched at the central office. Lines in this condition are technically called "tied

up." In my system, again, this trouble is obviated, because the line will test "busy" until it is disconnected at the central office whether or not the subscriber's telephone is on its switch. The system therefore combines the advantages and obviates the disadvantages of both the general systems outlined above.

The battery should be so adjusted to the apparatus and circuits that the current sent to a line when it is tested will not operate the annunciator or signal-bell. It should, however, be such as to operate the test receiving instruments over the circuits described.

The test system would be equally operative if the subscriber's battery were placed in the ground wire or connection at the subscriber's station. It would also be operative if the two branches of the line were not normally open to each other at the subscriber's station, the only difference being that the batteries would be in a closed circuit and there would be a larger consumption of battery material.

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

1. In a telephone-exchange system, a metallic-circuit line normally (or when the line is not in use) with its two branches open to each other at the subscriber's station and one of them grounded at the subscriber's station when it is not switched for conversation and not otherwise and having a subscriber's transmitter-battery in its circuit, and a switch at the central office containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections) said branch of the line which is normally grounded at the subscriber's station and has a battery in its circuit passing through said pair of contact-points and thence connected to said third contact-piece, in combination with a switch-plug adapted to be inserted into said switch and when inserted to disconnect the pair of contact-points which are normally in contact, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with said third contact-piece of the switch, substantially as set forth.

2. In a telephone-exchange system, a metallic-circuit telephone-line having its two branches normally open to each other and one of them normally with the subscriber's transmitter-battery in its circuit and grounded at the subscriber's station when it is not in use but not otherwise, and a switch at the central office containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded at the subscriber's station passing through said pair of contact-points and thence connected to said third con-

tact-piece, in combination with a switch-plug adapted to be inserted into said switch and when inserted to disconnect said pair of contact-points, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with said third contact-piece, substantially as set forth.

3. In a telephone-exchange system, a metallic-circuit line, the two branches of which are normally open to each other and one of which is normally grounded and has a transmitter-battery in its circuit at the subscriber's station, and a switch with contact-points to remove said ground connection and close the two branches of the line to each other when the line is in use, in combination with a switch to open the closed circuit of the line at the central office when the line is in use, and a test receiving instrument grounded on one side and connected on its other side to a switch testing plug or device, adapted, at the will of the operator, to be brought into connection with the line with the contact-points of said office switch between the connection and the normal ground of the line at the subscriber's station, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, the two branches of which are normally open to each other at the subscriber's station and one of which is normally grounded and has a transmitter-battery in its circuit at the subscriber's station, and switches at each subscriber's station, each with contact-points to disconnect the line from said ground connection and close the two branches to each other when the line is in use, in combination with test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with that branch of any line which is normally grounded at the subscriber's station, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line being normally (or when not in use) with its two branches open to each other and one of them grounded and with a transmitter-battery in its circuit at the subscriber's station when it is not in use and not otherwise, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, in combination with switch-plugs adapted to be inserted into said

switches and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

6. A test-circuit for a subscriber's line, containing normally, at the subscriber's station, a transmitter-battery and a pair of contact-points normally closed but which are open when the subscriber's telephone is switched for use to open said test-circuit, and at the central office, switch contact-points which open the circuit when the line is switched for use but not otherwise, and a pair of contact-points which are normally open and are closed by an operator on testing, in combination with a test receiving instrument in said circuit, substantially as set forth.

7. A test-circuit for a subscriber's line, containing at the subscriber's station, normally, a transmitter-battery and a pair of contact-points normally closed but which are open when the subscriber's telephone is switched for use to open said test-circuit, and, at the central office, a series of pairs of contact-points normally closed, one pair on each of several multiple boards, each pair open when the line is switched at their board, and a pair of contact-points normally open and closed by an operator on testing, in combination with a test receiving instrument in said circuit, substantially as set forth.

8. A test-circuit for a subscriber's line, containing, at the subscriber's station, normally, a transmitter-battery, and a pair of contact-points normally closed but which are open when the subscriber's telephone is switched for use to open said test-circuit, and, at the central office, switch contact-points which open the circuit when the line is switched for use but not otherwise, in combination with a series of branch or derived circuits to said test-circuit, each containing a test receiving instrument and a pair of contact-points normally open and closed by the operator on testing, substantially as set forth.

9. A test-circuit for a subscriber's line, containing, at the subscriber's station, normally, a transmitter-battery, and a pair of contact-points normally closed but which are open when the subscriber's telephone is switched for use to open said test-circuit, and at the central office, a series of pairs of contact-points normally closed, one pair on each of several multiple boards, each pair open when the line is switched at their board, in combination with a series of branch or derived circuits to said test-circuit, each containing a test receiving instrument and a pair of contact-points normally open and closed by the operator on testing, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, metallic-circuit lines con-

nected to the same, each line being normally (or when not in use) with its two branches open to each other and one of them grounded and with a transmitter-battery in its circuit at the subscriber's station when it is not in use, switches, one at each subscriber's station with contact-points to open such ground connection and close the two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with loop-switch plugs adapted to be inserted into said switches and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third contact-piece of the switch and with that contact-piece of the pair which is then connected with the first-mentioned side or branch of the line, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line being normally (or when not in use) with its two branches open to each other and one of them grounded and with a transmitter-battery in its circuit at the subscriber's station when it is not in use, switches, one at each subscriber's station with contact-points to open such ground connection and close the two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with pairs of loop-switch plugs, the two contact-pieces of each plug being connected with the two contact-pieces, respectively, of

its mate by flexible switch-conductors, and each plug adapted to be inserted into said switches at its board, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third contact-piece of the switch and with that contact-piece of the pair which is then connected with the first-mentioned side or branch of the line, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

12. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line being normally (or when not in use) with its two branches open to each other and one of them grounded and having normally the subscriber's transmitter-battery in its circuit, switches, one at each subscriber's station with contact-points to open such ground connection and close the two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with loop-switch plugs adapted to be inserted into said switches and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third contact-piece of the switch and with that contact-piece of the pair which is then connected with the first-mentioned side or branch of the line, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, and a battery at the subscriber's station in the complete test-circuit thereby established, substantially as set forth.

13. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each line being normally (or when not in use) with its two branches open to each other, and one of them grounded and having normally the subscriber's transmitter-battery in its circuit, switches, one at each subscriber's station with contact-points

to open such ground connection and close the two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with pairs of loop-switch plugs, the two contact-pieces of each plug being connected with the two contact-pieces, respectively, of its mate by flexible switch-conductors, and each plug adapted to be inserted into said switches at its board, and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third contact-piece of the switch and with that contact-piece of the pair which is then connected with the first-mentioned side or branch of the line, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device, adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at its board, and a battery at the subscriber's station in the complete test-circuit thereby established, substantially as set forth.

14. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, one side or branch of each line being grounded, with a transmitter-battery in its circuit at the subscriber's station when it is not in use, switches, one at each subscriber's station with contact-points to open such ground connection and close the two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station, passing, successively, through the pairs of contact-points of the switches of the line which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with loop-switch plugs adapted to be inserted into said switches and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third con-

tact-piece of the switch and with that contact-piece of the pair which is then connected with the first-mentioned side or branch of the line, and test receiving instruments, one at
5 each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with any of said third contact-pieces at
10 its board, substantially as set forth.

15 15. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, one side or branch of each line being grounded, with a transmitter-battery in its circuit at the subscriber's station when it is not in use, switches, one at each subscriber's station with contact-points to open such ground connection and close the
20 two sides or branches of the line to each other when the subscriber's telephone is switched for use, and switches, one on each board for each line, each switch containing a pair of contact-points normally in contact and a third contact-piece insulated from the rest (except
25 by the circuit connections), said branch of the line which is normally grounded and has a battery in its circuit at the subscriber's station passing, successively, through the pairs of contact-points of the switches of the line

which are normally in contact and thence being connected to said third contact-pieces of the switches, and said third contact-pieces being connected to the other side or branch of the line, in combination with pairs of loop-switch plugs, the two contact-pieces of each
35 plug being connected with the two contact-pieces, respectively, of its mate by flexible switch-conductors, and each plug adapted to be inserted into said switches at its board, and when a plug is inserted into a switch to
40 disconnect the pair of contact-points of the switch and connect the two contact-pieces of the plug, respectively, with said third contact-piece of the switch and with that contact-piece of the pair which is then connected
45 with the first-mentioned side or branch of the line, and test receiving instruments, one at each board, each instrument being grounded on one side and connected on its other side to a test plug or device adapted, at the will
50 of the operator, to be brought into connection with any of said third contact-pieces at its board, substantially as set forth.

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