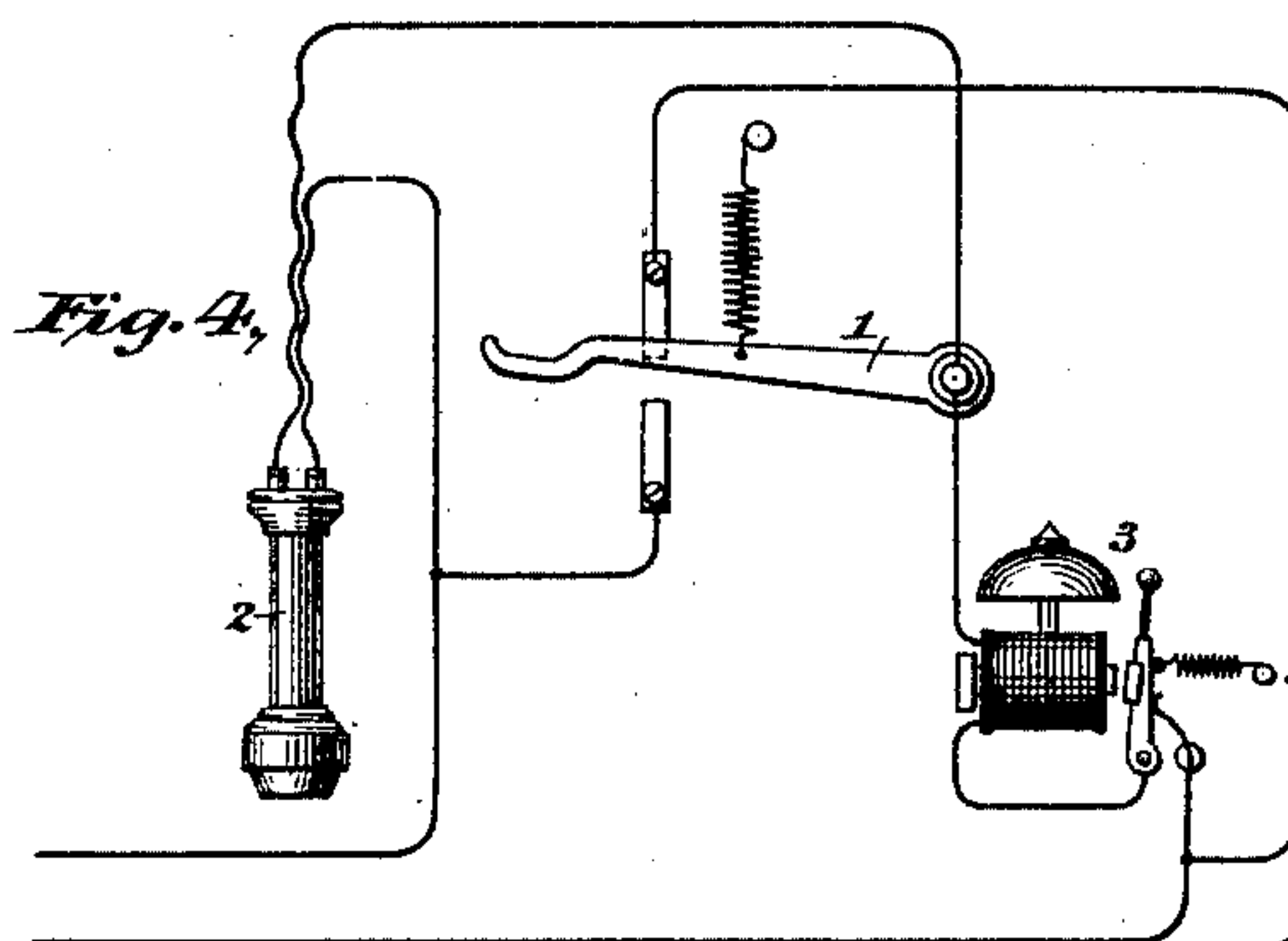
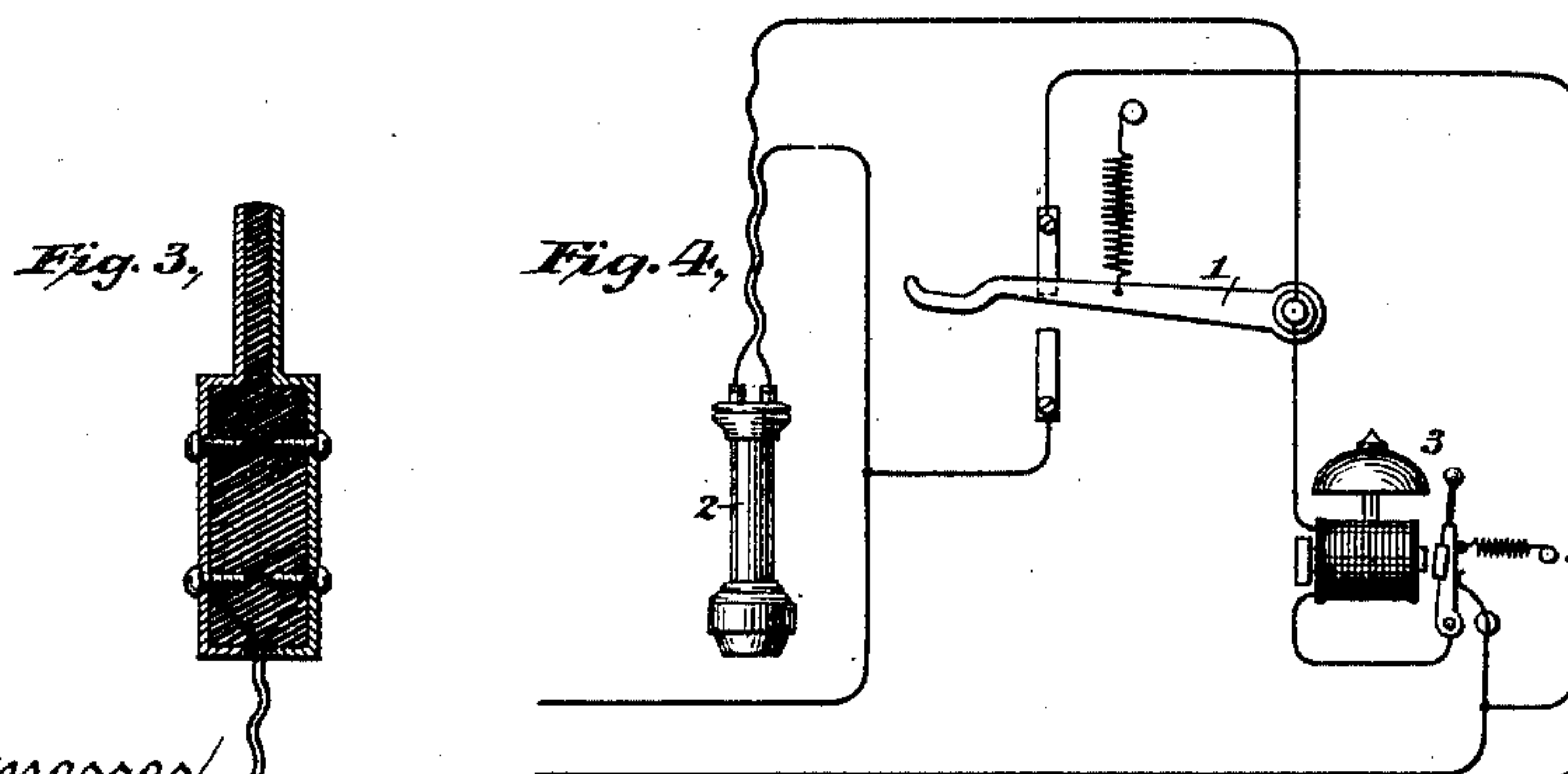
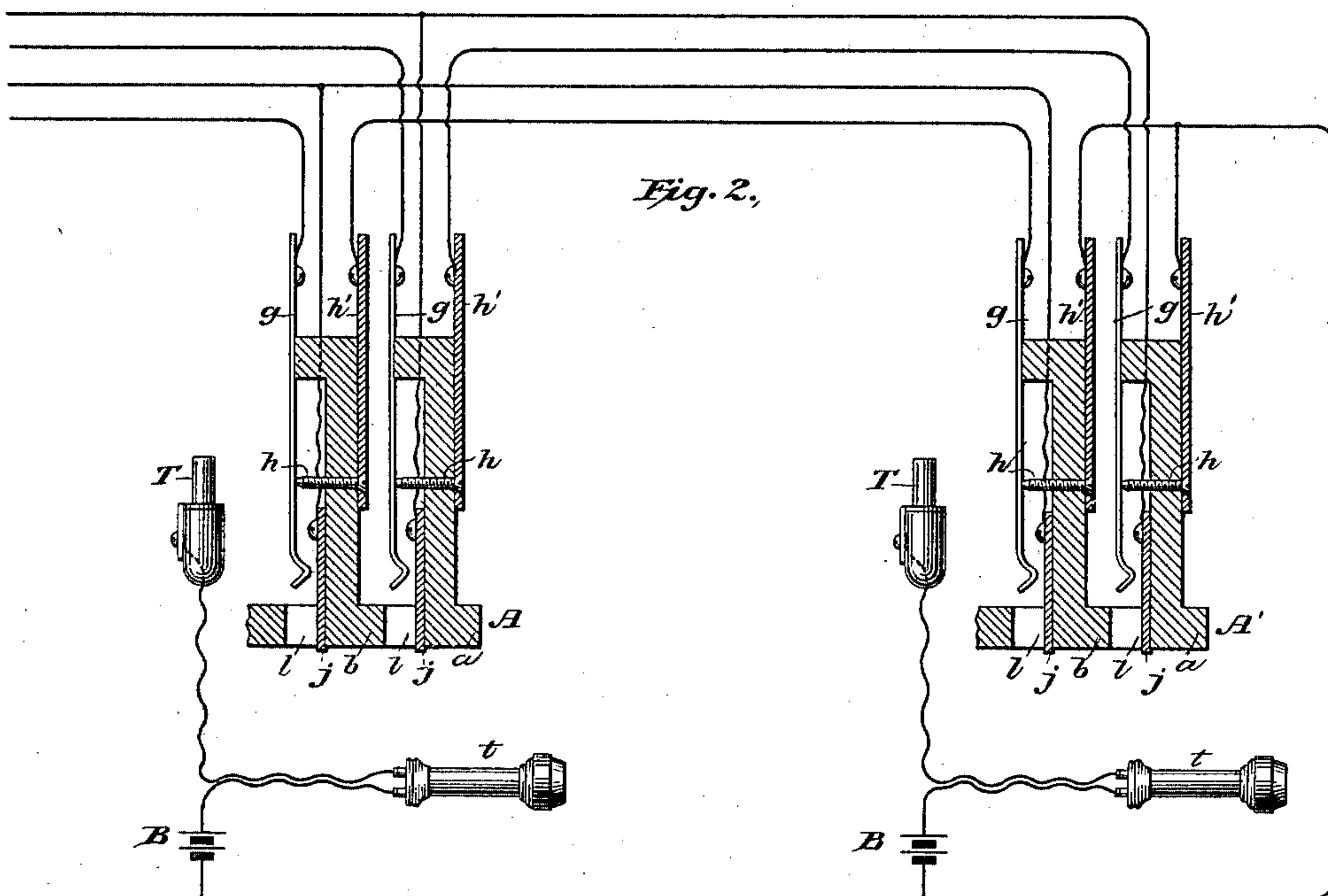
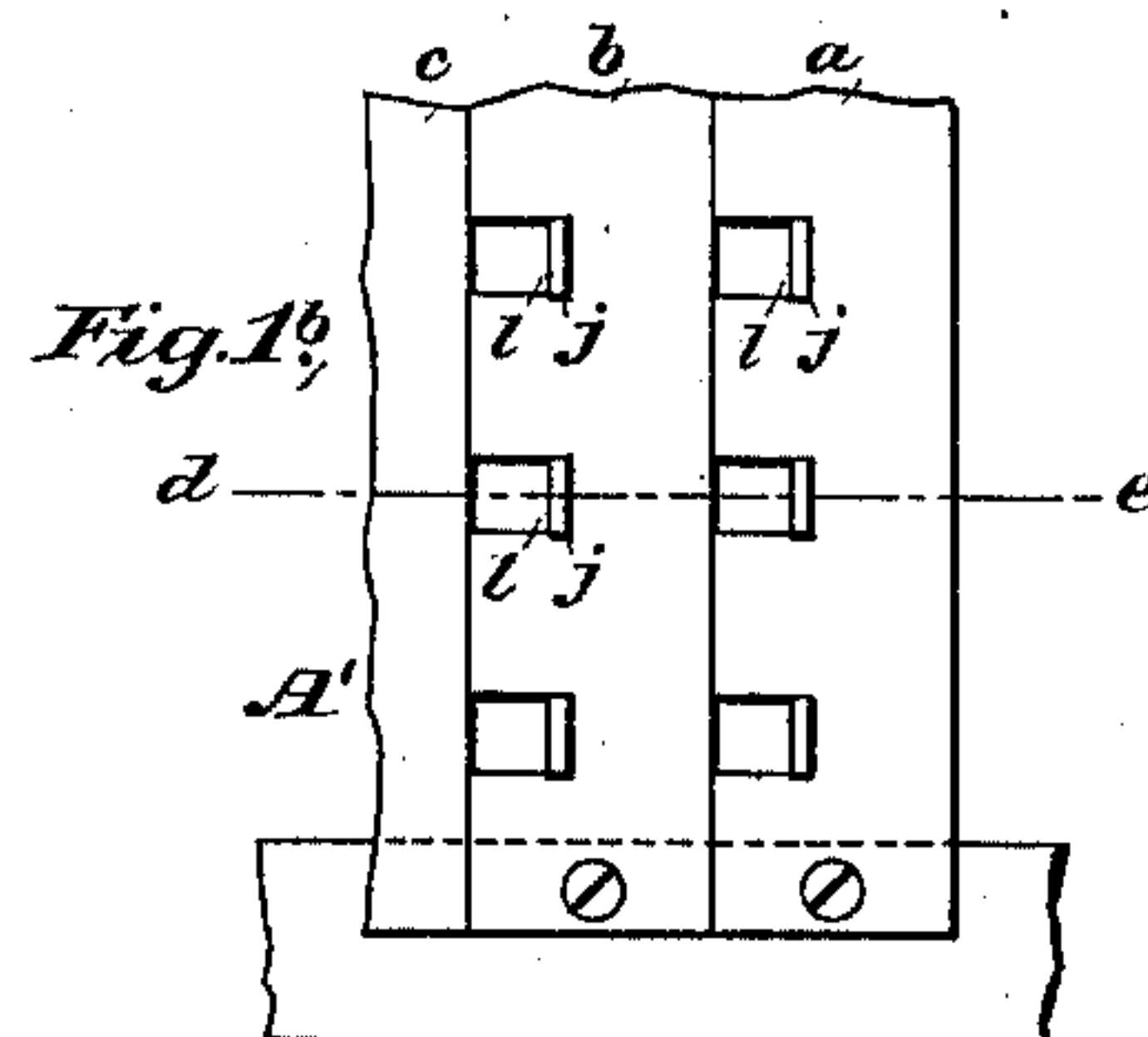
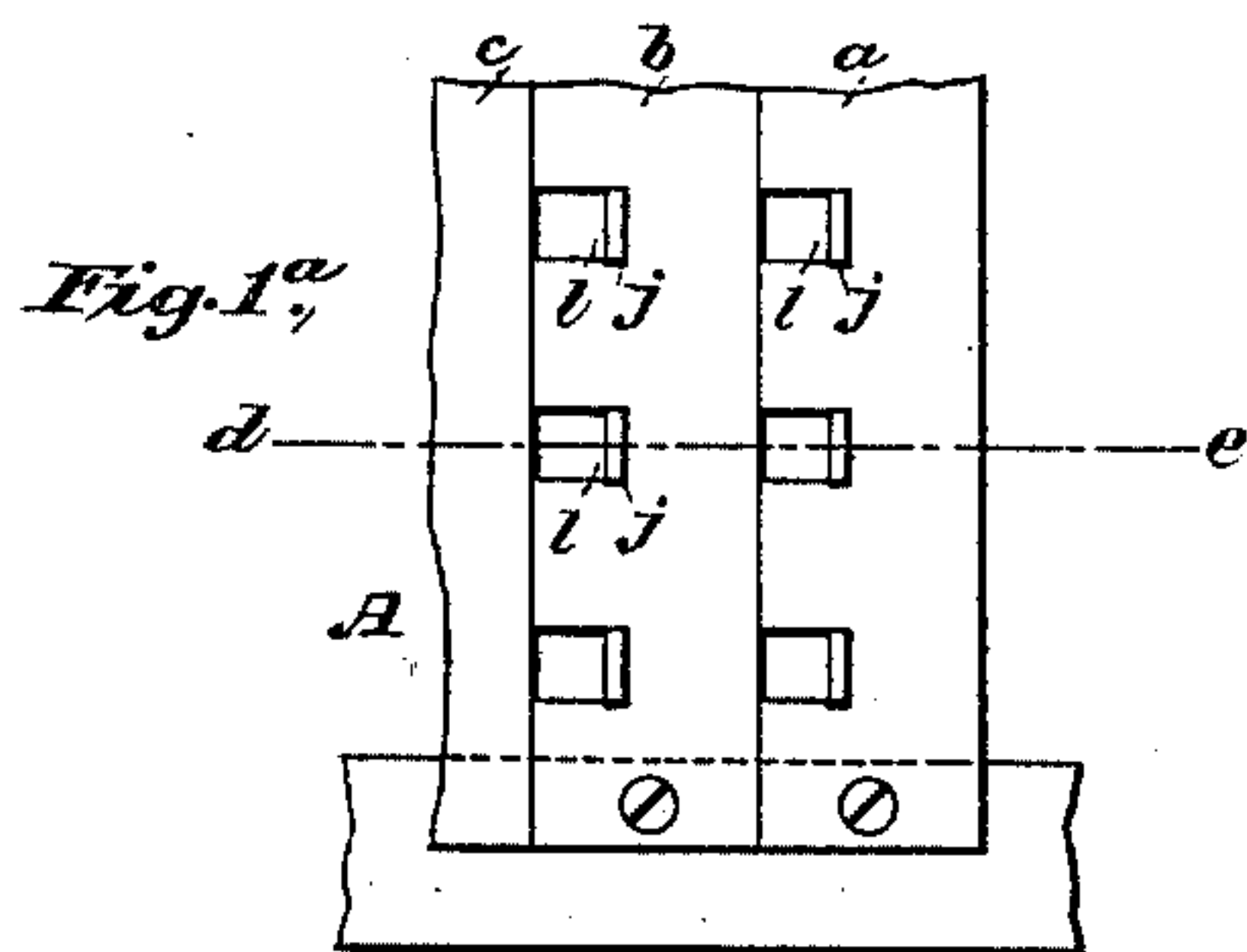


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,331.

Patented Oct. 26, 1897.



Witnesses
Geo. W. Dreck.
C. E. Ashley

Inventor
Milo G. Kellogg
By his Attorneys
Baldwin, Davidson & Wright

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. 592,331, dated October 26, 1897.

Application filed December 12, 1889. Serial No. 333,534. (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 the subscribers' lines are metallic-circuit lines connected to multiple switchboards; and it consists in a system of testing at any board to determine whether any line is in use.

I place as many switchboards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines. On each board I place for each line a spring-jack or similar switch having two contact-points which are normally in contact and a third contact point or piece insulated from the rest, (except by the circuit connections,) said switch being adapted to receive a loop-switch plug and, when a plug is inserted, to disconnect the switch-points which are normally in contact and connect one of them to one of the contact-pieces of the plug and at the same time connect the other contact-piece of the plug with said third contact-piece of the switch mentioned above. Said third contact-pieces of the switches are so placed and arranged that an operator may at will apply a test-plug or similar device to them.

Figures 1^a and 1^b of the drawings are front views of sections of two multiple switchboards to which the same lines are connected. Fig. 2 is a diagram of the boards, with the circuits and connections necessary to illustrate my invention. Fig. 3 shows a double or loop plug adapted to be used with the switches. Fig. 4 is a diagram of the subscriber's-station apparatus necessary to illustrate my invention.

In the drawings like parts and apparatus are indicated by the same letters and figures of reference.

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*. *a b* represent strips, of the shape substantially as shown, on which the metal parts of the switches are mounted. These strips may be of a length to receive any convenient number of switch parts. *ll* are square holes through the fronts of and at the edges of the strips, adapted to receive and guide the switch-plug. The contact-springs *g g* are mounted to the rear of and are parallel to the holes *ll* to which they belong, as shown. The contact-points *h h* corresponding to the contact-springs pass through the rubber strips, as shown, and are connected with the connecting-strips *h' h'*. *j j* are the contact-pieces of the switches, insulated from the rest of the parts, (except by circuit connections,) each adapted to connect one side of its line to one of the contact-pieces of a loop-plug when inserted and also to be the test-piece of its line at its board. The switch-plugs are substantially as shown in Fig. 3.

The several parts mentioned above are so made, shaped, arranged, and adjusted that when a plug is inserted into any switch-hole it raises the spring in the rear of the hole from the contact-point (on which it normally rests) and the spring is connected to one of the contact-pieces of the plug, while the other contact-piece of the plug is connected to the contact-piece *j* of the switch which is used. Each section of a rubber strip with its contact-spring, contact-point, contact-piece, and the hole, all arranged and operating as shown and described, may be considered as a spring-jack switch.

t t, Fig. 2, are test receiving instruments, and *T T* are test-plugs, one instrument and one plug for each operator, and each plug connected to one side of its test receiving instrument by a flexible cord, as shown. The plugs and cords are so constructed that the operators may at will bring the metal tips of the plugs into contact with any contact-pieces *j j* at their boards. *B B* are test-batteries, connected in the circuit as shown or in similar way to produce the result hereinafter described and of a strength to operate the test receiving instruments through the test-circuits described. Instead of a test-battery B

in each test connection or circuit containing an instrument t there may be a single test-battery in the common wire from which such connections branch.

5 The circuit of each subscriber's line is as follows: One branch, starting out from the subscriber's station, is connected with all the contact-pieces j of the switches of the line on the several boards. The other branch of the
10 line, starting out from the other side of the subscriber's-station apparatus, passes successively through the pairs of contact-points $g h$, normally in contact, of its switches on the several boards, being connected in each
15 case to the spring first. From the last contact-point h the line passes or is connected by a common wire c to all the test receiving instruments on the several boards on the other side of the instruments from that to which
20 their test-plugs are connected. The test-batteries are connected, preferably, in the circuit, so that they are between the pairs of contact-points $g h$ of the lines and the test-plugs T T.

25 In the subscriber's-station apparatus shown in Fig. 4, 1 is the telephone-switch, 2 is the telephone, and 3 is the subscriber's signal-receiving instrument. The switch shown is the usual form of gravity telephone-switch which
30 closes the switch-circuits in one position when the telephone is on the switch and closes circuits in another position when it is off from the switch. The signal-bell is an ordinary vibrating bell, (having an automatic circuit-breaker,) as shown, and of a resistance suitable
35 to the circuit.

The circuit connections of the subscriber's apparatus are such that when the telephone
40 is on the switch the bell-coil and its contact-points are in the direct circuit of the line, and when the telephone is off from the switch they are shunted by a wire of small resistance, so that a current passing over the line will not
45 operate the bell. When the subscriber's telephone is taken off the switch for use, the vibrating bell is shunted or short-circuited by a wire of comparatively low resistance and the shunt-circuit around the telephone is removed. The bell may have, say, one hundred
50 ohms resistance, and the short-circuit connection established around it when the telephone is off the switch may be of one-tenth ohm resistance. In that case about one one-thousandth of the current of the battery will pass through
55 the bell when the telephone is off the switch, and the rest of the current will pass through the short-circuiting wire. The battery should be strong enough to ring the bell of any line of the exchange when the plug is applied to
60 the line and the subscriber's telephone is not switched for use, but should not be so great that the small amount of current that passes through the bell when the telephone is switched for use will operate the bell. With
65 ordinary telephone-circuits and properly-constructed bells of, say, one hundred ohms resistance and suitable retractile springs thirty

or forty cells of battery would operate the bells when the telephone was on the switch. When the telephone was off the switch, this
70 number or a much larger number of cells would not operate the bell.

The lines and the test receiving instruments are not grounded at the central office, but are open to the ground there.

75 I have not indicated the calling apparatus or the operator's answering and connecting apparatus in detail, as it is not necessary to do so to illustrate my invention, and well-known forms of apparatus can be used for
80 them. For the calling system an independent calling-circuit common to many stations, as the Law or American district systems, may be used. When a line is to be tested, the operator places the test-plug on the contact-piece
85 j of the line and if it is not switched a complete circuit is established through the test receiving instrument and battery; but if the line is switched it is cut off from connection with the instrument and no current will pass
90 through the instrument. This test-circuit is from the common wire c through the test-battery and the test-plug used to test contact-piece j of line tested, thence through the line, by way of the subscriber's station, back to
95 central office, thence through the normally closed contacts of the switches of the line to common wire c . In the former case the test receiving instrument will give the defined sound due to the circuit-breaker if the sub-
100 scriber's telephone is on the switch and will not respond to the makes and breaks of the circuit-breaker if the telephone is off from the switch, and in the latter case when the line is switched it will not sound at all. The
105 operator can therefore determine, on testing a line, and her instrument not responding to the makes and breaks of the circuit-breaker, that either the line is switched at the central office or that the subscriber has his telephone
110 off its switch for use, and she will not switch the line with another line. Should, however, the instrument sound when the test is made, she knows that neither the line is switched nor the subscriber's telephone is off from its switch
115 for use, and she may connect the line with another line for conversation.

In some systems of multiple-switchboard testing the testing merely indicates whether or not a line is switched at some board, and
120 the line may test "free" when a subscriber has sent in his call and taken down his telephone for use, and may be connected to another line, to his annoyance and confusion. In other systems the test merely indicates
125 whether or not the subscriber's telephone is switched for use, and a line may test "free" and be connected to another line, when the subscriber has placed his telephone on its switch, but the line is not yet disconnected
130 or "cleared out" from another connection. In this case three lines will be connected together, to the annoyance and confusion of the subscribers and of the operators, who

generally have no ready means of finding out where the cross connection or "tying up" occurs. The test in this system being as pointed out above, neither of these faults or troubles can occur, and the service is more satisfactory to the subscribers and to the operators. The test receiving instruments are such as will respond to the vibrations of the circuit-breakers of the subscribers' bells.

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

1. A test-circuit for a metallic-circuit line, from one side of a test receiving instrument to a test plug or device, thence to one side or 15 branch of the line when the test is applied, thence through the circuit of the line and a pair of switch contact-points normally closed but open while the line is switched for use by the switch which controls them, to the 20 other side of said test receiving instrument, in combination with a circuit-breaker in said test-circuit while the subscriber's telephone is not switched for use but not otherwise, and a battery in said circuit, substantially as 25 set forth.

2. A test-circuit for a metallic-circuit line, from one side of a test receiving instrument to a test plug or device, thence to one side or branch of the line when the test is applied, 30 thence through the circuit of the line and pairs of switch contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched at their board, to the other side of said test receiving instrument, in combination with a 35 circuit-breaker in said test-circuit while the subscriber's telephone is not switched for use but not otherwise, and a battery in said circuit, substantially as set forth.

40 3. A test-circuit for one of the metallic-circuit lines, of a telephone-exchange from one side or branch of the line, through the circuit of the line and a pair of switch contact-points normally closed but open while the line is 45 switched for use by the switch which controls them, to a wire or circuit common to the other lines, thence through branch or derived circuits, each containing a test receiving instrument and terminating in a test plug or device 50 adapted to be brought for testing into connection with said side or branch of the line, in combination with a circuit-breaker at the subscriber's station, a switch with contact-points which switch said circuit-breaker into 55 the circuit of the line while his telephone is not switched for use but not otherwise, and a battery in a test-circuit established, substantially as set forth.

4. A test-circuit for one of the metallic-circuit-lines of a telephone-exchange from one 60 side or branch of the line, through the circuit of the line and pairs of contact-points, one pair on each of several boards, each pair normally closed but open while the line is 65 switched for use at their board, to a wire or circuit common to the other lines, thence through branch or derived circuits, one for

each board, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought into connection 70 with said side or branch of the line, in combination with a circuit-breaker at the subscriber's station, a switch with contact-points which switch said circuit-breaker into the circuit of the line while his telephone is not 75 switched for use but not otherwise, and a battery in a test-circuit established, substantially as set forth.

5. A test-circuit for a metallic-circuit line, from one side or branch of the line, through 80 the circuit of the line and pairs of contact-points, one pair on each of several boards, each pair normally closed but open while the line is switched for use at their board to a wire or circuit common to the other lines, 85 thence through branch or derived circuits one for each board, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought into connection with said side or branch of the line, in 90 combination with a circuit-breaker at the subscriber's station, a switch with contact-points which switch said circuit-breaker into the line while his telephone is not switched for use but not otherwise, and a battery be- 95 tween said pairs of contact-points and any test-plug, substantially as set forth.

6. In a telephone-exchange system, a test receiving instrument normally connected on one side to one side or branch of a metallic- 100 circuit line and connected on its other side to a test plug or device adapted to be brought for testing into connection with the other side or branch of the line, in combination with switching devices to open said normal con- 105 nection between one side of said instrument and one side of said line while the line is switched for conversation, a circuit-breaker in the circuit of the line while the subscriber's telephone is not switched for use but not 110 otherwise, and a battery in the circuit established when the test is made, substantially as set forth.

7. In a telephone-exchange system, a metallic-circuit line normally passing, on one 115 side, successively through pairs of contact-points, one pair on each of several boards, each pair being normally closed but open while the line is switched for use at their board, and thence connected to one side of a test 120 receiving instrument, in combination with a test plug or device connected to the other side of said instrument and adapted to be brought for testing into connection with the other side of said line, a circuit-breaker at the sub- 125 scriber's station, a switch with contact-points which switch the circuit-breaker into the circuit of the line while the subscriber's telephone is not switched for use but not otherwise, and a battery in the circuit established 130 when the test is made, substantially as set forth.

8. In a telephone-exchange system, a metallic-circuit line normally passing, on one

side, successively through pairs of contact-points, one pair on each of several boards, each pair being normally closed but open while the line is switched for use at their
 5 board, and thence connected to one side of each of several test receiving instruments, one at each board, and each connected on its other side to a test plug or device adapted to be brought for testing into connection with
 10 the other side of said line, in combination with a circuit-breaker at each subscriber's station, a switch with contact-points which switch the circuit-breaker out of the circuit of the line while the subscriber's telephone
 15 is switched for use and into the circuit while it is not thus switched, and a battery in the circuit established on making a test, substantially as set forth.

9. In a telephone-exchange system, multiple switchboards, test receiving instruments, one at each board, and a metallic-circuit line normally connected on one side to one side of each of said instruments, in combination with switching devices to connect said line
 25 with any other line for conversation and when it is thus connected to open said normal connection between it and said instruments, test plugs or devices, one for each of said instruments and connected to the other side of
 30 the instrument, each plug being adapted to be brought for testing into connection with the other side of the line, a circuit-breaker at the subscriber's station, a switch with contact-points which connect said circuit-breaker
 35 into the circuit of the line while his telephone is not switched for use and out of circuit

while it is switched for use, and a battery in the circuit established on making a test, substantially as set forth.

10. In a telephone-exchange system, metallic-circuit lines, multiple switchboards for said lines, switches for said lines, one switch on each of the boards, each switch having a pair of contact-points normally in contact but open while their line is switched at their
 45 board and a third contact-piece insulated from the rest (except by the circuit connections); and test receiving instruments, one at each board, each line passing, on one of its sides or branches, successively through its
 50 pairs of contact-points on the several boards, and thence connected to one side of each of said test receiving instruments and connected on its other side to each of its said third contact-pieces, in combination with test plugs
 55 or devices, one for each of the test receiving instruments and connected to the other side of the instrument and adapted to be brought into connection with any of said third contact-pieces at its board, a circuit-breaker at
 60 each subscriber's station in the circuit of his line while his telephone is not switched for use but not otherwise, and a battery in the test-circuit between each test-plug and the pairs of contact-points of the lines, substantially as set forth.
 65

In witness whereof I hereunto subscribe my name this 6th day of November, 1889.

MILO G. KELLOGG.

Witnesses:

FRANCES D. KELLOGG,
 ELISE HÖLZER.