

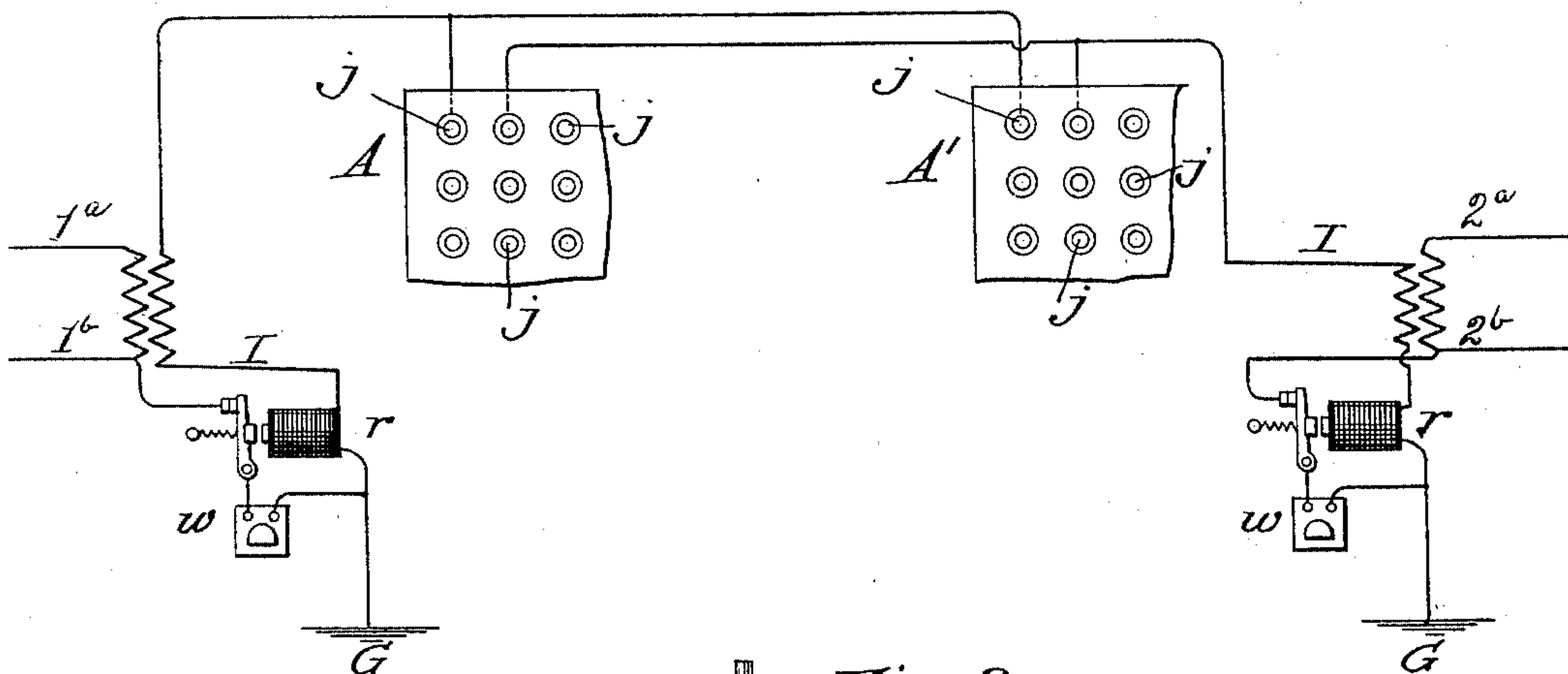
(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

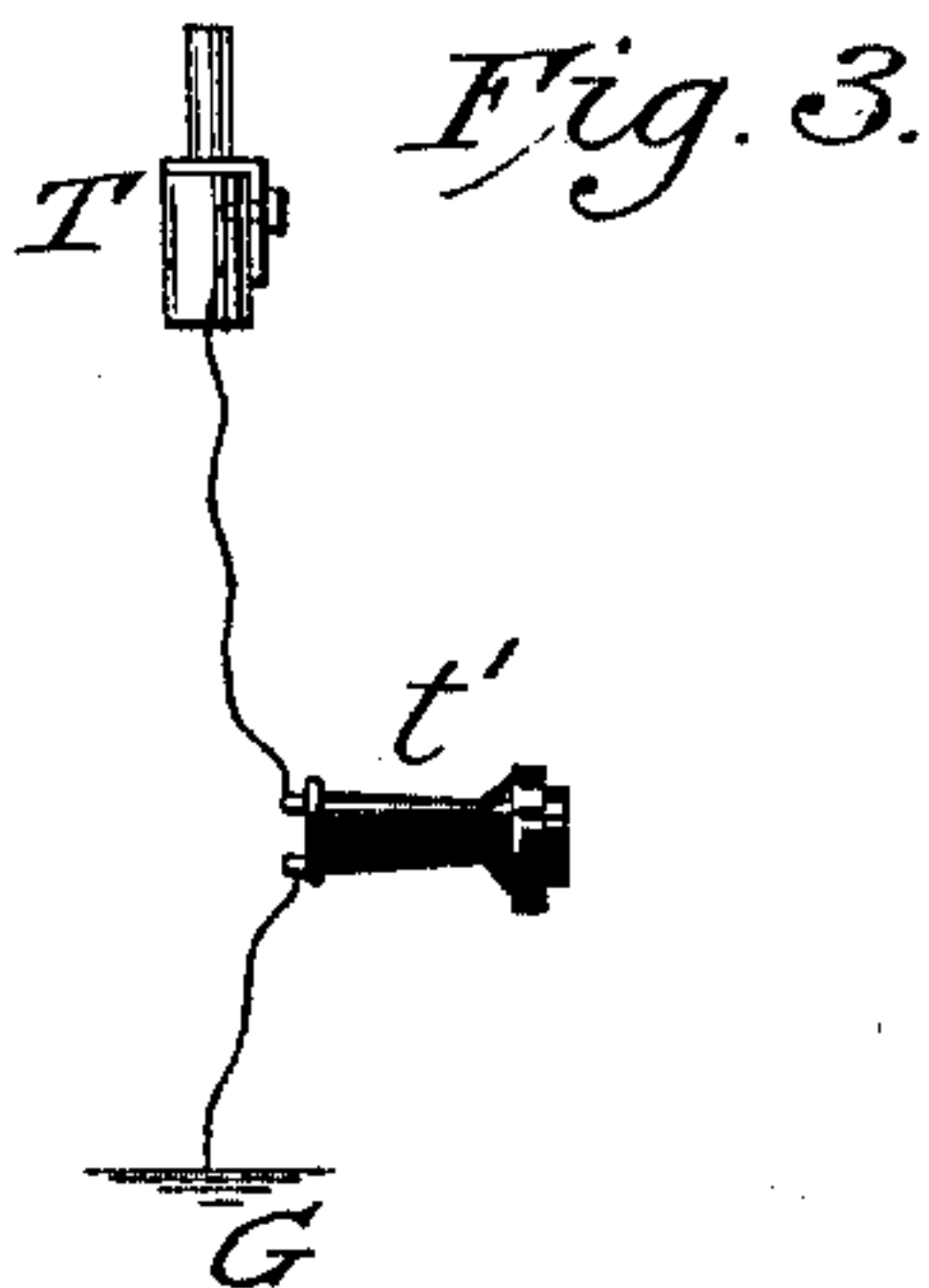
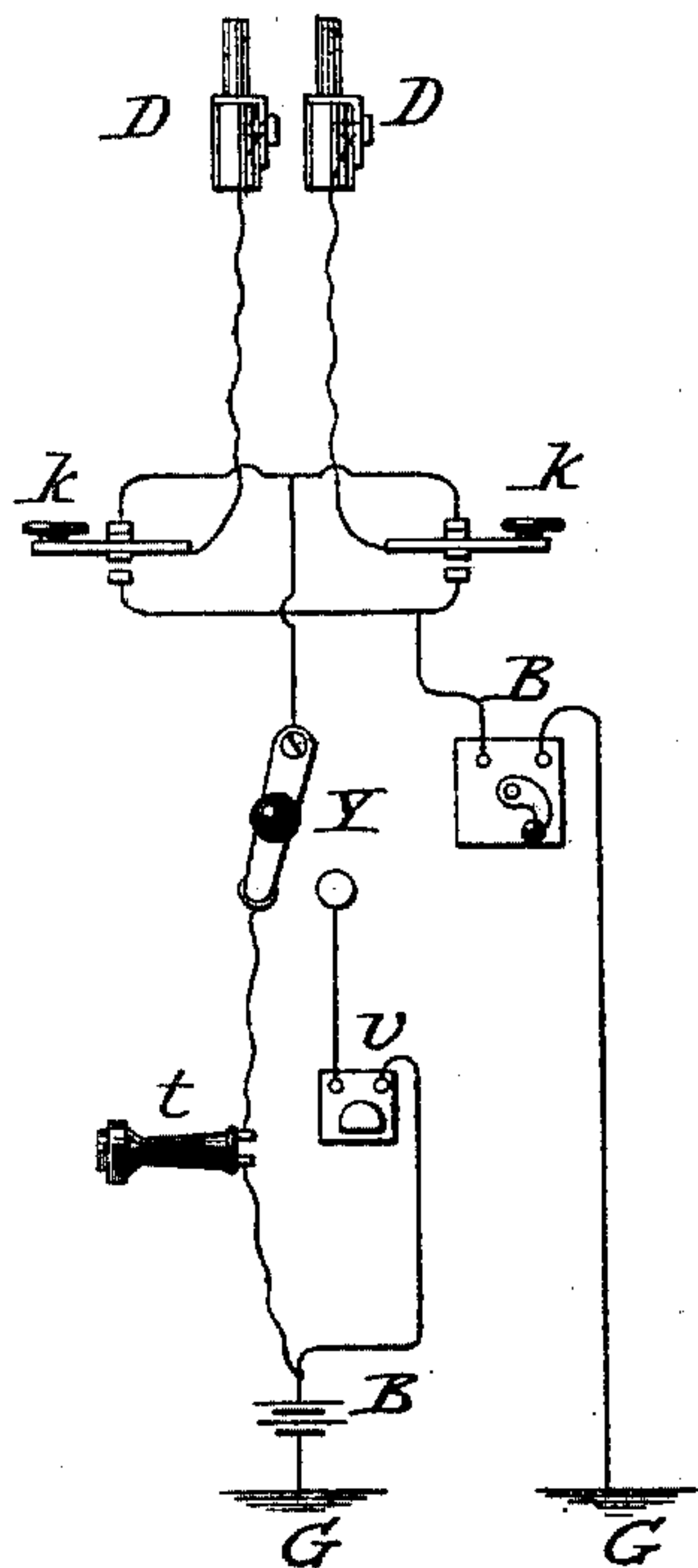
No. 592,407.

Patented Oct. 26, 1897.

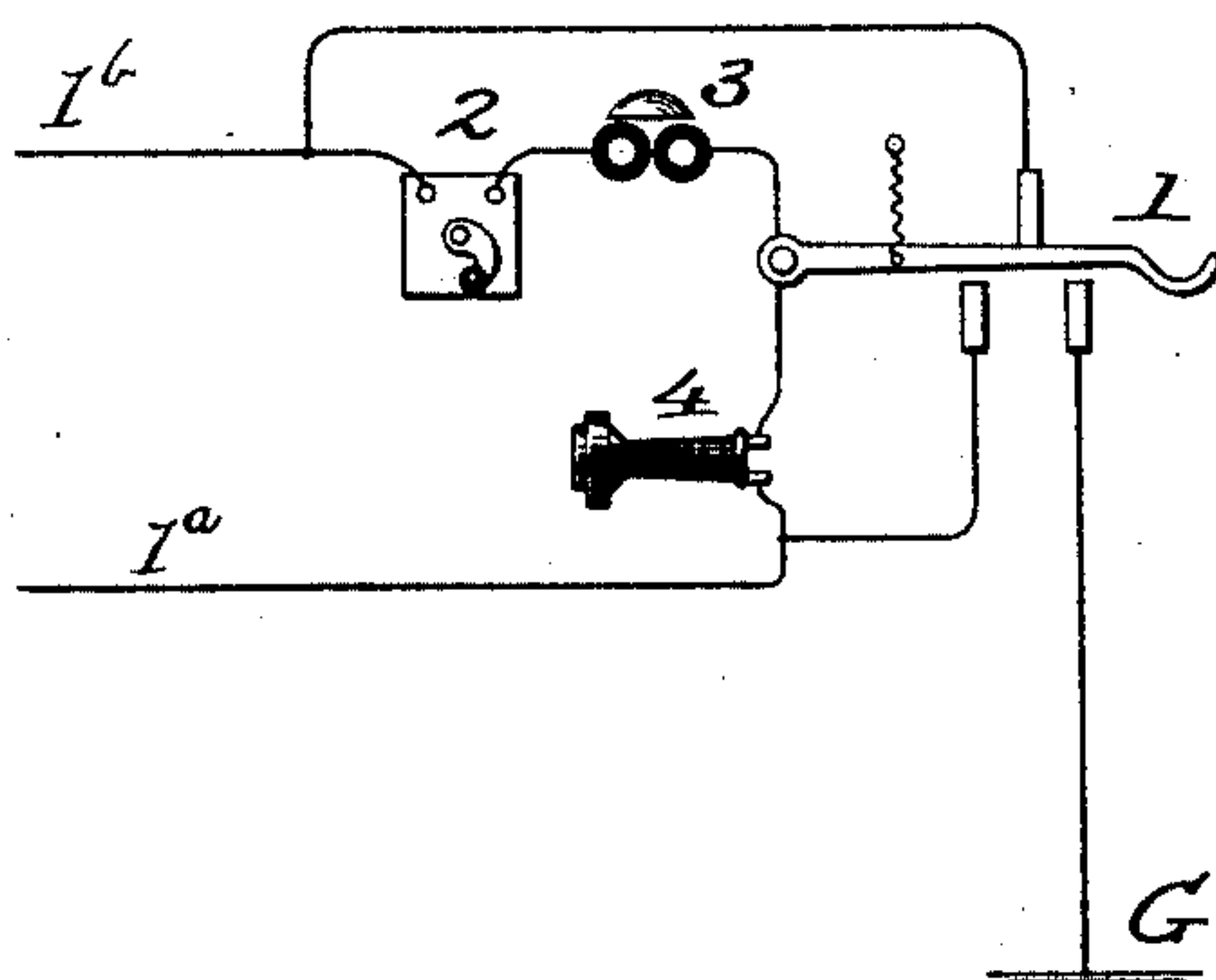
*Fig. 1*



*Fig. 2.*



*Fig. 4.*



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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. 592,407, dated October 26, 1897.

Application filed August 25, 1891. Serial No. 403,716. (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 induction-coil translators are used at the central office, one for each line; and it consists in a system of switching and of answering calls, sending  
15 signals to the subscribers wanted, and clearing-out signals and apparatus which I shall describe and claim in detail.

In the drawings illustrating my invention and the description of the same I use metallic-circuit lines and the multiple-switchboard system of operation. The invention is, however, applicable to other kinds of lines and to other than the multiple system of operation.

25 In the accompanying drawings, illustrating my invention, Figure 1 shows a front view of sections of the boards to which the same lines connect with the central-office apparatus of two lines and the connections thereto. Fig.  
30 2 shows an operator's cord system to be used at each board. Fig. 3 shows an operator's test system to be used at each board. Fig. 4 is a diagram of the subscriber's-station apparatus to be used with each line.

35 In Fig. 1, A A' are the sections of the two boards. Each board has a metallic socket or contact-piece for each line adapted to receive and form connection with the switch-plug shown in Fig. 2 and marked D D.  
40 Those contact-pieces are marked *jj*. I I are induction-coil translators. *r r* are plugs, and *w w* are annunciators, there being one of each for each line. The translators may be of the ordinary kind used in translating  
45 telephone-currents from one circuit to another and the relays of the ordinary form of back-contact relays, which have the relay-contacts closed when no current passes through the magnet and opened while a current is passing. One coil of each translator  
50 is in the circuit of its line. The contact-

pieces *jj* of a line are connected together and grounded through the other coil of the translator and the line-relay. One of the contact-points of the relay is connected to the line 55 and the other is connected to the ground, and the annunciator of the line is in this circuit between the line and the ground.

In the operator's cord system shown in Fig. 2, D D are a pair of switch-plugs; *k k*, two 60 calling-keys; Y, a switch; *v*, a clearing-out annunciator; *t*, the operator's telephone; B' a battery, and B a calling-generator. Each pair of plugs has two keys, one switch, and one clearing-out annunciator. One battery 65 and one calling-generator will answer for the exchange. The plugs are adapted to be inserted into the switch-holes of the terminals *jj* at their board and form connection with the terminals. The keys *k k* have each a 70 lever normally in contact with a point and another point against which the lever comes in contact when it is pressed away from the first-mentioned point.

One of the plugs is connected by a flexible 75 conductor to one of the key-levers, and the other plug is similarly connected to the other key-lever. The two points against which the levers normally press are connected together and connected to the lever of the switch Y of 80 the pair of plugs. The other contacts of the keys are grounded through the calling-generator. One of the contact-bolts of the switch Y is connected through the operator's telephone to one side of the battery B', and the 85 other bolt of the switch is connected through the clearing-out annunciator *v* to the same side of the battery. The other side of the battery is connected with the ground.

In the operator's test system shown in Fig. 90 3, T is the test-plug, and *t'* the test receiving instrument. The plug is connected to a flexible conductor and is adapted to be brought for testing into connection with any contact-piece *j* at its board and is grounded through 95 the test receiving instrument.

Only one pair of plugs with their special apparatus is shown in Fig. 2. Other pairs may be added as required by the operator and connected to the system substantially as described and as will be apparent to those skilled 100 in the art. The connection of a clearing-out



annunciator with a battery should not be through any other clearing-out annunciator.

Each operator has one cord system and one test system suitably arranged at her board.

5 In the subscriber's-station apparatus shown in Fig. 4, 1 is the telephone-switch; 2, the calling-generator; 3, the signal-receiving bell, and 4 the subscriber's telephone. The circuits and contacts are substantially as shown.  
10 When the telephone is on the switch, the bell and generator are in the direct circuit of the line and the circuit of the line is grounded. When the telephone is off the switch, it is in the direct circuit of the line and the ground  
15 connection of the line at the subscriber's station is removed.

The subscriber's-station apparatus should preferably be connected into the line-circuit so that the translator-coil at the central office  
20 is not in the normal circuit from the subscriber's ground through his calling-generator to ground through the relay-points and annunciator.

The operation of the system is as follows:  
25 When a subscriber wishes a connection, he operates his generator and a current passes through the ground-circuit, which includes his generator and annunciator, and operates the annunciator. The operator on observing  
30 the call places one of her plugs D in the metallic socket of the line and places the switch Y so that her telephone is in circuit with the plug. A complete circuit is thereby established which can be traced from the ground  
35 through the battery B', the operator's telephone, the switch Y to the other plug, and thence to ground through the translator-coil and relay of the line. The operator can then converse with the subscriber, the telephone-  
40 currents being translated from one circuit to the other through the translator, and can find out what line is wanted. She then tests for the line wanted, as will hereinafter be indicated, and if she finds that it is not already in use she  
45 places the other plug of the pair in the socket of the line. The translator-coils of the two lines are thereby included in a closed circuit and the circuit is grounded through the telephone and battery. The operator then  
50 presses on the key-lever which is connected with the plug in the socket of the line wanted, and the calling-generator is thereby included in a closed circuit with the translator-coil of the line, and induced currents will be sent to  
55 the line, which will ring the bell at the subscriber's station. The operator then releases the key and moves the switch Y, so that the clearing-out annunciator is connected in a third leg to the circuit of the two coils. The  
60 lines are then connected for conversation and any telephone-current generated in the circuit of one line will be translated through the translators of the two lines to the circuit of the other line. The two subscribers can there-  
65 fore carry on conversation.

When a plug is in the socket of any line, the line-relay is in closed circuit with the

battery B', and the relay-armature being attracted the circuit of the line to ground through the annunciator is opened. When, 70 therefore, a line is switched as described, its ground connection at the central office is opened.

When a subscriber desires to send a clearing-out signal, he operates his calling-generator 75 (which he may do after replacing his telephone on the switch.) A current is thereby generated in his line-circuit, and an induced current is generated in the circuit which contains the clearing-out annunciator, 80 and will operate it.

The battery B' should be so related to the relays and clearing-out annunciators that when they are connected as described the battery will operate the relay, but will not 85 operate the annunciator. This result can be easily obtained by having the relays of more sensitive construction than the annunciators.

Although the battery B' does not operate the clearing-out annunciators, it will, how- 90 ever, reinforce the clearing-out currents which are sent through them.

The test system is as follows: When an operator tests any line, she places her test-plug T on the metallic socket *j* of the line. If, 95 then, the line is switched as described, a complete circuit is established from the ground through the test receiving instrument to the piece *j* tested, thence to the piece *j*, in which a switch-plug is inserted, and thence 100 to ground through the battery B'. The instrument will then sound or respond. If, however, there is no plug in a socket of the line, the instrument will not sound. The operators can, therefore, determine on testing whether 105 or not any line is in use.

The clearing-out annunciators should preferably be constructed as to offer considerable retardation to telephone-currents. In certain cases separate retardation-coils might 110 be used if desired.

It is not necessary to the operation of the system that the central-office connections be all made to ground, as described. For instance, the translator-coils might be connect- 115 ed together by a metallic-circuit connection instead of going to ground, and in that case the connection of the test systems, the calling-generator, and the battery B' would be preferably to this circuit connection instead 120 of to ground, as described.

It will be observed in this system that the circuits of any two pairs of coils which are temporarily connected together for conversation between the subscribers are in connection. This connection is, however, between 125 the clearing-out annunciators of the two pairs of plugs used in making the connections. These annunciators may be of such construction as to offer considerable retardation to 130 the passage of telephone-currents and form retarding-coils.

With properly-constructed apparatus and circuits the connection above described will



not prevent the successful operation of the system.

I claim as my invention—

1. In a telephone-exchange system, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with a switchboard, switch-contacts on the board, one for each line, connected through the other coil of the translator to the ground, switch apparatus to connect together any two of said contacts, battery through which the contact of a line is grounded when connected with another contact, and relays one for each line in circuit with the translator-coil between its contact and the ground, said relay having two contacts normally closed but open while connected with the battery, one of said contacts being connected with the line and the other to a connection to ground, substantially as set forth.

2. In a telephone-exchange system, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with a switchboard, switch-contacts on the board, one for each line, connected through the other coil of the translator to the ground, switch apparatus to connect together any two of said contacts, a connection from a contact thus connected to the ground, but not through its translator-coil, battery in said connection, relays one for each line in circuit with the translator-coil between its contact and the ground, said relay having two contacts normally closed but opened while connected with the battery, one of said contacts being connected with the line and the other to a connection to ground, and annunciators, one for each line in its connection to ground, substantially as set forth.

3. In a telephone-exchange system, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with a switchboard, switch-contacts on the board, one for each line, connected with one side of the other coil of the translator and the other side of the coil being connected with the same side of the same coils of the other translators, switch apparatus to connect together any two of said contacts, relays one for each line in circuit with the translator-coil between its contact and the common connection of the coils, and battery in closed circuit with said relay while a contact of its line is connected with a contact of another line, said relay having two contacts normally closed but opened while connected with the battery, one of said contacts being connected with the line and the other to a connection to ground, substantially as set forth.

4. In a telephone-exchange system, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with a switchboard, switch-contacts on the board,

one for each line, connected to one side of the other coil of the translator, and the other side of the coil being connected with the same side of the same coils of the other translators, switch apparatus to connect together any two of said contacts, relays, one for each line, in circuit with the translator-coil between its contact and the common connection of the coils, and battery in closed circuit with the relay while a contact of its line is connected with the contact of another line, said relay having two contacts normally closed but opened while connected with the battery, one of said contacts being connected with the line and the other to a connection to ground, and annunciators, one for each line in its connection to ground, substantially as set forth.

5. In a telephone-exchange system, metallic-circuit lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with switching apparatus to connect any two of the other coils of the translators into a complete circuit, annunciators, one for each line in a normally closed ground connection of the line, contact-points in such normal ground connection normally closed but open while the translator-coil of the line is connected in circuit with another translator-coil, a ground connection of each line at the subscriber's station, open while the line is in use for conversation and closed while a signal is being sent by the subscriber, and a calling-generator between such grounds at the subscriber's station and central office, substantially as set forth.

6. In a telephone-exchange system, metallic-circuit lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with switching apparatus to connect any two of the other coils of the translators into a complete circuit, annunciators one for each line in a normally closed ground connection of the line, a switch at each subscriber's station with contacts to ground the line as long as the telephone is on the switch, and a calling-generator between such grounds at the subscriber's station and central office, substantially as set forth.

7. In a telephone-exchange system, metallic-circuit lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with switching apparatus to connect any two of the other coils of the translators into a complete circuit, annunciators, one for each line in a normally closed ground connection of the line, contact-points in such normal ground connection normally closed but open while the translator-coil of the line is connected in circuit with a translator-coil of another line, a switch at each subscriber's station with contacts to ground the line while the telephone is on the switch, and a calling-generator between such grounds at the subscriber's station and central office, substantially as set forth.

8. In a telephone-exchange system, two metallic-circuit lines and translators for said



lines, one translator for each line, one coil of which is in the circuit of its line, the other two coils of the translators being temporarily connected in a complete circuit for conversation between the two subscribers, relay in circuit with said other coils, a ground connection to each line normally closed but open while its translator-coil is thus connected for conversation, calling-annunciators, one for each line in its said ground connection, calling apparatus at each subscriber's station in the line-circuit while being operated, and a ground connection for each line at its subscriber's station closed at the will of the operator, substantially as set forth.

9. In a telephone-exchange system, a metallic-circuit line normally grounded at the central office and having in its circuit at the central office one coil of its translator, the other coil of the translator being temporarily switched for conversation with a translator-coil of another line and automatic disconnecting apparatus to disconnect the line from the ground at the central office as long as the coil is thus switched.

10. In a telephone-exchange system, two metallic-circuit lines, each normally grounded at the central office and having in its circuit at the central office one coil of its translator, the two other coils of the translators being temporarily switched in a circuit for conversation and automatically disconnecting apparatus for each line to disconnect the line from the ground at the central office as long as its coil is thus switched.

11. In a telephone-exchange system, a metallic-circuit line normally grounded at the central office and normally grounded at the subscriber's station, a calling-annunciator in its ground connection at the central office, and a calling-generator in the line-circuit at the subscriber's station, in combination with a translator for the line at the central office, one coil of which is in the circuit of the line, switching apparatus to disconnect the line from the ground at the central office in switching the other coil of the translator in a complete circuit for conversation, and a clearing-out annunciator in said complete circuit.

12. In a telephone-exchange system, subscribers' telephone-lines, annunciators, one for each line, each normally in a circuit with its line, switches on a switchboard, one for each subscriber's talking-circuit and having

each a contact-piece, electromagnetic devices, one for each line, each actuated when a current is established through it to open the normal circuit of the line with the annunciator, pairs of switch-plugs, each plug having a contact-piece adapted to form connection with said contact-piece of the switch of a subscriber's talking-circuit when the plug is placed in said switch to switch said talking-circuit for conversation, said contact-pieces of the pair of plugs being connected together by a flexible switch-conductor, and a battery connected on one side to said switch-conductors of said pairs of plugs and on its other side to circuit connections, one through the electromagnetic device of each line to said contact-piece of the switch for the line.

13. In a telephone-exchange system, multiple switchboards, subscribers' telephone-lines, annunciators one for each line, each normally in a circuit with its line, switches, one on each board for the talking-circuit of each subscriber and having each a contact-piece, electromagnetic devices, one for each line, each actuated when a current is established through it to open the normal circuit of the line with the annunciator, pairs of switch-plugs at each board, each plug having a contact-piece adapted to form connection at its board with said contact-pieces of the switches of the subscribers' talking-circuits when the plug is placed in either of said switches to switch a talking-circuit for conversation, said contact-pieces of each pair of plugs being connected together by a flexible switch-conductor, a battery or batteries connected on one side to said switch-conductors of said pair of plugs and connected on the other side in circuit connections, one through the electromagnetic device of each line to said switch contact-pieces of the switches of the line, and test receiving instruments, one at each board, each connected on one side to said last-named side of said battery or batteries and on its other side to a test plug or device adapted to be brought for testing into connection with either of said switch contact-pieces at its board.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,  
EDWARD S. FRASHER.