

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,344.

Patented Oct. 26, 1897.

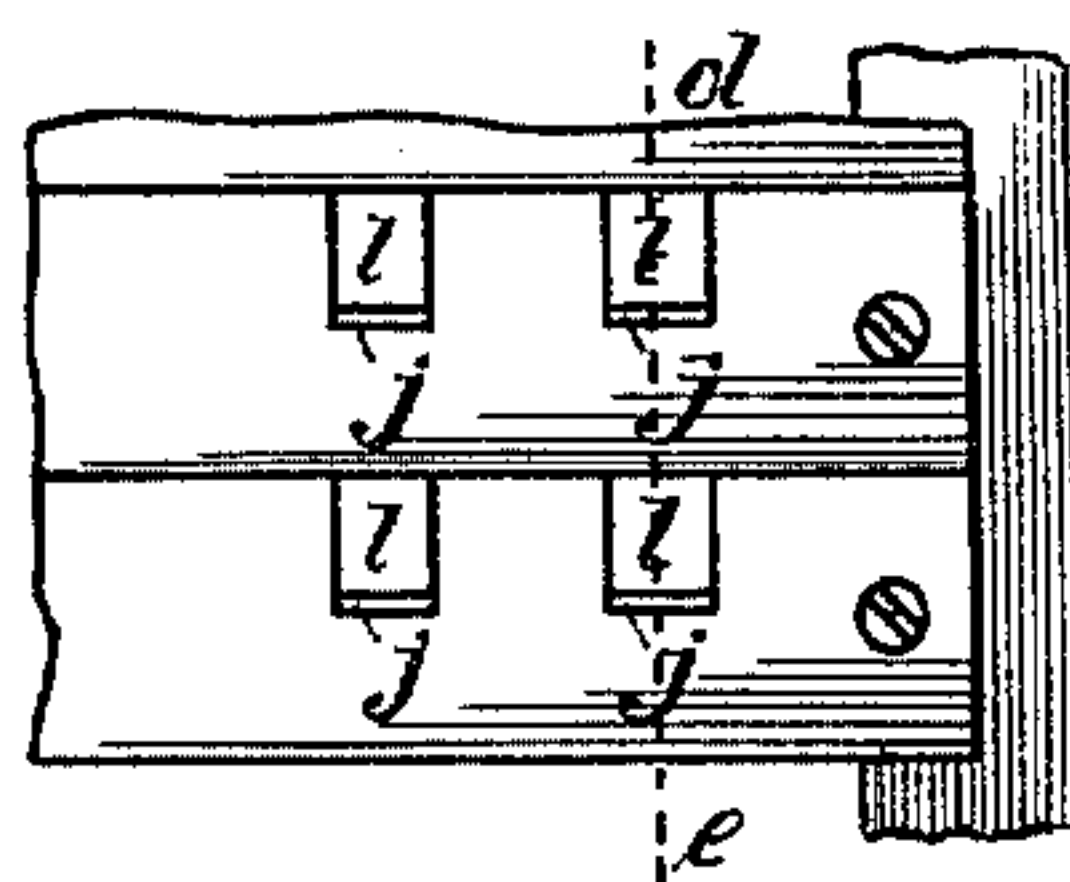


Fig. 1^a

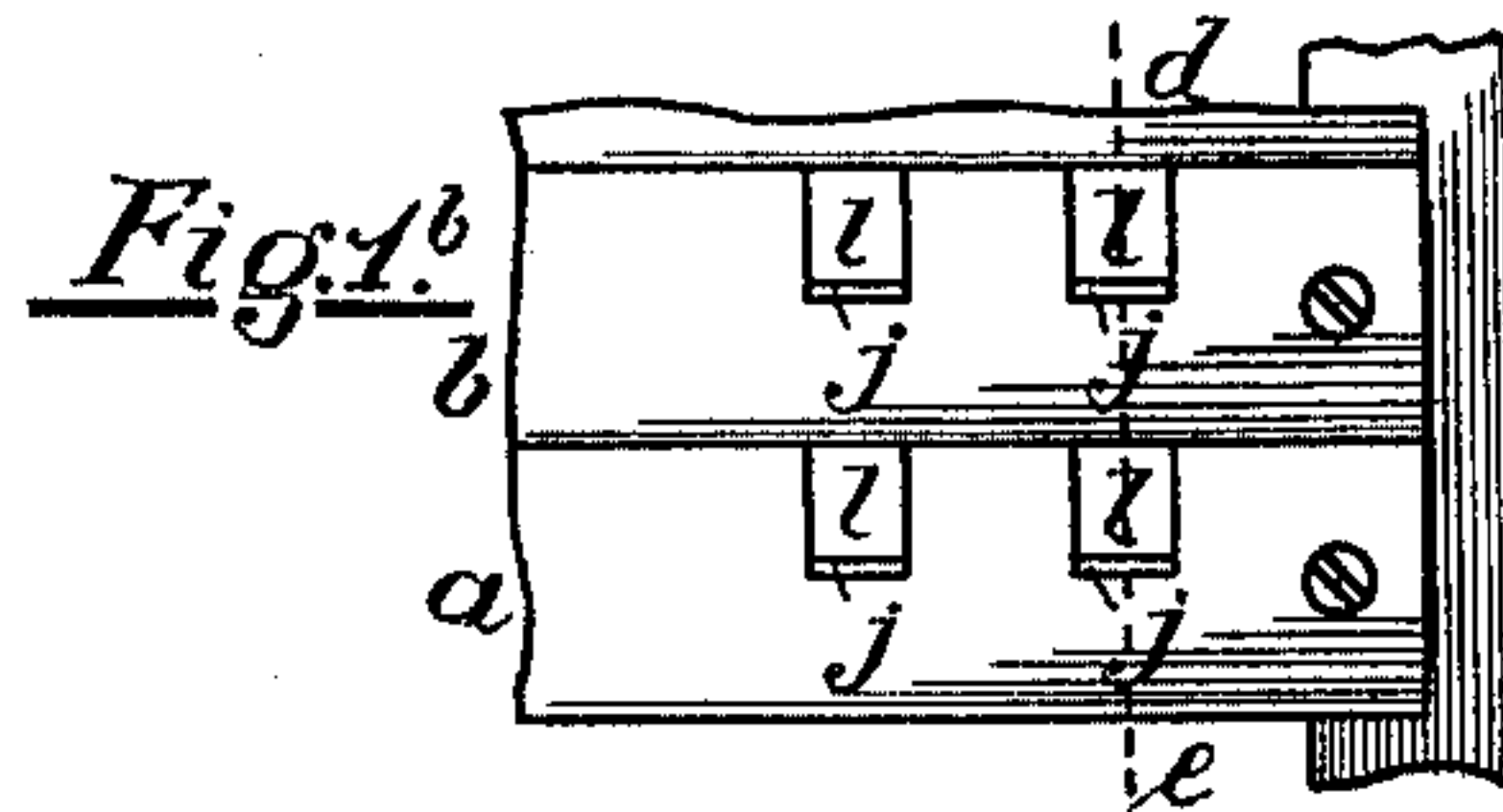


Fig. 1^b

Fig. 2

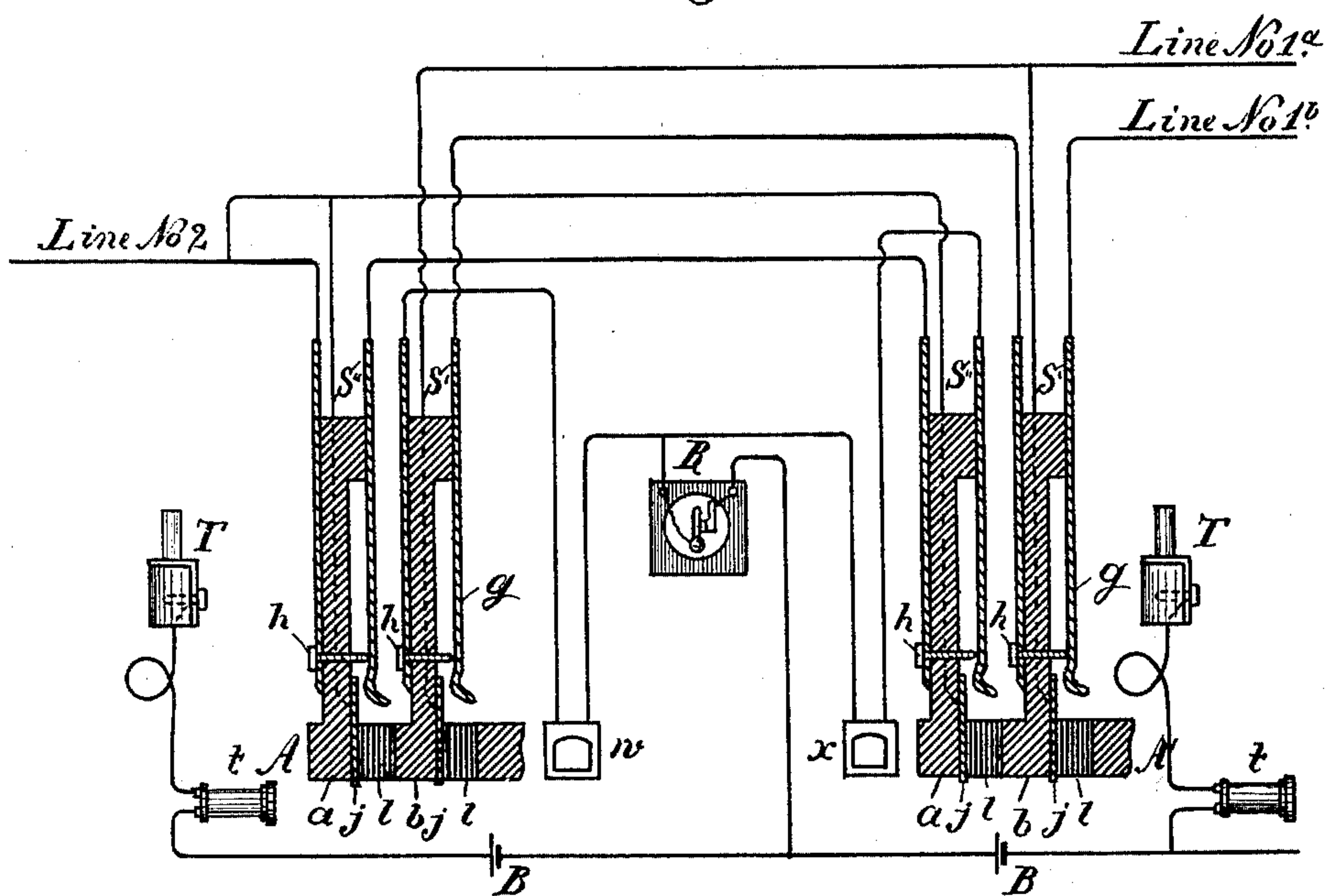
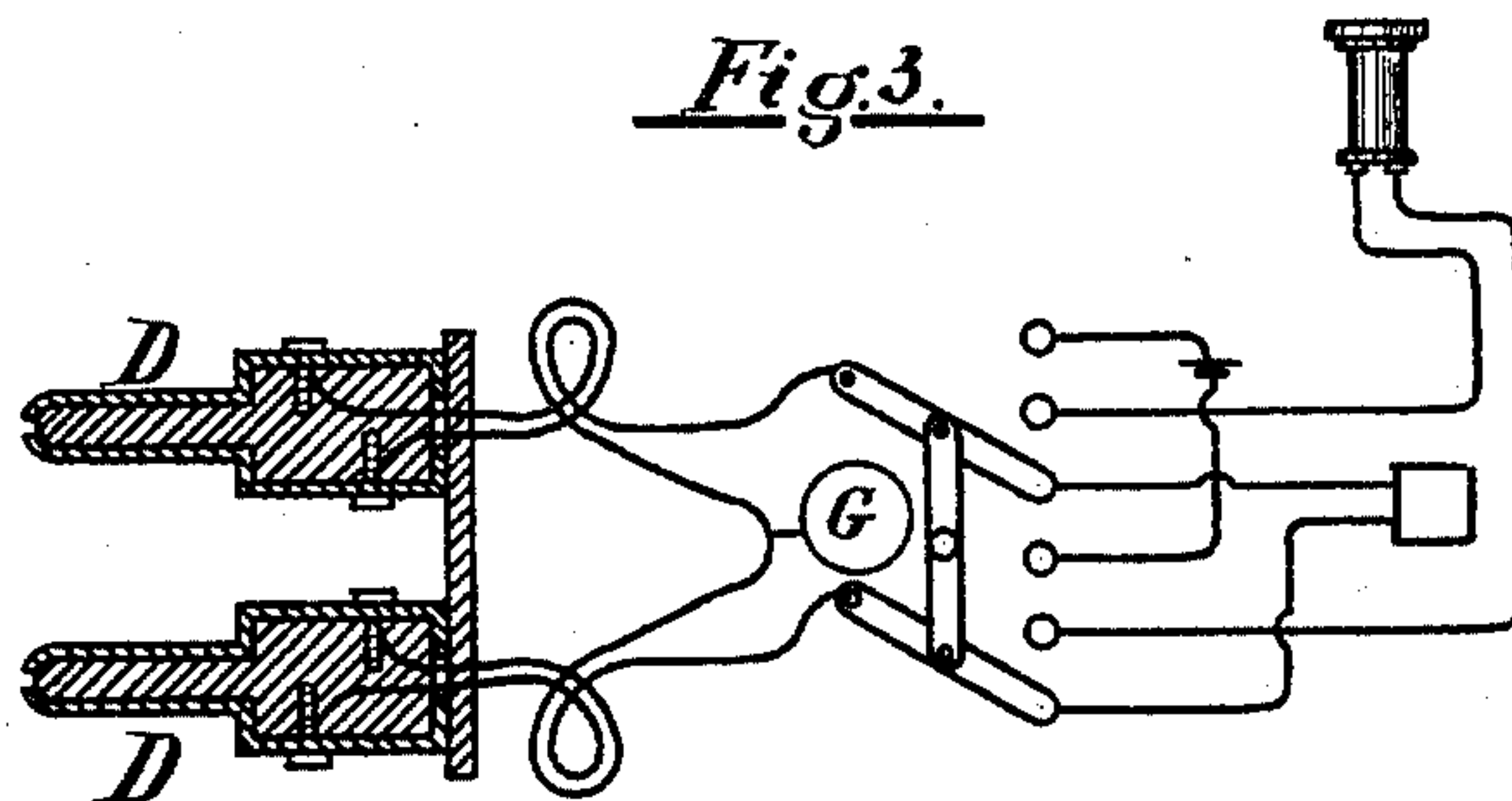


Fig. 3.



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. 592,344, dated October 26, 1897.

Application filed December 21, 1889. Serial No. 334,522. (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, 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 telephone-exchange systems in which the lines are single-circuit lines or metallic-circuit lines, or in which the two lines are combined in one exchange; and it consists in a system of switching and testing with such lines, which I shall describe and claim.

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 necessary connections and disconnections. 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 contact-piece insulated from the rest (except by the circuit connections) and is adapted to receive a loop-switch plug and, when a plug is inserted, to disconnect the spring from the contact-point and connect the two contact-pieces of the plug with the spring and with said switch contact-piece, respectively.

The lines of the exchange, whether single or metallic-circuit lines, pass successively through the pairs of contact-points of their switches on the several boards. The lines then unite into a common wire in which is a rheotome. When the lines are switched for conversation, they are disconnected from this common wire. Test receiving instruments at each board are connected to the other side of the rheotome and are adapted to be brought for testing into connection with the several lines whether the lines are switched or not. The test receiving instruments and the rheotome and its common wire are disconnected from the ground at the central office.

In the accompanying drawings, illustrating my invention, Figures 1^a and 1^b represent sections of two multiple switchboards of the ex-

change to which the same lines are connected.

Fig. 2 shows a diagram of the boards with the line connections and apparatus necessary to illustrate my invention. Fig. 3 shows an operator's cord system to be used with the boards.

In the drawings like parts and apparatus are indicated by the same letters 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*.

In Fig. 2, *g g* represent the springs of the 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 b* are the rubber strips on which the contact-pieces are mounted, as shown, and through the fronts of which are the holes *l l*. The insulated contact-pieces *j j* of the switches are so placed that a test-plug or similar device may readily be applied to them. When a switch-plug (shown in Fig. 3) is inserted into a switch-hole *l*, it separates the pieces *g h* of the switch, and one of the contact-pieces of the plug is in contact with the piece *j*, and the other piece is in contact with the spring *g*. The switches for the single-circuit lines are marked S'', and those for the metallic-circuit lines are marked S'.

R is a rheotome or mechanical circuit-breaker containing a clockwork-movement actuated by a spring. It contains an oscillating bar fixed to the verge-shaft and standing at right angles to it. A pair of contact-points is connected with the bar or with the shaft in such a way that their contact is alternately made and broken with the oscillations. The pair of contact-points are properly insulated and are connected into the circuit, as indicated, for the rheotome. Instead of the rheotome shown any form of mechanical or electrical rheotome or any apparatus which changes the electrical condition of the line, so that the change will be indicated on the test receiving instruments, may be connected into the circuit, as indicated, for the rheotome.

Two lines are shown in Fig. 2, one a metallic-circuit line, the two sides or branches of which are marked line No. 1^a and line No. 1^b, respectively, and one a single-circuit line

(to be grounded at its outer end) marked line No. 2.

The circuit of the single-circuit line is as follows: from the subscriber's ground, through his station apparatus, through the line and the pairs of contact-points $g h$, successively, of its switches on the several boards, going in each case to the point h first and thence to the common wire of the lines in which is the rheotome. All the contact-pieces $j j$ of a single-circuit line are connected together and to their line between its switches and the subscriber's station.

The circuit of a metallic-circuit line is as follows: One side or branch of the line—say line No. 1^a, as shown—is connected with all the contact-pieces $j j$ of its switches on the boards. The other branch of the line, say line No. 1^b, passes successively through the pairs of contact-points $g h$ of its switches on the several boards, going in each case to the spring first. It then passes to the common wire, in which is the rheotome.

$t t$ are test receiving instruments, one at each board. This test receiving instrument should be of such a character that it will respond to variations in the strength of the test-current. As an operator's telephone is extremely sensitive to such variations, it is preferably used in connection with this system.

$T T$ are test-plugs, one for each instrument, each connected by a flexible cord to one side of its instrument and adapted to be brought for testing into connection with any contact-piece j at its board. The other side of each test receiving instrument is connected to said common wire of the lines, in which is the rheotome. The connection of the test receiving instruments to said common wire must be on the other side of the rheotome from that to which the lines are normally connected.

$B B$ are test-batteries. There should be a test-battery in the circuit between the place where the lines are united with said common wire and any test-plug. The battery may be placed in the common wire between the place where the lines unite with it and the place where the test-instrument circuits branch off from the common wire. In that case only one battery would be required for the exchange.

In the operator's cord system shown in Fig. 3, $D D$ are two loop-plugs, the two contact-points of which are connected by double flexible cords to their loop-switch, clearing-out annunciator, and the operator's telephone and calling-generator, substantially as shown. Only one pair of plugs, with their cords and apparatus, is shown; but other pairs may be added in a way which will be apparent to those skilled in the art. One of the contact-pieces of each of the loop-switch plugs is connected by a flexible conductor to a lever of the looping-in switch, and the two other contact-pieces of the plugs are connected together by means of a flexible cord-circuit. One pair of the plug-bolts are connected together through a clearing-out annunciator.

Another pair are connected together through the operator's telephone, and the third pair are connected together through the calling generator or battery.

Each operator has a cord system, and it is conveniently mounted and arranged for her work. This cord system does not require specific description, on account of the fact that any of the usual systems may be adapted to this exchange. The essential feature is that when a line is switched for use it shall be cut off from the rheotome.

I will not explain in detail the operation of the operator's cord system in connection with the switchboards, as its operation will be apparent to those skilled in the art. It will be seen that when a line is switched with another line by the insertion of switch-plugs into their switches they are disconnected from the common wire c , in which is the rheotome. When a line is tested by placing a test-plug in a contact-piece j of the line, and the line is not switched at any board, there is a complete circuit from the common wire through the test receiving instrument over the line by way of the subscriber's station, in the case of a metallic-circuit line, to the pairs of switch contact-points of the line. The rheotome and the common wire and battery are in this circuit, and the test receiving instrument will sound or respond to the vibrations of the rheotome, indicating to the operator that the line is free to be connected to. Should, however, the line be switched at any board, this circuit is open and the instrument will not sound or respond. When the instrument, on a test being made, does not respond, the operator knows, therefore, that the line is switched for use and she will not then connect it with another line.

I have not shown or described any subscriber's calling system. An independent calling-circuit common to many subscribers' stations, such as the Law or American district systems, may be used in connection with the test system above described.

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

1. A test-circuit for a metallic-circuit line, from one side or branch of the line, through the circuit of the line and then to a pair of switch contact-points normally in contact but open while the line is switched by the switch which controls them, thence by an all-metallic connection to a wire common to the lines and through said common wire to a test-wire containing a test receiving instrument and battery, a rheotome in said common wire and a test plug or device in which said test-wire terminates, adapted to be brought into connection with said side or branch of the line, substantially as set forth.

2. A test-circuit for a metallic-circuit line, from one side or branch of the line, through the circuit of the line and then to a pair of switch contact-points normally closed but open while the line is switched by a switch

which controls them to a wire common to the lines, thence by an all-metallic connection to a test-wire connected to said common wire and containing a test receiving instrument, a rheotome in said common wire and a test plug or device in which said test-wire terminates, adapted to be brought for testing into connection with said side or branch of the line, and a battery in the circuit between said pair of contact-points and said test-plug, substantially as set forth.

3. A test-circuit for a metallic-circuit line disconnected from the ground at the central office, from one side or branch of the line through the circuit of the line and pairs of contact-points, one pair on each of several boards, to a wire common to the lines, thence to a test-wire, containing a test receiving instrument, said test-wire being connected to said common wire and terminating in a test plug or device adapted to be brought for testing into connection with said side or branch of the line, a rheotome in said common wire and a test-battery between the place where the lines are united with said common wire and said test-plug substantially as set forth.

4. A test-circuit for a telephone-line disconnected from the ground at the central office, from one side of a test receiving instrument, through the instrument to a test plug or device, thence when the test is applied to the line, thence through a pair of switch contact-points normally in contact but open while the line is switched by a switch which controls them, to a wire common to the lines, thence, to said side of the test receiving instrument, a rheotome in said common wire, a battery in the circuit between the place where the lines are united to said common wire and said test-plug, substantially as set forth.

5. A test-circuit for a telephone-line disconnected from the ground at the central office, through pairs of contact-points normally in the circuit of the line, one pair on each of several boards, to a wire common to the lines, thence in multiple or parallel circuit to test-wires, one for each board, branching off from said common wire, each containing a test receiving instrument and terminating in a test plug or device adapted to be brought for testing into connection with the line before the line passes to said pairs of contact-points, a rheotome in the circuit of said common wire between the lines and said test-wires and battery in circuit between the place where the lines are connected to said common wire and any test-plug, substantially as set forth.

6. A test-circuit for a telephone-line disconnected from the ground at the central office, through a pair of switch contact-points in the circuit of the line normally closed but open while the line is switched by a switch which controls them, to a wire common to the lines, thence in multiple or parallel circuit to test-wires, one for each of several boards, each test-wire containing a test receiving instrument and terminating in a test plug or

device adapted to be brought for testing into connection with said line before the line passes to said pair of contact-points, a rheotome in the circuit of the common wire between said lines and said test-wires and battery in the circuit thereby established, substantially as set forth.

7. In a telephone-exchange system, a metallic-circuit line ungrounded at the central office, one side or branch of which normally passes, successively, through pairs of switch contact-points, one pair on each of several boards and each pair normally in contact but open while the line is switched at their board, and thence connected through a wire common to the lines to one side of a test 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 the line, a rheotome in said common wire and a battery in the circuit between said contact-points and said test-plug, substantially as set forth.

8. In a telephone-exchange system, a line ungrounded at the central office and which normally passes, 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 thence through a wire common to the lines to one side of each of several test receiving instruments, one at each of the boards in combination with test plugs or devices, one for each of the instruments connected to it on the other side and adapted to be brought for testing into connection with the line, a rheotome in the circuit of the common wire and a battery in circuit between said contact-points and any test-plug, substantially as set forth.

9. In a telephone-exchange system, a line ungrounded at the central office and normally connected through a wire common to the lines to each of several test receiving instruments, one at each of several boards, in combination with switching devices to disconnect the line from its normal connection with one side of said instruments when the line is switched for conversation, test plugs or devices connected to the other side of the instruments one plug to each instrument and adapted to be brought for testing into connection with the line whether the line is switched or not, a rheotome in said common wire and a battery in circuit between the points where said normal connection may be broken and any test-plug, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, metallic-circuit line, switches for said line, one switch on each board for said line, each switch containing a pair of contact-points normally in contact but separated while the line is switched at their board and a third contact-piece insulated from the rest (except by the circuit connections), one branch of the line passing, suc-

cessively, through the pairs of contact-points of its switches and thence to a wire common to the lines, and the other branch of which is connected to said third contact-pieces of its switches, in combination with test-wires, one for each board, each branching off from said common wire, containing a test receiving instrument at its board and terminating in a test plug or device adapted to be brought for testing into connection with any of said third contact-pieces at its board, a rheotome in said common wire before said test-wires branch off from it and a battery in the test-circuit thereby established, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, telephone-lines ungrounded at the central office, switches for said lines, one switch for each line on each of the boards, each switch having a pair of contact-

points normally in contact but open while its line is switched at their board, each line passing normally through said pairs of contact-points of its switches and uniting with a wire common to the lines, in combination with test receiving instruments, one at each board each connected on one side to said common wire and on its other side to a test plug or device adapted to be brought for testing into connection with any line whether the line is switched or not, a rheotome in said common wire and battery in any test-circuit established on testing substantially as set forth.

In witness whereof I hereunto subscribe my name this 29th day of November, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,

MARGARETHA RIEHL.