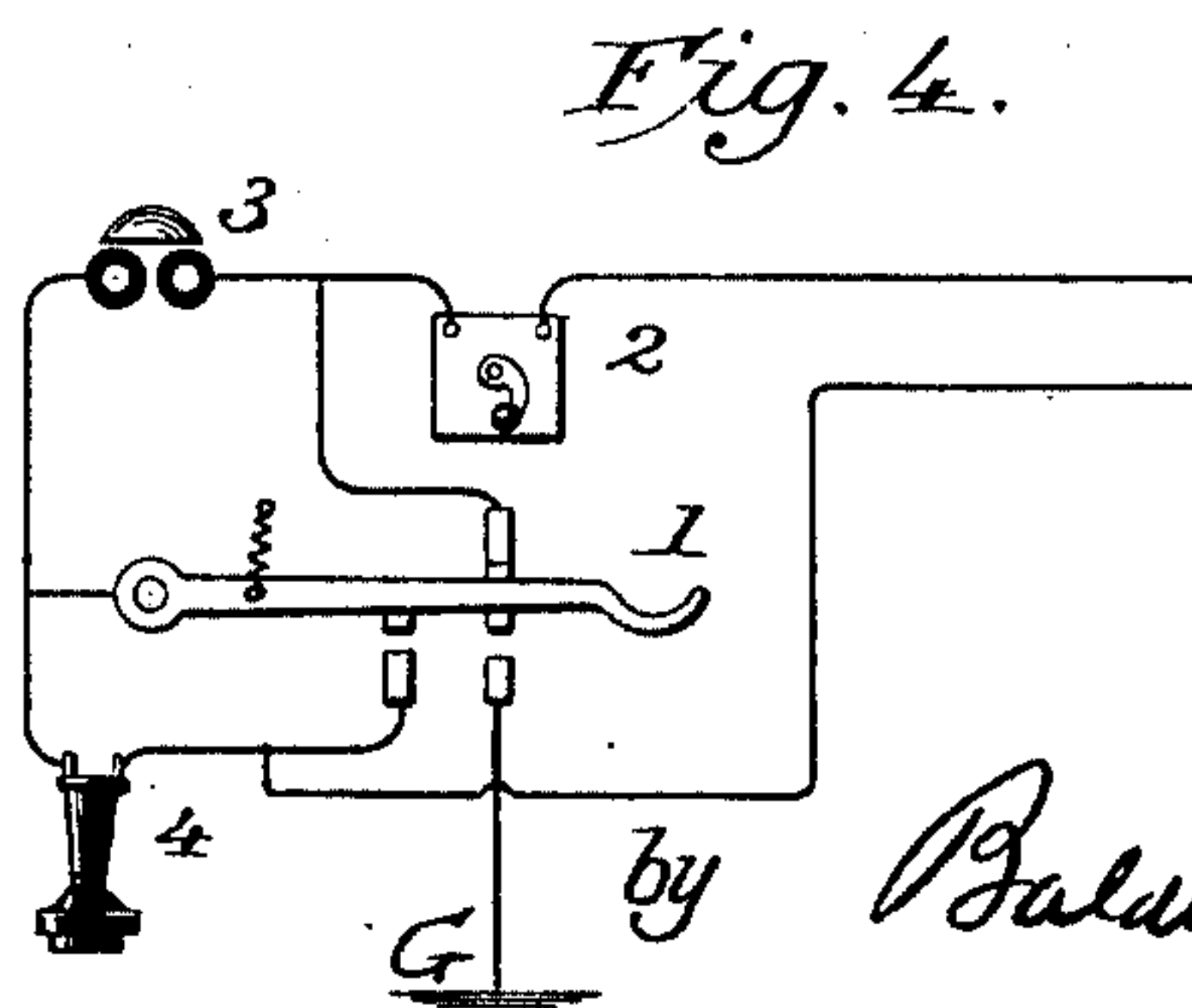
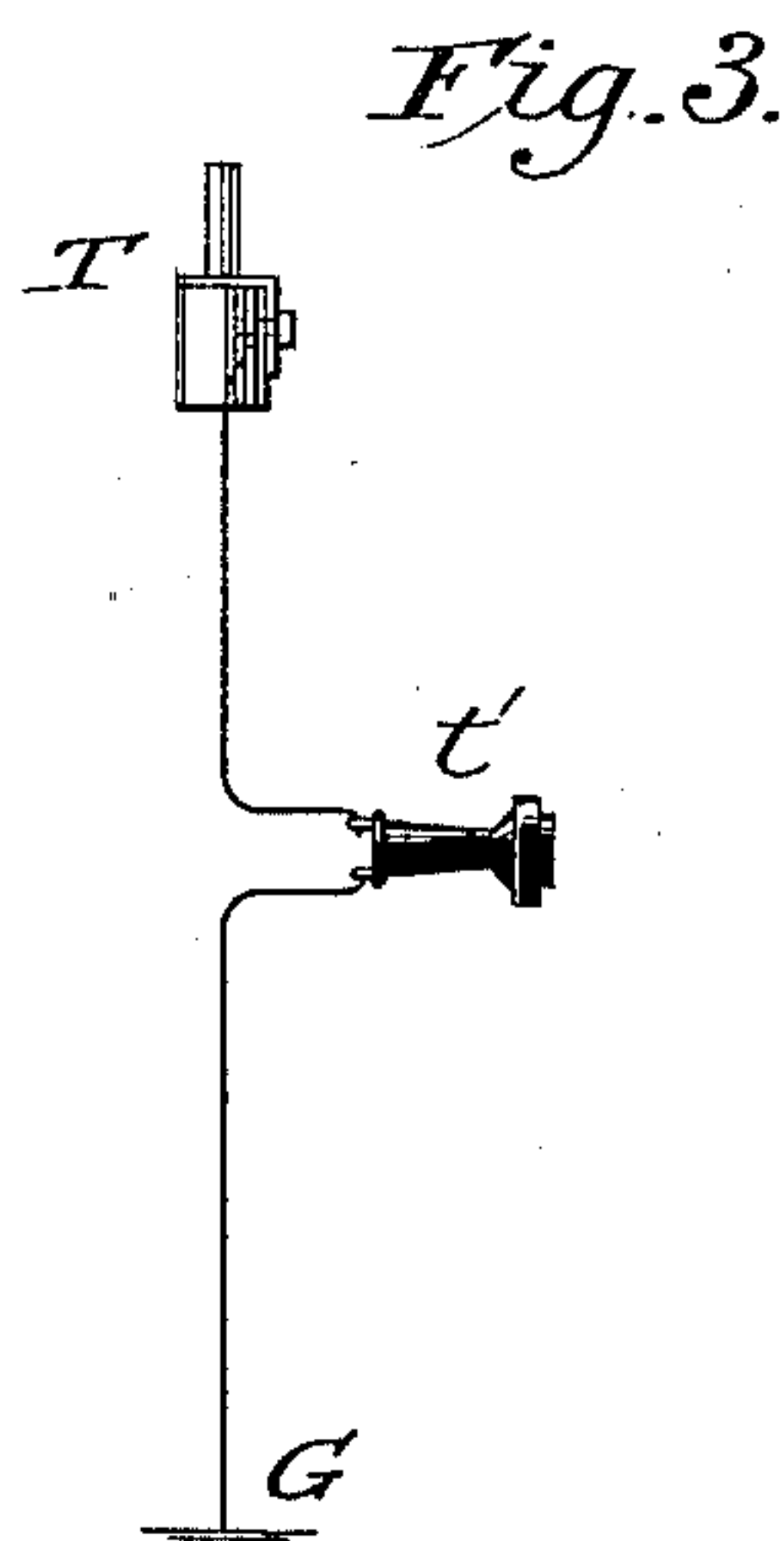
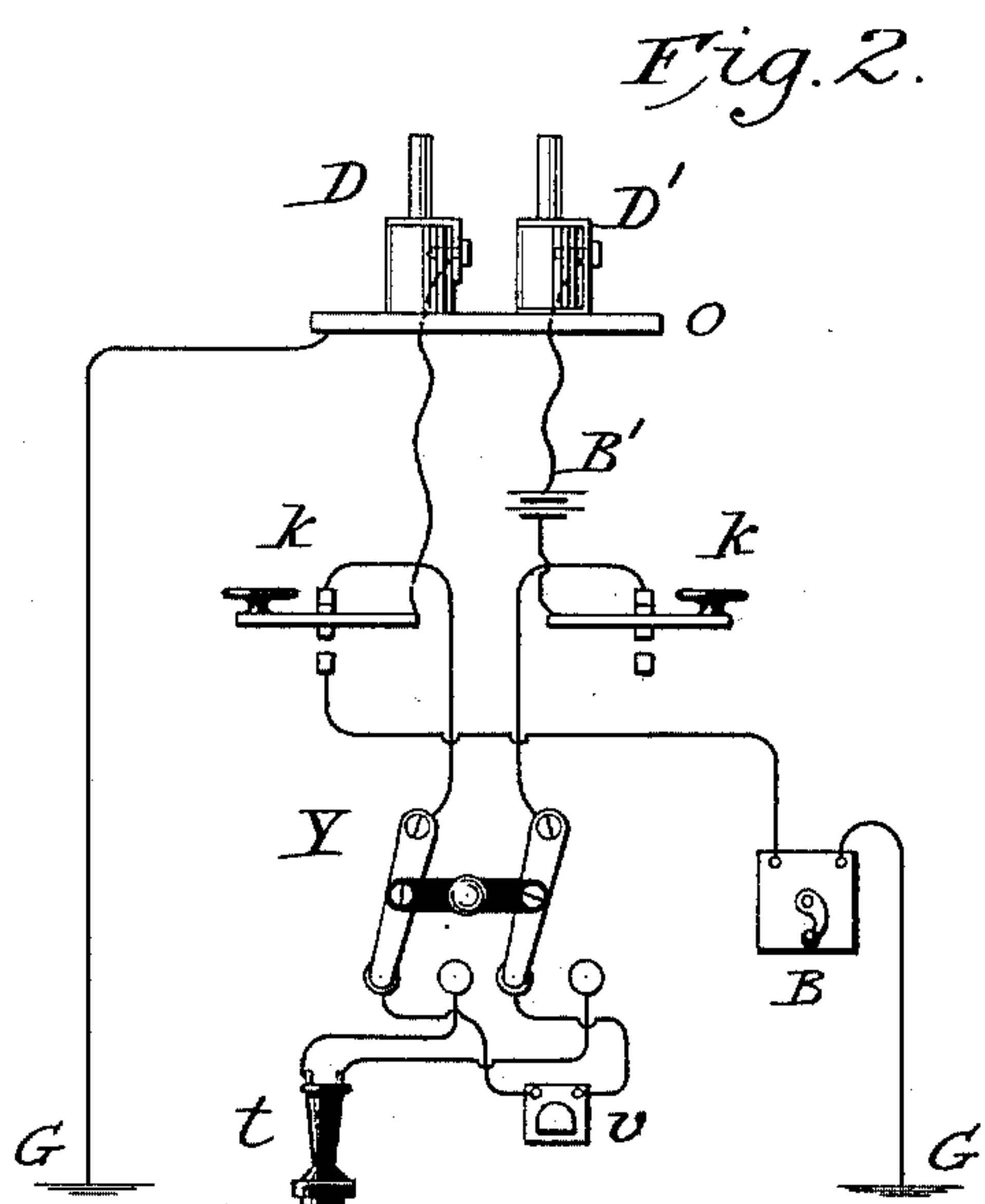
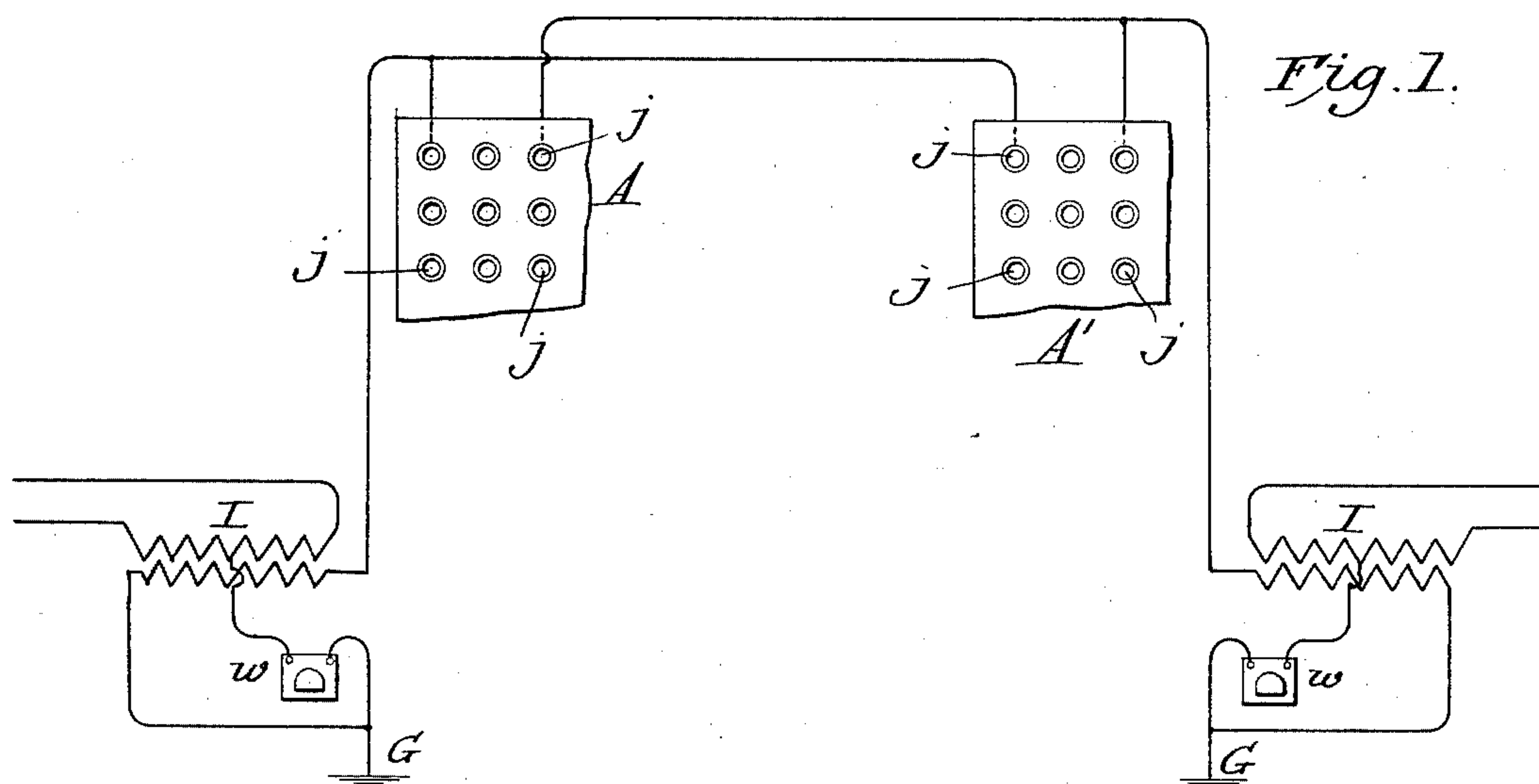


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,411.

Patented Oct. 26, 1897.



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. 592,411, dated October 26, 1897.

Application filed September 8, 1891. Serial No. 405,093. (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 especially to a telephone-exchange system in which the lines are metallic-circuit lines and in which induction-coil translators are used at the central office, one coil for each line; and it consists in a sys-  
15 tem of calling, switching, testing, and clearing out for such an exchange which I shall describe and claim in detail.

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

In Fig. 1, A A' are the sections of the two boards. Each board has a metallic socket or  
30 contact-piece for each line adapted to receive and form connection with the switch-plugs shown in Fig. 2 and marked D D'. These contact-pieces are marked *j j*. I I are induction-coil translators, and *w w* are annunciators,  
35 there being one of each for each line. The translators may be of the ordinary kind used in translating telephone-currents from one circuit to another. One coil of each translator is in the circuit of its line. The contact-  
40 pieces *j j* of a line are connected together and grounded through the other coil of the translator. Each line is grounded at the central office through the line-annunciator, and this ground connection may be permanent, as  
45 shown. This ground connection of the line through the annunciator is preferably made from the center of the translator-coil which is in circuit with the line.

In the operator's cord system shown in Fig.  
50 2, D D' are a pair of switch-plugs; *k k*, two calling-keys; Y, a looping-in 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 looping-in switch, one test-battery, and one clearing-out  
55 annunciator. One calling-generator will answer for the exchange. The calling-generator should preferably be such that intermittent or pulsatory currents may be sent in calling. The plugs are adapted to be inserted into the  
60 switch-holes of the terminals *j j* at their board and form connection with the terminals. The keys *k k* have each a lever normally in contact with a point and another point against which the lever comes in contact when it is  
65 pressed away from the first-mentioned point.

One of the plugs is connected by a flexible conductor to one of the key-levers and the other plug is similarly connected to the other  
70 key-lever. The two points against which the levers normally press are connected to the two levers of the switch Y of the pair of plugs.

The bolts of one pair of the contact-bolts with which the levers of the switch Y may be placed in contact are connected together  
75 through the operator's telephone and the other pair are connected together through the clearing-out annunciator of the pair of plugs. The test-battery of the pair of plugs is con-  
80 nected in circuit with one of the cords. The contact-pieces of the plugs D' D' extend, as shown, to the bottom of their handles and rest normally on the metal strip *o*, which connects them with the ground.

In the operator's test system shown in Fig.  
85 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  
90 contact-piece *j* at its board and is grounded through 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  
95 connected to the system substantially as described and as will be apparent to those skilled in the art.

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

In the subscriber's-station apparatus shown  
100 in Fig. 4, 1 is the telephone-switch; 2, the calling-generator; 3, the signal-receiving bell, and



4 the subscribers' telephone. The circuits and contacts are substantially as shown. When the telephone is on the switch, the bell is 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 connection of the line at the subscribers' station is removed.

The generator-magnet is in the circuit of the line when the generator is operated whether the telephone is on the switch or not.

The operation of the system is as follows: When a subscriber wishes a connection, he operates his generator while his telephone is on the switch and a current passes through the ground-circuit, which includes his generator and annunciator, and operates the annunciator. The operator on observing 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 through one plug, through the battery B', the operator's telephone, and the switch Y to the other plug which is in the metallic socket of the line, and thence to ground through the translator-coil of the line. The operator can then converse with the subscriber, the telephone-current 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 described, and if she finds that it is not already in use she places the other plug D of the pair in this socket of the line. The local translator-coils of the two lines are thereby included in a closed circuit and the telephone and battery are in the circuit. The operator then 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 the line which will ring the bell at the subscribers' station. On account of the connection of the line to ground through the annunciator being at the center of the translator-coil no current will be generated in the line-annunciator when the signal is thus sent through the circuit of the line and the annunciator will not be caused to indicate. The operator then releases the key and moves the switch Y, so that the clearing-out annunciator is connected in the circuit with the two translator-coils. When the lines are thus connected through their translators, the test-battery is in circuit with the annunciator 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 therefore carry on conversation.

When a subscriber desires to send a clearing-out signal, he operates his calling-generator before 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 and will operate it. As the telephone is off the switch when the clearing-out signal is sent there is no ground-circuit through the subscriber's line-annunciator and the annunciator will not be operated.

The subscriber's generator being in the closed metallic circuit of his line whenever it is operated, whether his telephone is on its switch or not, it follows that even if the subscriber, when his line is switched at the central office, operates his generator after he has placed his telephone on its switch the clearing-out annunciator at the central office will still be operated, because the generator is then also in closed circuit with the translator-coil at the central office and by induction current will pass to the other coil of the translator to operate the clearing-out annunciator. This is important, as the subscriber whose line is still connected at the central office may sometimes through forgetfulness of the rules, or because he thinks the disconnection has already been made, operate his generator after having placed his telephone on its switch. It is important to have the system such that even then the clearing-out annunciator will be operated. This I accomplish by having the calling-generator in the closed circuit of the line whenever it is operated and whether a primary calling or a clearing-out signal is intended.

The battery B' should be so related to the clearing-out annunciator that when they are connected as described the battery will not operate the annunciator. This result can be easily obtained by having the annunciators less sensitive than the test receiving instruments.

Although the battery B' does not operate the clearing-out annunciator, it will, however, reinforce the clearing-out currents which are sent through it.

The test system is as follows: When an operator tests any line, she places her test-plug T on the metal socket *j* of the line. If, 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 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 operator can therefore determine on testing whether or not any line is in use.

It will be observed that when a test is made as described and a switch-plug is in a metallic socket which belongs to the line there will be two connections to ground—one through the test-battery of the plug used and the other through the translator-coil connected to the metal socket. The translator-coil is of such resistance that with a suitable test re-



ceiving instrument—as, for instance, a hand-telephone—the instrument will not be short-circuited so as to be prevented from responding.

5 It will also be observed that when the test is made and a switch-plug is in a metallic socket which belongs to the line there will be a connection to ground through the test-battery whether or not the other plug of the  
10 pair is in the metal socket of a line. When it is not, the connection is to ground through the plate *o*, on which the plug normally rests, and when it is in the metal socket of a line the connection is to ground through the trans-  
15 lator-coil of that line.

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 connected  
20 by a metallic-circuit connection instead of going to ground, and in that case the connection of the test systems and the calling-generator *B'* would be preferable to this circuit connection instead of to ground, as described.

25 The advantage of the construction of the switch-plugs *D D'*, by which *D'* is normally grounded and *D* is normally open to the ground, (except through its connection with *D'*), is that the operator may leave her tele-  
30 phone normally in circuit with each pair of her plugs without having it on closed circuit with the plug-circuit and may connect so as to talk with any subscriber by the mere act of placing the plug *D* in the metal socket of  
35 the line, whereas otherwise it would be necessary for the operator to leave her telephone normally out of circuit with the plugs and operate the switch *Y* before beginning conversation.

40 I claim as my invention—

1. In a telephone-exchange system, metallic-circuit lines, each grounded at the subscriber's station as long as the subscriber's telephone is not switched for use and only  
45 then, and translators for said lines at the central office, one for each line, one coil of which is in the circuit of the line, in combination with annunciators, one for each line, in a ground connection from the center of said  
50 coil of the line, signal-bells, one for each line, in the circuit of the line at the subscriber's station while the subscriber's telephone is not switched for use, calling-generators, one for each line in circuit at the subscriber's station  
55 between such ground connections of the line at the subscriber's station and the central office, switching apparatus to connect together any two of the other coils of the translators and calling apparatus whereby a calling-current may be sent through either of said other  
60 coils of the translators, substantially as set forth.

2. In a telephone-exchange system, metallic-circuit lines, each grounded at the subscriber's station as long as the subscriber's telephone is not switched for use and only  
65 then, and translators at the central office for

said lines, one for each line, one coil of which is in the circuit of the line, in combination with annunciators, one for each line, in a  
70 ground connection of the line at the central office, calling-generators, one for each line, in the circuit of the line whenever the generator is being operated, connecting apparatus to connect together any two of the other coils  
75 of the translators and a clearing-out annunciator in circuit with any two coils thus connected, whereby each subscriber may operate his line-annunciator and whenever his line is thus connected for conversation and his gen-  
80 erator is operated the clearing-out annunciator will thereby be operated, substantially as set forth.

3. In a telephone-exchange system, metallic-circuit lines and translators at the central  
85 office for said lines, one for each line, one coil of which is in the circuit of the line, in combination with annunciators, one for each line, in a ground connection from the center of said coil of the line, a clearing-out annunciator in  
90 circuit with the other or local coil of the translator of the line when said coil is connected with the coil of another line for conversation between subscribers, a calling-generator at each subscriber's station in the  
95 closed metallic circuit of the line whenever the generator is being operated to call the central office and a ground connection of the line at the subscriber's station closed by the telephone-switch while the telephone is on  
100 the switch, whereby the subscriber by operating his calling-generator when the telephone is on the switch operates the line-annunciator and by operating the generator when the telephone is off the switch operates  
105 a clearing-out annunciator which may be in circuit with the local coil of the line without operating the line-annunciator.

4. In a telephone-exchange system, metallic-circuit lines and translators at the central  
110 office for said lines, one for each line, one coil of which is in the circuit of the line and the other coil of which is local to the central office, in combination with annunciators, one for each line, in a ground connection to the  
115 line, switching apparatus to connect together any two of said local coils, a clearing-out annunciator in circuit with a local coil when the coil is connected with another coil, a calling-generator at each subscriber's station in the  
120 closed metallic circuit of the line whenever the generator is operated for calling, and a ground connection to the line closed at the will of the subscriber, whereby he may at will operate his line-annunciator or whenever he  
125 operates his generator a clearing-out annunciator which may be in circuit with the local coil of his line-translator will invariably be operated.

5. A metallic circuit extending from the  
130 subscriber's station to the central office and including at the central office one coil of a translator, in combination with a branch from the center of said coil to the ground, an an-



nunciator in said branch, an annunciator in circuit with the other coil of the translator while said coil is connected for conversation, a calling-generator at the subscriber's station  
5 in said metallic circuit whenever the generator is operated for calling or clearing out and a ground connection to said metallic circuit at the subscriber's station closed at the will of the subscriber, whereby the subscriber  
10 may at will operate said first-mentioned generator and said second-mentioned annunciator is in circuit with the coil of the translator said annunciator will invariably be operated.

6. A metallic circuit extending from the  
15 subscriber's station to the central office and including at the central office one coil of a translator, in combination with a branch at the central office from said metallic circuit to the ground, an electromagnet in said branch,

an annunciator in circuit with the other coil of 20 the translator while said coil is connected for conversation, switching apparatus at each subscriber's station to, at the will of the subscriber, ground said circuit, and a calling-generator in said metallic circuit whenever 25 the generator is being operated while said ground connection is opened or closed, whereby whenever said generator is operated and said annunciator is in circuit with said other coil of the translator said annunciator will 30 invariably be operated.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

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