

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,372.

Patented Oct. 26, 1897.

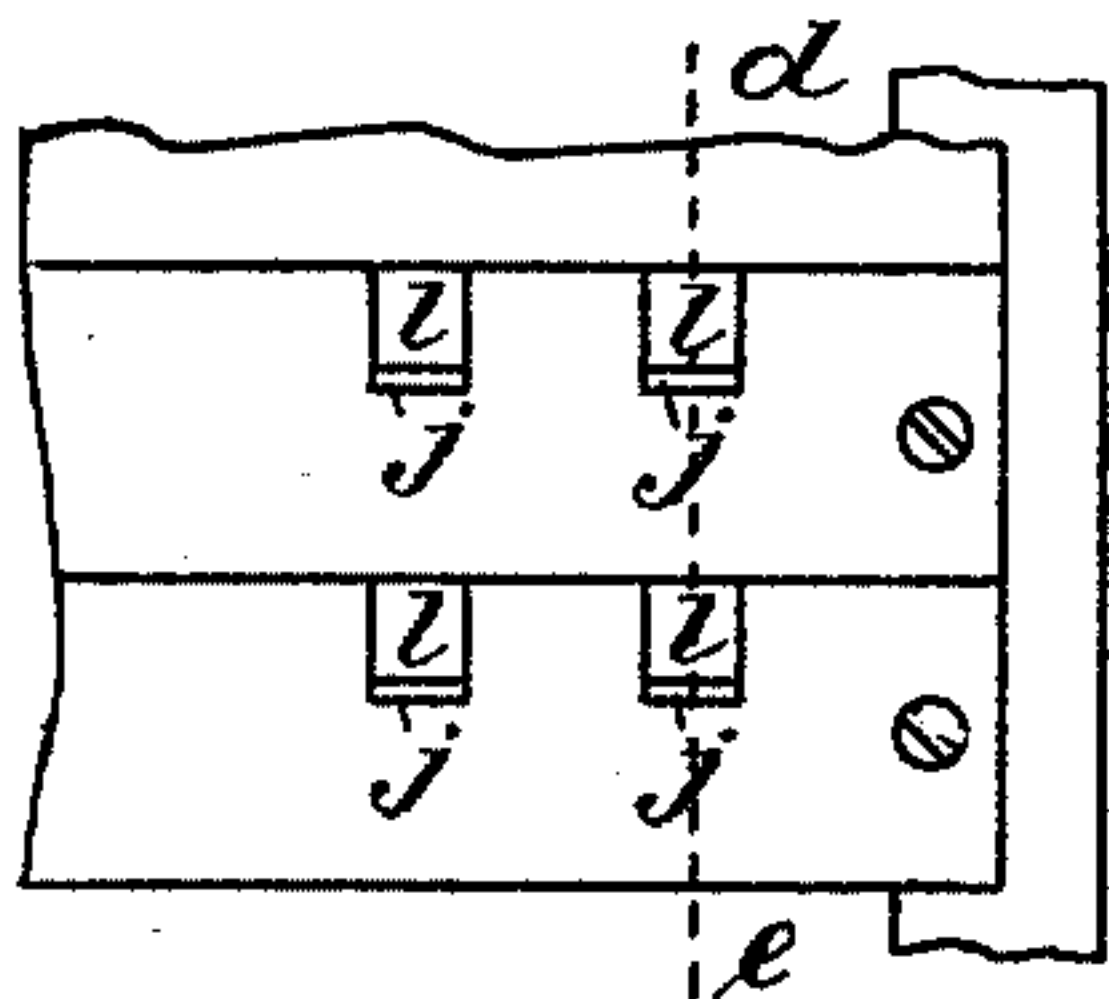


Fig. 1^a

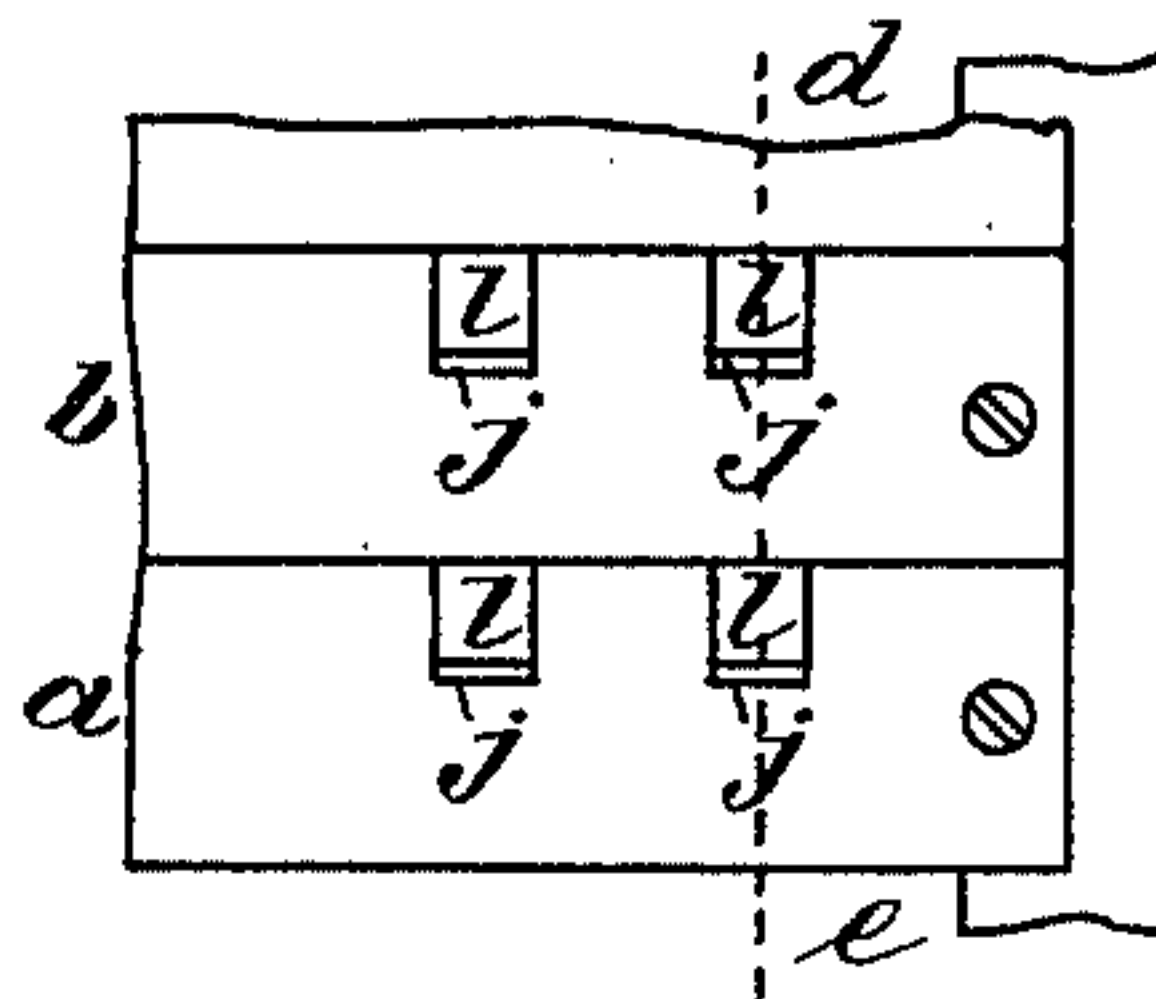


Fig. 1^b

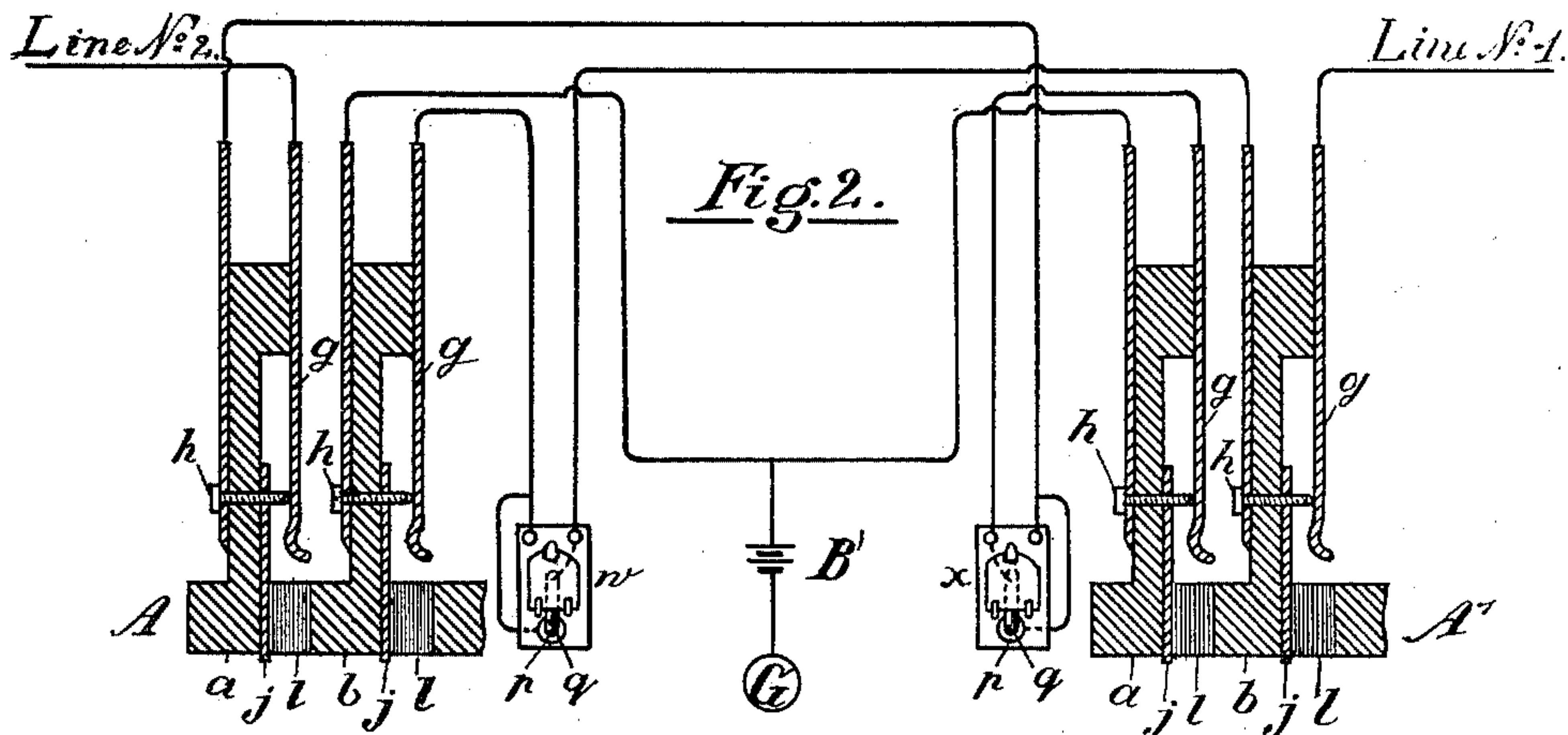


Fig. 2.

Fig. 3.

Fig. 4.

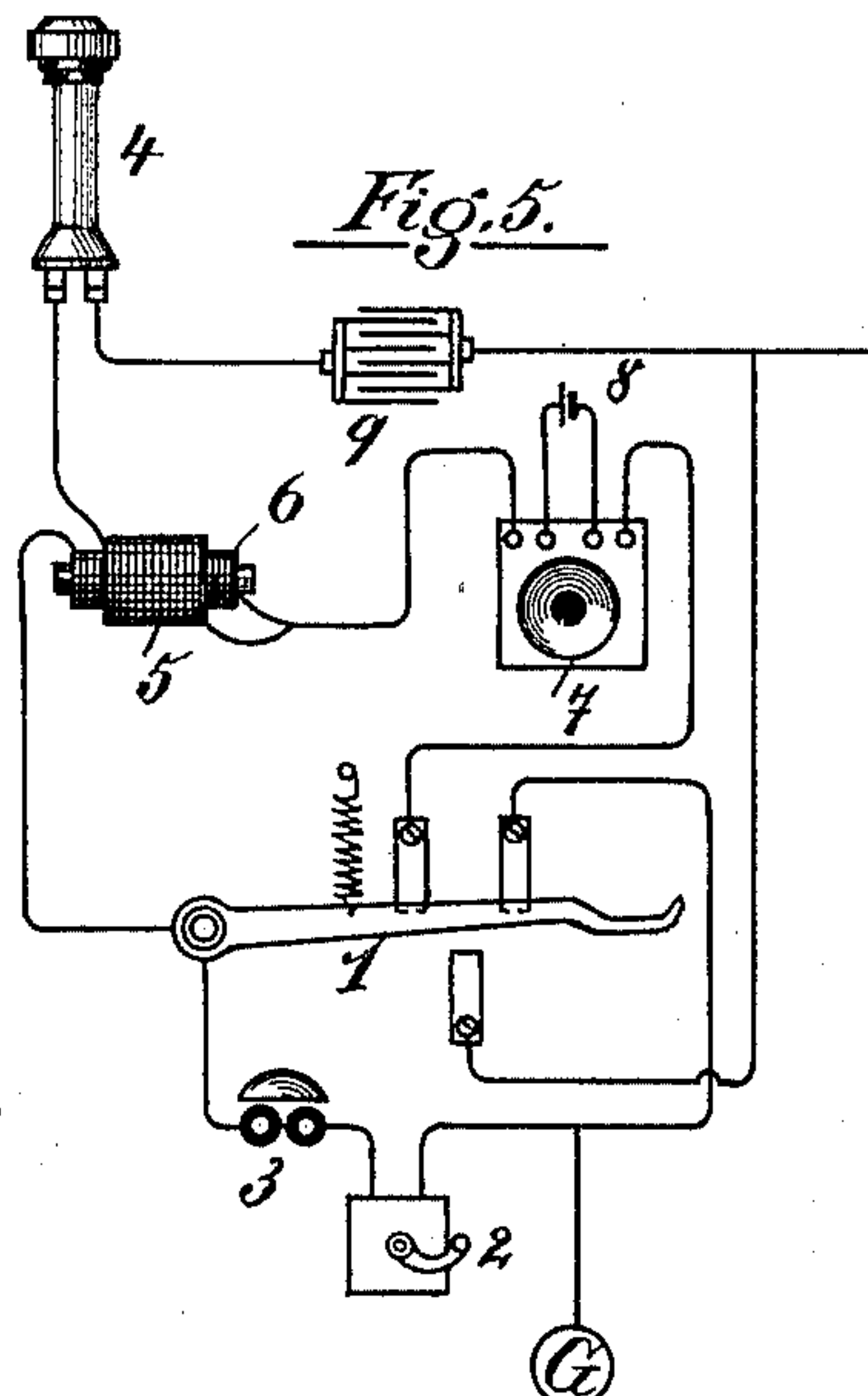
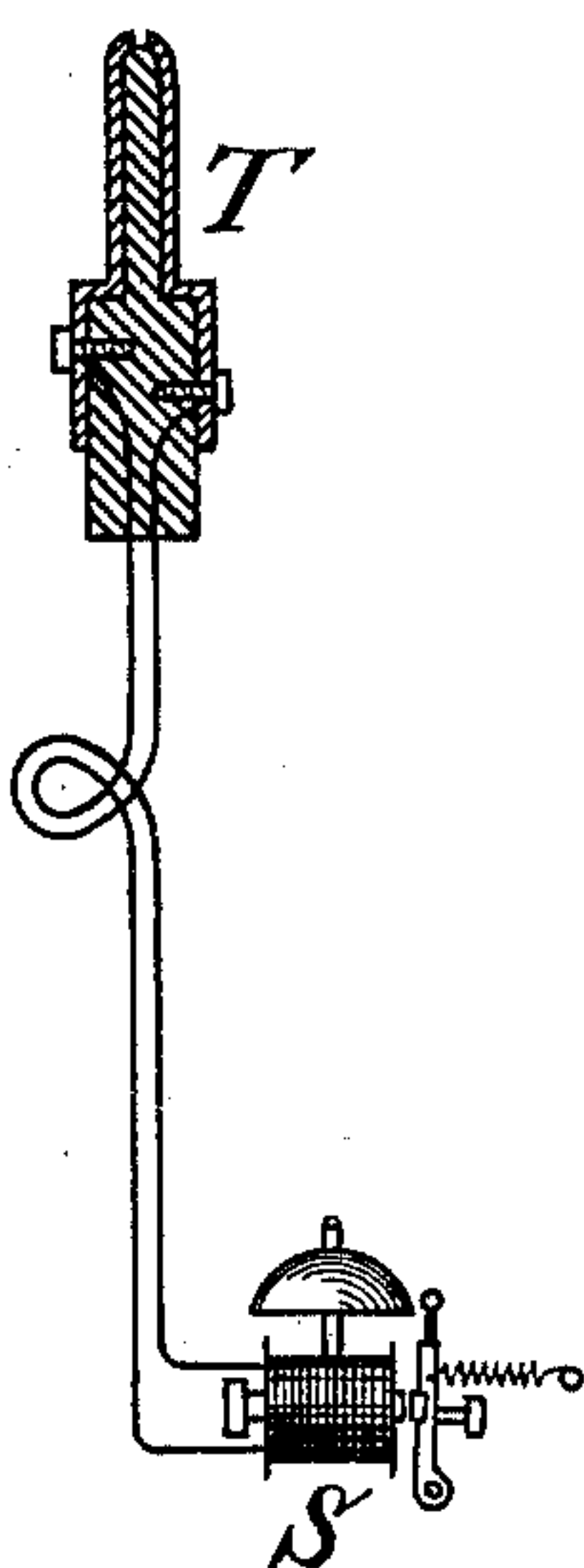
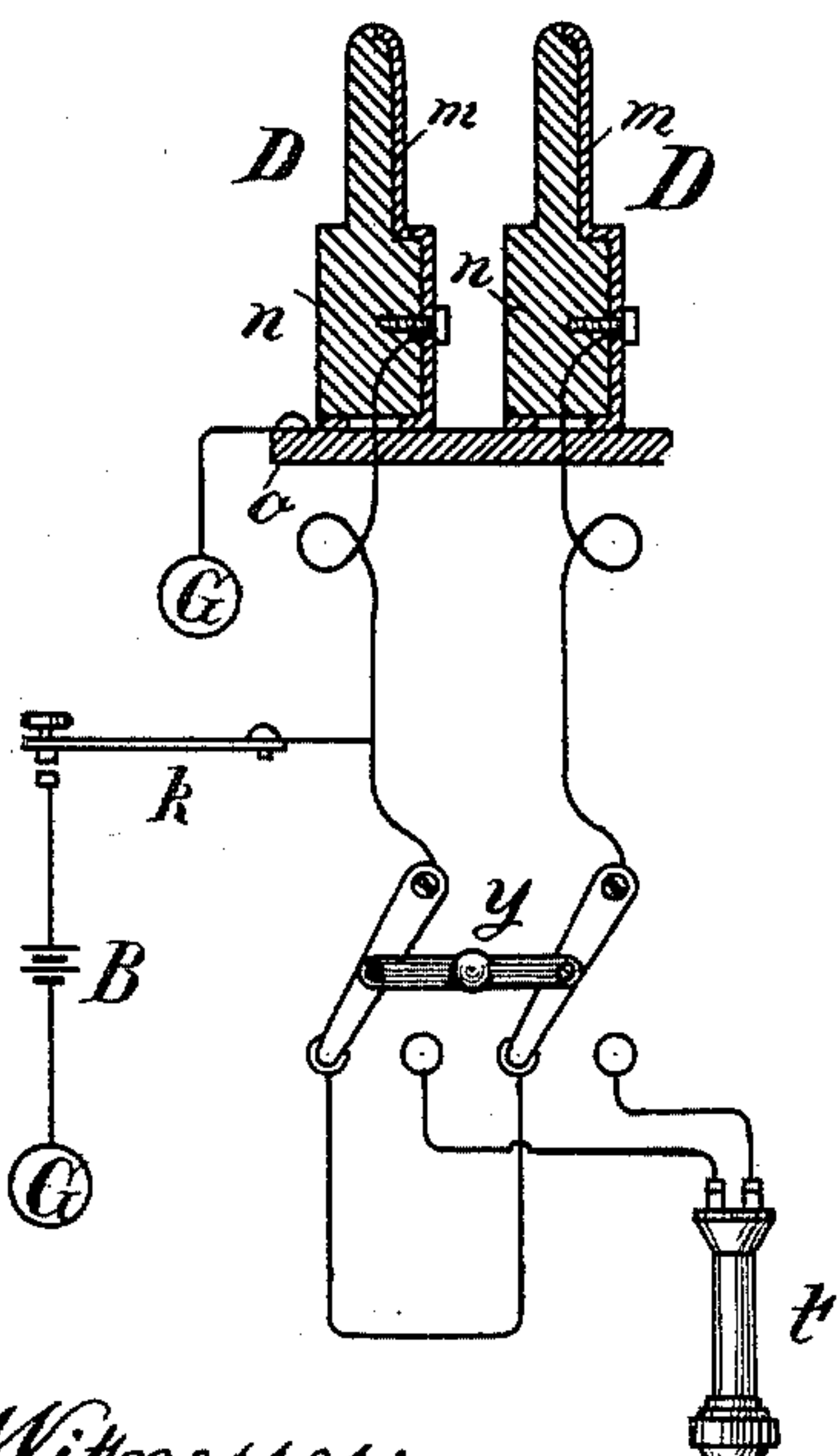


Fig. 5.

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. 592,372, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,082. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful

5 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.

10 My invention relates to a telephone-exchange system in which the lines are single-circuit lines grounded at their outer ends and normally grounded at the central office; and it consists in a system of testing the lines to

15 determine whether they are in use and in an arrangement of the annunciators and switches of a line by which special clearing-out annunciators are not required for the pairs of cords.

20 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 diagram of the boards, with the main-

25 line apparatus and connections necessary to illustrate my invention. Fig. 3 shows a diagram of an operator's cord system to be used in connection with the boards. Fig. 4 shows an operator's test system to be used at the

30 boards. Fig. 5 shows a subscriber's-station apparatus.

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

35 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 operate the exchange. On each board is a spring-jack or other suitable switch

40 for each line. Each switch has a contact-spring which normally connects with an insulated contact-piece and is adapted to receive a loop-plug and, when a plug is inserted, to disconnect the spring from the contact-piece

45 and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively. The switch is also adapted to receive a single-contact switch-plug and, when a plug is inserted, to disconnect the spring from the contact-piece and

50 connect the spring with the contact-piece of

the plug. In the construction of the switches as shown and as will hereinafter be described I prefer to have a contact-point electrically connected with the contact-piece, and on

55 which the spring normally bears, as there is less chance of poor connection when the spring bears on a point than when it bears on a surface adapted to be brought into connection with the plug-contacts.

60

In Fig. 2, *g g* represent the springs of the different switches, *h h* the contact-points on which the springs normally bear, and *j j* the contact-pieces of the switches connected with the points *h h*. *l l* are the switch-holes. *a b*

65 are the rubber strips on which the metal parts of the switches are mounted, as shown, and through the fronts of which are the switch-holes *l l*.

The contact-pieces *j j* are so placed along one of the surfaces of the plug-holes as readily to form connection with one of the contact-pieces of the loop-plugs.

70

The holes *l l* are adapted to receive the switch-plugs shown in Fig. 3 and marked

75 D D, and when a plug is inserted into a switch it raises the spring *g* from the contact-point *h* and the spring *g* and contact-piece of the plug are in contact. These holes are also adapted to receive the loop-plug shown in

80 Fig. 4, and when a plug is inserted into a hole it raises the spring of the switch from the contact-point *h* and the spring *g* and the contact-piece *j* of the switch are in contact with the two contact-pieces of the plug, re-

85 spectively.

w and *x* are calling-annunciators, one for each of the lines shown.

Each line-annunciator has a pair of contact-points *p q*, which are normally out of

90 contact while the annunciator does not indicate a call, but which are pressed into contact by the drop while it indicates a call. One of these contact-points is connected to the circuit of the annunciator on one side of

95 the magnet and the other point is connected to it on the other side of the magnet.

B' is a test-battery placed in the common ground wire or connection of the lines.

Two lines are shown in the drawings, one

100 marked line No. 1 and the other line No. 2. These lines are ordinary single-circuit lines

grounded at their outer ends and having at the subscriber's station any usual and appropriate subscriber's-station apparatus. Each line passes successively through the
 5 pairs of contacts of its switches on the several boards, passing in each case to the spring first. It then passes to the common ground wire or connection in which is the test-battery B'. Each annunciator is connected into
 10 the circuit of its line between the pair of contact-points of the switch nearest to said ground connection in which is the test-battery and the pair of contact-points immediately preceding them and is located at the
 15 board where said switch nearest the ground connection is located. The circuit of each line shown may thus be traced in Fig. 2.

In the operator's cord system shown in Fig. 3, D D are the switch-plugs of a pair of cords,
 20 *n n* are the rubber insulations of the plugs, and *m m* are their contact-pieces. These contact-pieces pass each to the bosom of its plug and are adapted to rest normally, or when the plug is not in use, on the metal piece *o*, which
 25 then connects it with the ground. These plugs are adapted to be inserted into any of the switches at their board and when a plug is inserted it operates the switch, as above described. The plugs should be inserted so
 30 that the contact-piece *m* is in contact with the spring *g*. The connections of the lines might have been reversed, so that the lines pass first to the contact-piece *j* of each of their switches, and in that case the plugs
 35 should be inserted in such a position that their contact-pieces form connection with the pieces *j* of the switches.

Y is the looping-in switch for the pair of cords shown.

40 K is the calling-key.

t is the operator's telephone, and B is her calling generator or battery.

The circuits are substantially as shown.

45 The operation of the system in connection with the switchboards will be apparent to those skilled in the art.

It will readily be apparent that when a line is switched by the insertion of a plug into its switch the line is disconnected from its normal ground-wire at the central office in which
 50 is the test-battery B' and is connected into a circuit with the pair of cords. Only one pair of cords are shown, but the connection of such other pairs, with their accompanying apparatus, as the operator may need will be apparent to those skilled in the art. To each pair of cords, with its plugs, belong a looping-in switch and a calling-key. One telephone
 55 and one calling-generator will answer for her system of cords.

60 In the operator's test system shown in Fig. 4, T is a loop test-plug adapted to be inserted into any of the switches and when inserted to operate them, as heretofore described, and S
 65 is a test receiving instrument. The instrument is connected in a loop which terminates in the two contact-pieces of the plug.

Each operator has one cord system and one test system, and they are conveniently mounted and arranged for her work. 70

In the subscriber's-station apparatus shown in Fig. 5, 1 is the telephone-switch. 2 is the calling-generator. 3 is the signal-receiving bell. 4 is the subscriber's telephone. 5 is the secondary, and 6 is the primary, of the
 75 induction-coil. 7 is the transmitter. 8 is the transmitter-battery. 9 is a condenser. These parts may be of usual forms of apparatus and are connected as shown or in other ways so as to perform practically the opera-
 80 tions required and the operations hereinafter described.

When the subscriber's telephone is on its switch, the signal-receiving bell is in the circuit of the line and the telephone, the secondary of the induction-coil, and the con-
 85 denser are shunted by a wire of small resistance, so as to be practically out of the circuit. When the telephone is off the switch, the telephone, the secondary of the induction-coil, 90 and the condenser are in the circuit and the signal-bell is practically out of the circuit.

The test receiving instruments and test-batteries should be so constructed and adjusted to each other and the circuits that the
 95 instrument will sound or respond when it and the battery are looped into the closed circuit of any single line and the subscriber's telephone is not off its switch for use, but will not respond if the circuit is open at any point or
 100 if the subscriber's telephone is off its switch and the condenser at the subscriber's station is included in the circuit or the line is switched with another line and thereby has its test-circuit open, as will hereinafter be indicated. 105

The operation of the test system is as follows: When an operator desires to test a line, she places her test-plug into the switch of the line, and by so doing disconnects the points *g* and *h* of the switch and connects them with
 110 the contact-pieces of the plug. If, then, the line is not switched at any board and the subscriber's telephone is on its switch, the test receiving instrument will sound or respond, indicating that the line is free to be switched
 115 to. If, however, the subscriber has taken his telephone from the switch for use, the instrument will not sound, as the condenser in the circuit will prevent it from doing so. If, again, the line is switched at some board and
 120 the test is made in the cut-off portion of the line—that is, that portion which is between the switch used for switching and the office ground—the instrument will not sound, because the test-circuit is open at the pair of
 125 contact-points of the switch used for switching. If, again, the line is switched at any board with another line and the test is made in some switch between the one used for switching and the subscriber's station, the
 130 instrument will not sound on account of the battery being cut off from the circuit in which the test receiving instrument is included. In that case the test receiving instrument, it is

true, is in the closed circuit of the two lines, and this circuit has continuity for battery-currents while the subscribers' telephones are not switched for use. Nevertheless, as the
5 test-battery is cut off from the line and consequently there is no battery in circuit with the test receiving instrument, the instrument will not sound.

When a test of a line is made and the test
10 receiving instrument sounds, the operator knows that neither the line is switched for use nor the subscriber's telephone is switched for use, and when the instrument does not sound she knows that either the subscriber's
15 telephone is switched for use or the line is switched for use and she will not connect the line with any other line. By this system a subscriber's line is reserved to himself from the time he sends in his call or the line is
20 switched for use.

When two lines are connected together as described and the line-annunciator of only one of the lines is located at the board where the connection is made, that annunciator
25 alone will be in their circuit to indicate the clearing-out signal. The annunciator of the other line will be cut off from its line-circuit and consequently will not be in the circuit of the two connected lines. This results from
30 the placing of the annunciators, as heretofore indicated, in the circuit of its line at the board nearest its ground connection, but with the switch of the line at that board between the annunciator and the ground connection.
35 When both annunciators are located at the board where the connection is made, they will both be connected into the circuit, and the operator will then leave one of the drops down while the connection exists, and this
40 will shunt the annunciator-magnet out of circuit and the other annunciator will indicate any clearing-out signal which may be sent over the circuit.

In multiple systems heretofore devised the
45 line-annunciators have been placed in the circuit-wire which connects the two branches of the line after one of the branches has passed through all the pairs of its switch contact-points and the other has been connected to
50 the other contact-pieces of its switches on the several boards and a special clearing-out annunciator has been required for each pair of switch-cords.

In my system by the employment of the
55 line-annunciators constructed with contact-points, as described, and the location of the annunciators in their respective circuits, as described, I provide for a single annunciator in the circuit of each two lines connected to-
60 gether for conversation, which is located at the board where the connection between the two lines is made, and which will indicate any clearing-out signal sent over the line, and at the same time I dispense with the use and the
65 accompanying expense of special clearing-out annunciators for the several pairs of cords.

In some multiple systems the test indicates

to the operator that the line was switched at some board of the exchange. In other systems the test indicates that the subscriber's
70 telephone is switched for use. In my system the test indicates that the line is busy whether it is switched at any board or the subscriber has taken his telephone down for use, and the service of the exchange is more satisfactory
75 to the subscribers than in either of the other general systems of testing above indicated.

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

1. In a telephone-exchange system, a tele-
80 phone-line grounded at its outer end and passing normally successively through 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,
85 and to a ground-wire and test-battery in said ground-wire in combination with switching devices at each board to disconnect the pair of contact-points at the board and switch the line for conversation, and a loop test-plug in
90 the two contact-pieces of which terminate the two sides of a loop containing a test receiving instrument, said plug being adapted to be inserted into the switches and when inserted into a switch to disconnect the contact-points
95 of the switch and connect them with the contact-pieces of the plug, and the subscriber's station apparatus for each line, each with a telephone, a telephone-switch, a condenser and contacts and circuits by which the con-
100 denser is included in the circuit of the line while the telephone is switched for use but not while it is not thus switched, substantially as set forth.

2. In a telephone-exchange system, a tele-
105 phone-line normally on closed circuit and passing successively through 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, and
110 thence to a common wire and test-battery in said ground-wire, in combination with switching devices at each board to disconnect the pair of contact-points at the board and switch the line for conversation, and a loop test-plug
115 in the two contact-points of which terminate the two sides of a loop containing a test receiving instrument, said plug being adapted to be inserted into the switches and when inserted into a switch to disconnect its pair of
120 contact-points and then connect them with the two contact-pieces of the plug, and the subscriber's station apparatus for each line, each with a telephone, a telephone-switch, a condenser and contacts and circuits by which
125 the condenser is included in the circuit of the line while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

3. In a telephone-exchange system, a tele-
130 phone-line grounded at its outer end and having in its circuit pairs of switch 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, and thence to a common ground-wire and battery therein, in combination with switching devices at each board, to disconnect the pair of contact-points at the board and switch the line for conversation, and loop test-plugs, one at each board each plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument and adapted to be inserted into the switch of the line at its board and when inserted to disconnect the pair of contact-points which are normally in contact and connect them with the two contact-pieces of the plug, and the subscriber's-station apparatus for each line, each with a telephone, a telephone-switch, a condenser and contacts and circuits by which the condenser is included in the circuit of the line while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards, telephone-lines, each line normally on closed circuit, switches for said lines, one switch on each of the boards for each line, each switch having a pair of contact-points normally in contact and open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switch and thence to a common wire and test-battery therein, in combination with pairs of switch-plugs at each board, the contact-pieces of each pair being connected by flexible conductors in the circuit, said plugs being adapted to be inserted into the switches at their board and when a plug is inserted into a switch to disconnect the pair of contact-points of the switch and connect the line contact-piece, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, and the subscriber's-station apparatus, with a telephone, a telephone-switch, a condenser and contacts and circuits by which the condenser is included in the circuit of the line while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends, switches for said lines, one switch on each of the boards, for each line, each switch having a pair of contact-points normally in contact but open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switches and thence to a ground-wire and battery therein, in combination with pairs of switch-plugs at each board, each pair having their contact-pieces connected by flexible conductors, said plugs

being adapted to be inserted into the switches at their board and when a plug is inserted into a switch to disconnect the contact-points of the switch which are normally in contact and connect the line contact-point with the contact-piece of the plug, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, and subscriber's-station apparatus with a telephone, a telephone-switch, a condenser and contacts and circuits by which the condenser is included in the circuit of the line, while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, telephone-lines, each line normally on closed circuit, switches for said lines, one switch on each of the boards for each line, each switch having a pair of contact-points normally in contact and open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points, of its switch, and thence to a common wire and battery therein, in combination with switching devices at each board to disconnect any line from said common wire, and connect it with any other line for conversation, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect them with the contact-pieces of the plug, and subscriber's-station apparatus, with a telephone, a telephone-switch, a condenser and contacts and circuits by which the condenser is included in the circuit of the line while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, telephone-lines grounded at their outer ends, switches for said lines, one switch on each of the boards, for each line, each switch having a pair of contact-points normally in contact but open while a switch-plug is inserted into it, each line passing normally successively through the pairs of contact-points of its switches and thence to a ground-wire and test-battery therein, in combination with switching devices at each board to disconnect any line from said ground-wire and connect it with any other line for conversation, and loop test-plugs, one at each board, each plug having two contact-pieces in which terminate the two sides of a test receiving instrument, each plug being adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of

the switch and connect them with the contact-pieces of the plug, and subscriber's-station apparatus, with a telephone, a telephone-switch, a condenser and contacts and circuits
5 by which the condenser is included in the circuit of the line while the telephone is switched for use, but not while it is not thus switched, substantially as set forth.

8. In a telephone-exchange system, telephone-lines and multiple switchboards for
10 said lines, each board having a switch for each line by which the line may be switched with any of the other lines for conversation, each line being connected successively to its
15 switches on the several boards, in combination with line-annunciators, one for each line located at the same board as is the switch of the line connected farthest from the subscriber's station and in the line-circuit between
20 such switch and the preceding switch, and contact-points and connections by which each annunciator-magnet is short-circuited while

the annunciator indicates a call, substantially as set forth.

9. In a telephone-exchange system, telephone-lines and multiple switchboards for
25 said lines, each board having a switch for each line by which the line may be switched with any of the other lines for conversation, each line being connected successively to its
30 switches on the several boards, in combination with line-annunciators, one for each line located at the same board as is the switch of the line connected farthest from the subscriber's station and in the line-circuit between
35 such switch and the preceding switch, substantially as set forth.

In witness whereof I hereunto subscribe my name this 23d day of June, 1890.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
C. STRICH-CHAPELL.