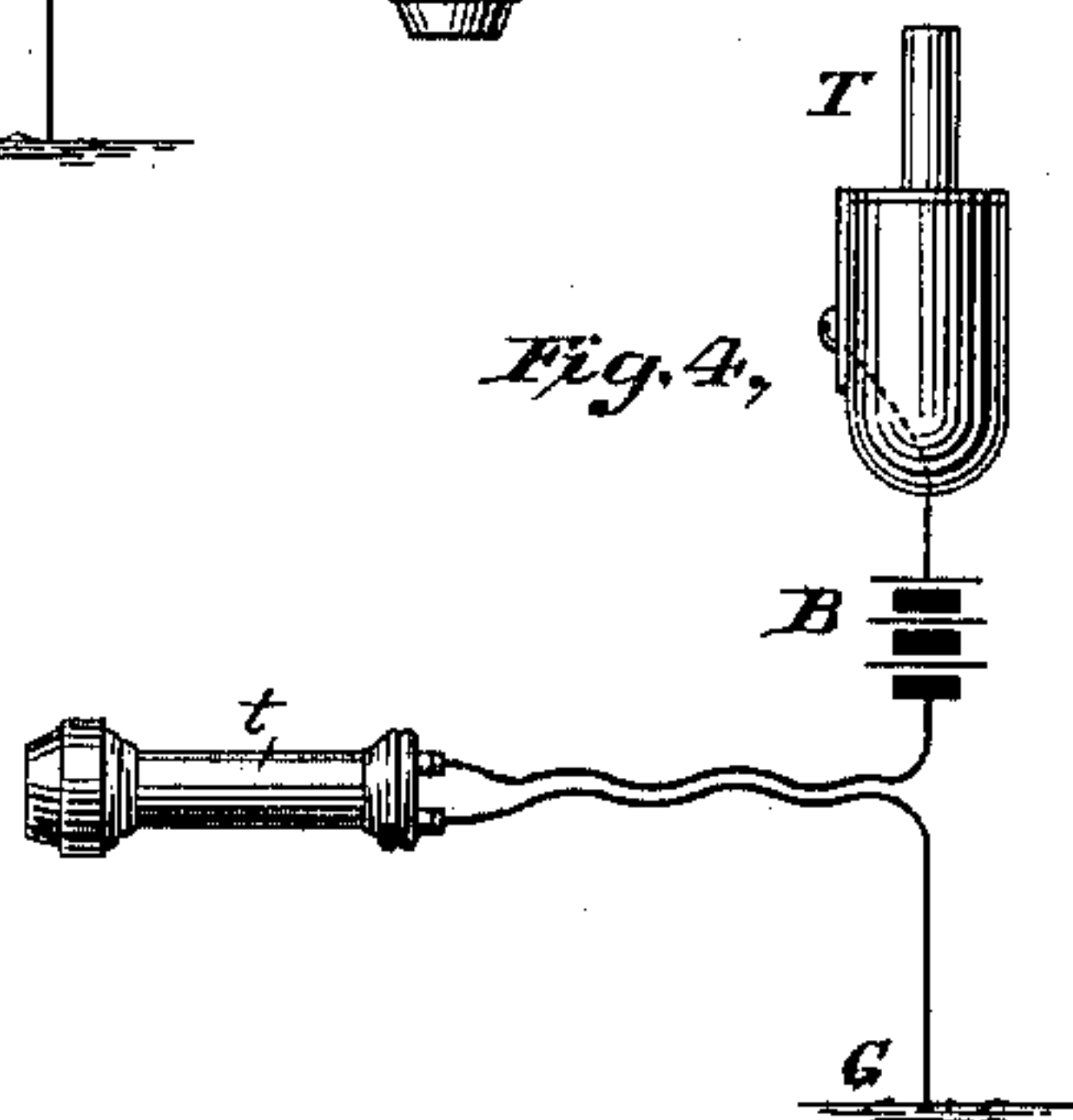
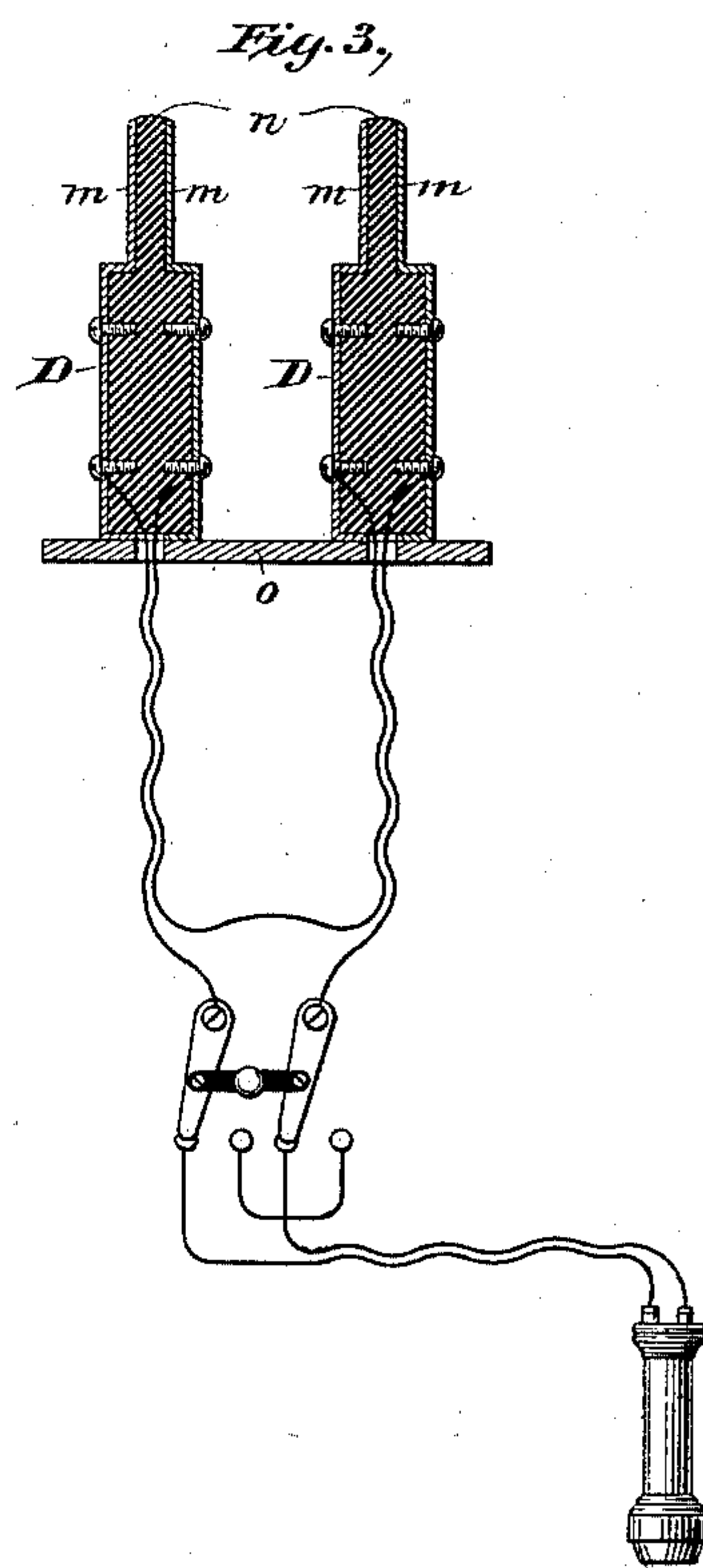
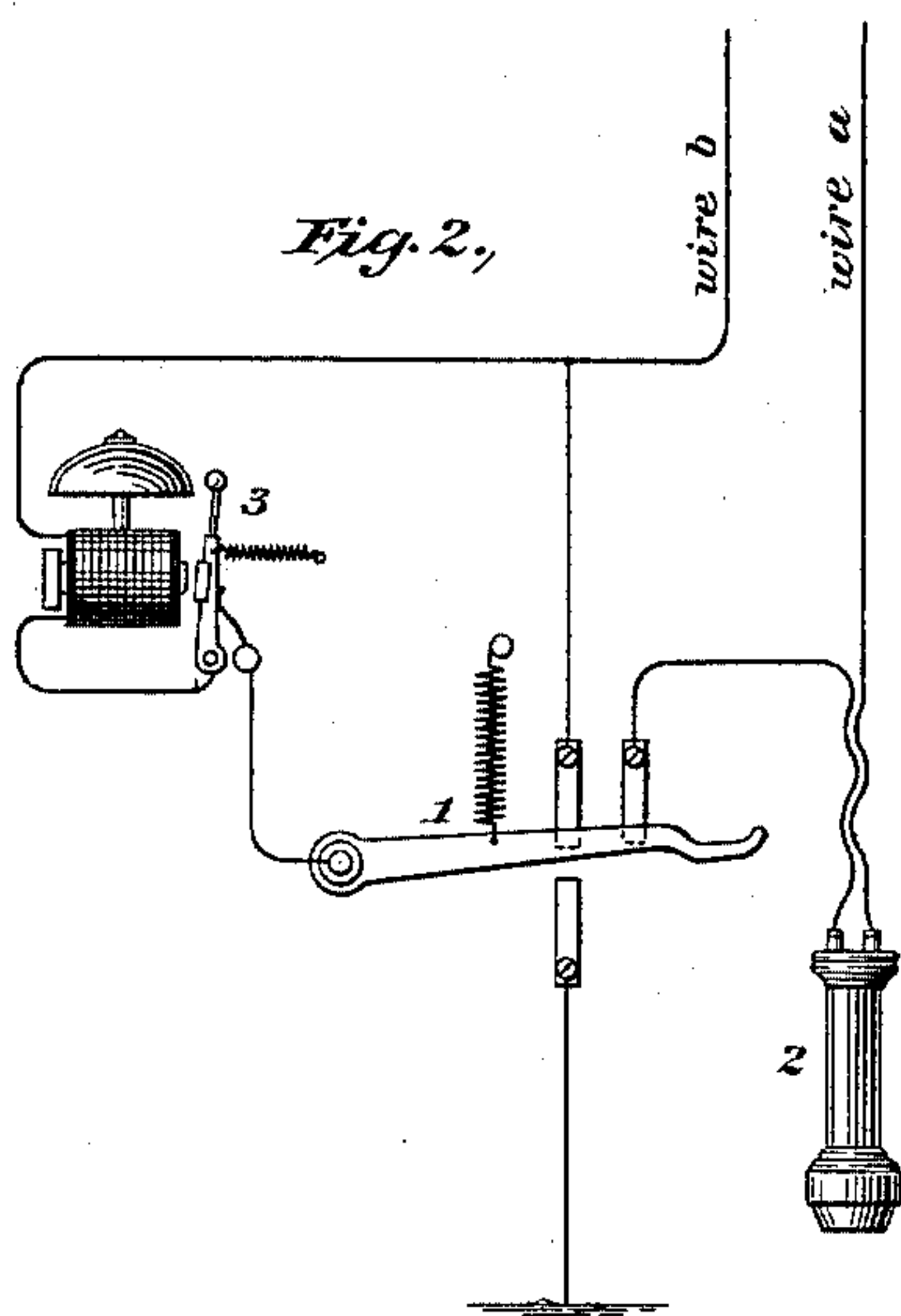
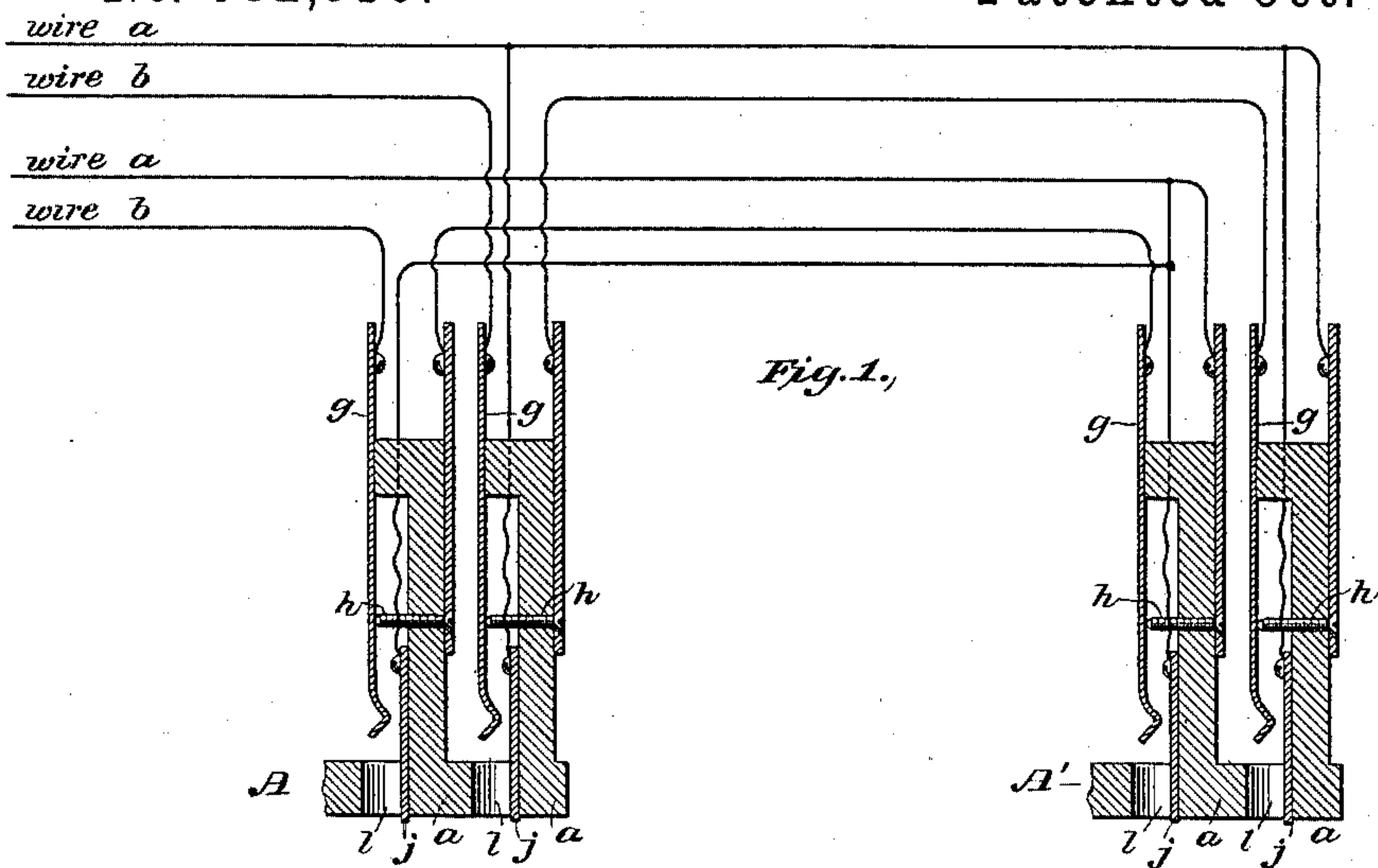


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,316.

Patented Oct. 26, 1897.



Witnesses
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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. 592,316, dated October 26, 1897.

Application filed November 29, 1889. Serial No. 332,019. (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 system, and is especially applicable to a system of exchange in which the calling by the subscribers is done on an independent calling-circuit.

It consists of apparatus for and a system of testing metallic-circuit 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 apparatus and circuits. Fig. 2 shows a diagram of the subscriber's-station apparatus necessary to illustrate my invention. Fig. 3 is a diagram of the operator's cord system for receiving calls and switching lines. Fig. 4 shows an operator's test system, including a test-plug with cord, test receiving instrument, and a test-battery.

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 board, 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 properly answer the calls and make the 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 loop-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 figure *g g* represent the contact-springs of the different switches, *h h* the contact-points on which the springs normally bear, 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 testing device may be readily applied to them.

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 in the figure—is connected to all the contact-pieces *j j* of its switches on the different boards. 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 the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch. 2 is the subscriber's telephone. 3 is the signal-bell, and G is the ground connection. The circuits and contact-points of the apparatus are substantially as shown. The signal-bell is an automatic or vibrating bell with an automatic circuit-breaker, as shown, which makes and breaks the circuit of the bell when the current passes through it. The bell is in the circuit of the branch of the line designated as wire *b* when the subscriber's telephone is on its switch. The switch has contact points and connections, as shown, which ground one branch of the line, wire *b*, and open the two branches of the line to each other when the telephone is on the switch and remove said ground and close the two branches to each other when the telephone is taken from the switch.

Fig. 3 shows an operator's cord system with one pair of loop-switch plugs and their double cords, looping-in switch, her telephone, and circuits. D D are the loop-plugs. *n n* are their rubber insulation, and *m m* are their contact-pieces. *o* is a metal strip on which the

plugs normally rest and which then connects the two contact-pieces of the plug together. The method of operating the system in connection with the switchboards will be apparent to those skilled in the art.

The plugs should be inserted into the line-switches of two lines connected together for conversation in such a direction that the sides or branches of the lines marked wire *a* are connected together by one of the cord-circuits of the pair of cords and the other sides or branches are connected together by the other cord-circuit.

The operator's test system shown in Fig. 4 consists, essentially, of a wire with a test receiving instrument and test-battery in its circuit, said wire being grounded at one end and connected at the other end to a flexible conducting-cord adapted at the will of the operator to be brought into contact with any switch contact-piece *j* at her board. *T* is the test-plug, *I* is the test receiving instrument. *B* is the test-battery, and *G* is the ground connection. The test-battery should be strong enough to operate any subscriber's signal-bell and the test receiving instrument through the line-circuit of one of the sides or branches of the line to the subscriber's ground when the test is made as indicated and the line is "free," but is not strong enough to operate the signal-bell through the complete metallic circuit of the line.

Each operator has a cord system with as many pairs of cords as she may need and one test system, and they are conveniently arranged and connected to operate the exchange system.

When an operator makes a test of a line by placing her test-plug on the contact-piece *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 are the test receiving instrument and battery and the subscriber's signal-bell, and the bell will ring, calling the subscriber, and the test receiving instrument will respond or indicate the make and break of the bell and show the operator that the line is free. This complete circuit is from the subscriber's ground, through his switch contact-points to the line, over the line and through the several pairs of contact-points of its switches, thence to contact-piece *j*, to which the test-plug is applied, and thence to ground through the test receiving instrument and test-battery. The signal-bell is then in the circuit at the subscriber's station. If, however, when a test is made the line is in use either by its being switched at some board or by the subscriber's telephone being off its switch, the test instrument will not respond.

When the subscriber has taken down his telephone for use and the line is not yet switched at any board, the test-circuit above described is opened by the opening of the ground connection at his station. When a switch-plug is inserted into a switch of the line, but the line

is not yet switched with another line, the circuit above described is opened at the pair of contacts of the switch in which the plug is placed. If the line is connected with another line for conversation and their telephones are switched for use, no complete circuit will be established on testing, because the metallic circuit of the two lines is not connected with the ground at either subscriber's station. If when the subscribers' lines are thus connected for conversation both of their telephones are placed on their switches, no complete circuit will be established on testing, because the test is made to a test contact-piece *j*, which is connected with the circuit of the two wires *a* of the lines, and these wires are then disconnected from the ground at the subscribers' stations. In either of these cases no complete circuit is established, and therefore the signal-bell will not operate and no response will be indicated in the test receiving instrument. If when two subscribers' lines are connected together for conversation the telephone at one of the stations should be on the switch and that at the other station not on the switch, a complete circuit will be established as follows: on testing one of the lines from the office ground through the test receiving instrument and battery to the test-plug, thence through wire *a* of the line whose telephone is switched for use and back to the central office through wire *b* of that line, and thence through wire *b* of the other line to its ground connection established by the telephone being on the switch. The signal-receiving bell in the circuit at the subscriber's station will not then sound, because it and the test-battery are included in a circuit which includes one branch of that line and both branches of the other line.

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 calls at practically the same moment, 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 to 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 switched for use or not by its being on or off its switch confusion frequently occurs from the fact that a subscriber places his telephone on its switch when he is through conversation without sending

in a clearing-out signal and his line tests "free" and is "connected to" when it is already switched at the central office with some other line. 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. This system, therefore, combines the advantages and obviates the disadvantages of the two general systems of testing outlined above.

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 it is not in use) with its two branches open to each other at the subscriber's station and one of them with an automatic circuit-breaking bell in its circuit and grounded at the subscriber's station when his telephone is not switched for 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 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 wire or circuit at the central office containing a test receiving instrument and battery and grounded at one end and connected at its other end 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.

2. In a telephone-exchange system, a metallic-circuit line having one of its branches with an automatic circuit-breaking bell in its circuit and grounded at the subscriber's station when his telephone is not switched for use but not otherwise and its branches normally open to each other, 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 which is thus normally grounded 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 said pair of contact-points, and a test wire or circuit at the central office containing a test receiving instrument and battery and grounded at one end and connected at its other end 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 having one of its branches with an automatic circuit-breaking bell in its

circuit and grounded at the subscriber's station when his telephone is not switched for use but not otherwise and with its branches normally open to each other, 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 which is thus normally grounded 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 said pair of contact-points, 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, and a battery in the test-circuit thereby established, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line the two branches of which are normally open to each other and one of which has an automatic electric-circuit breaker in its circuit and is grounded at the subscriber's station when his telephone is not switched for use, and a switch with contact-points to close said branches to each other and remove said ground connection when the telephone is switched for use, in combination with a switch at the central office with contact-points to open the closed circuit of the line there when the line is switched for use, and a test wire or circuit containing a test receiving instrument and battery and grounded on one side and connected on its other end with a test plug or device adapted, at the will of the operator, to be brought into connection with the line with the pair of contact-points of said office switch between said connection and the normal ground of the line at the subscriber's station, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit line the two branches of which are normally open to each other and one of which has an automatic electric-circuit breaker in its circuit and is grounded at the subscriber's station when his telephone is not switched for use, and a switch with contact-points to close said branches to each other and remove said ground connections when the telephone is switched for use, in combination with a switch at the central office with contact-points to open the circuit of the line when the line is switched for use, 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 the line with the pair of contact-points of said office switch between said connection and the normal ground of the line at the subscriber's station, and a battery in the test-circuit thereby established, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each normally (or when

not in use) with its two branches open to each other and one of them with an automatic electric-circuit breaker in its circuit and grounded at the subscriber's station when his telephone is not switched for use but not otherwise, and switches at the central office, one on each board for each line, each 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 each line which is thus normally grounded passing successively through said pairs of contact-points of its switches and thence connected to said third contact-pieces of its switches, in combination with switch-plugs adapted to be inserted into said switches and when a plug is inserted to disconnect the contact-points of the switch, 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 of the operator, to be brought into connection with any of said third contact-pieces of the switches at its board, and a battery in the test-circuit thereby established, substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each of which has its two branches normally open to each other and one of the branches with an automatic electric-circuit breaker in its circuit and grounded at the subscriber's station when his telephone is not switched for use, and a switch for each line with contact-points to close its branches to each other and remove its ground connection when the subscriber's telephone is switched for use, in combination with a switch on each board for each line to open the circuit of the line when it is switched at the board, 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 of the operator, to be brought into connection with any line with the pairs of contact-points of its said switches between said connection and its normal ground connection, substantially as set forth.

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

9. A test-circuit for a subscriber's line containing at the subscriber's station, normally, an automatic circuit-breaking bell and a pair

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

10. In a telephone-exchange system, a metallic-circuit line having one of its branches with both an automatic circuit-breaking bell in its circuit at the subscriber's station and grounded at the subscriber's station when his telephone is not switched for 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 which is thus normally grounded 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 said pair of contact-points, 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, and a battery in the test-circuit thereby established, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, metallic-circuit lines connected to the same, each of which has one of the branches with both an automatic electric-circuit breaker in its circuit at the subscriber's station and grounded at the subscriber's station when his telephone is not switched for use, and a switch for each line with contact-points to remove its ground connection when the subscriber's telephone is switched for use, in combination with a switch on each board for each line to open the circuit of the line when it is switched at the board, 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 of the operator, to be brought into connection with any line with the pairs of contact-points of its said switches between said connection and its normal ground connection, and a battery in the test-circuit thereby established, substantially as set forth.

In witness whereof I hereunto subscribe my name this 4th day of October, 1889.

MILO G. KELLOGG.

Witnesses:

MARGARETHA RIEHL,
FRANCES D. KELLOGG.