

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,410.

Patented Oct. 26, 1897.

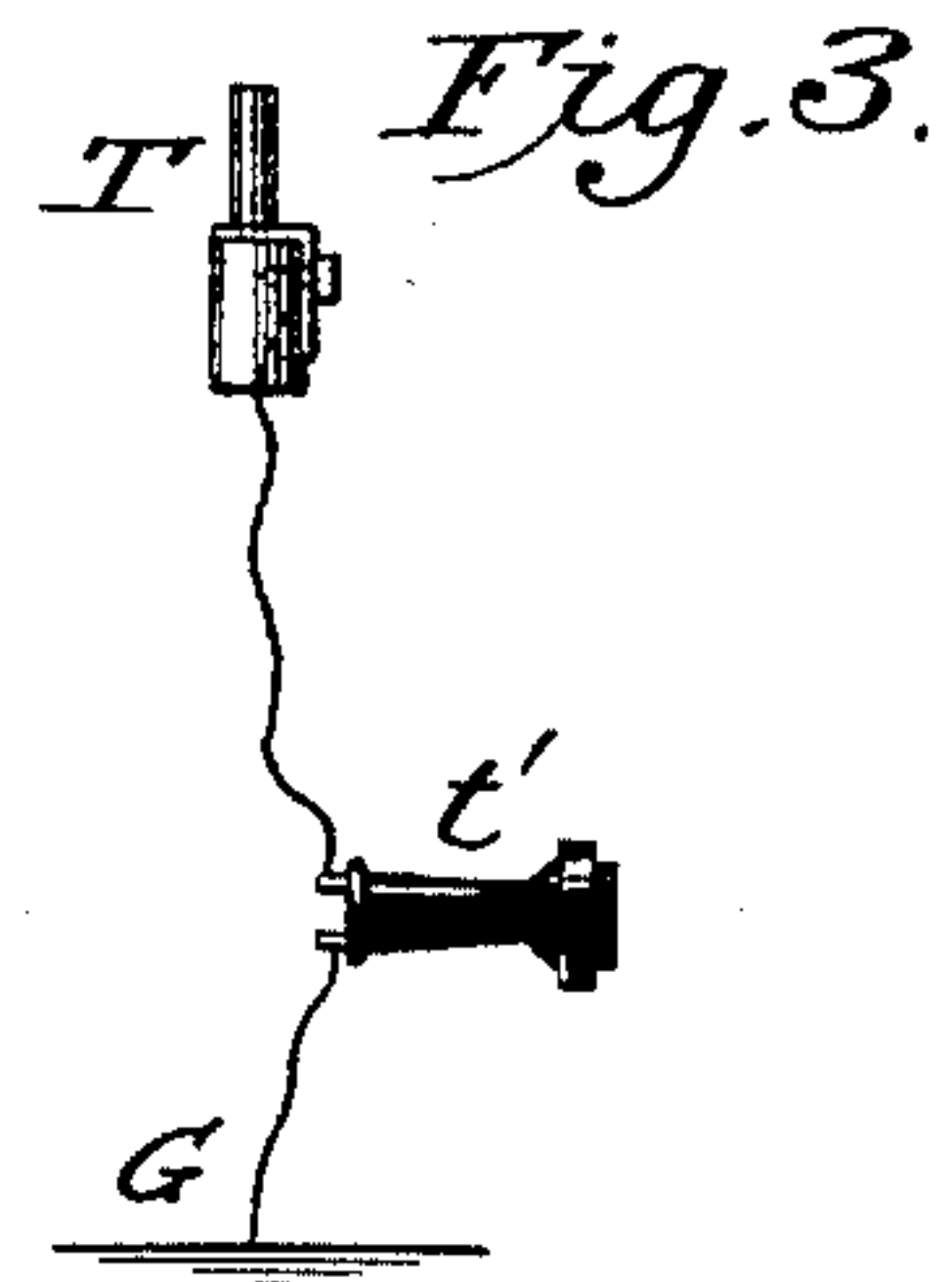
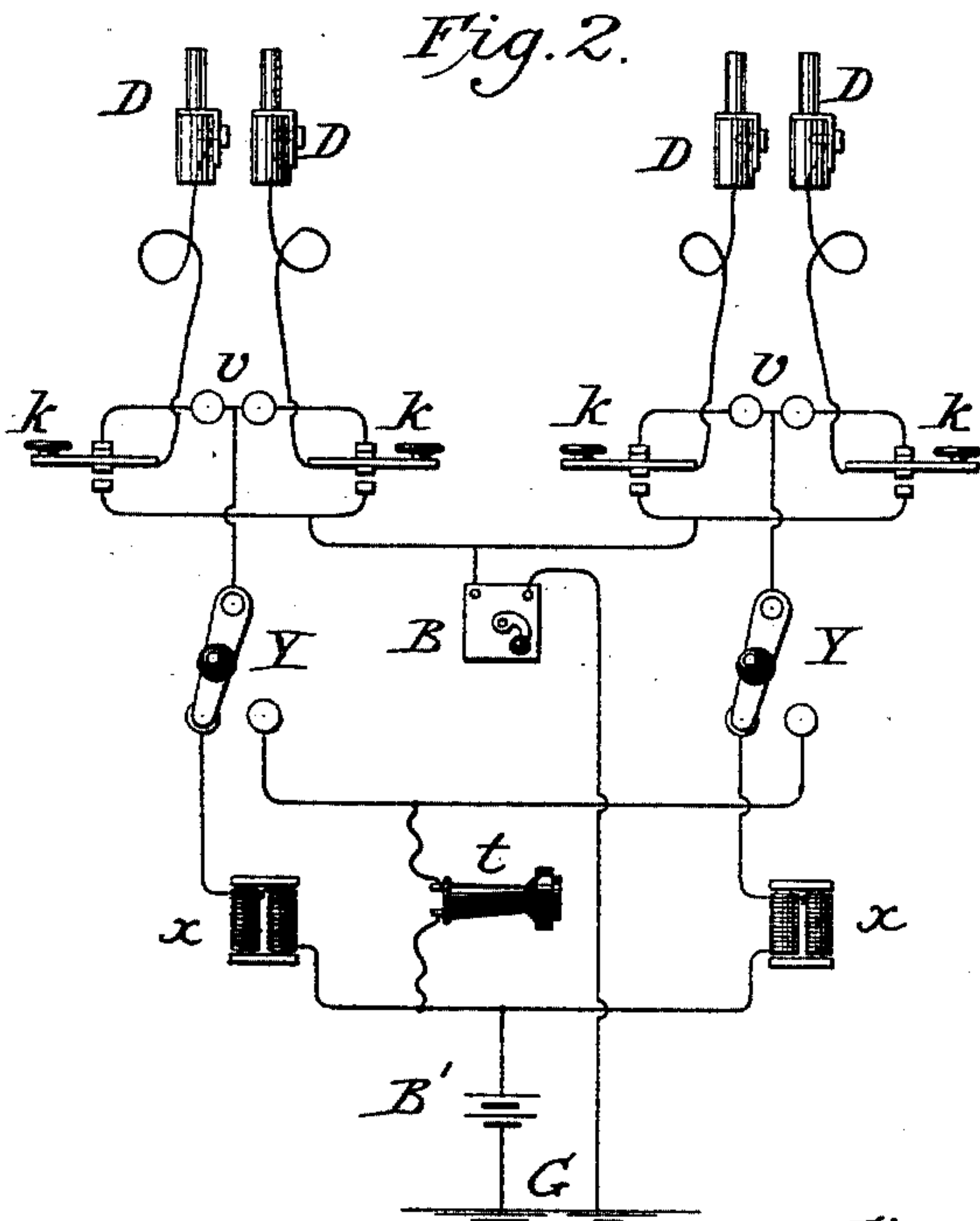
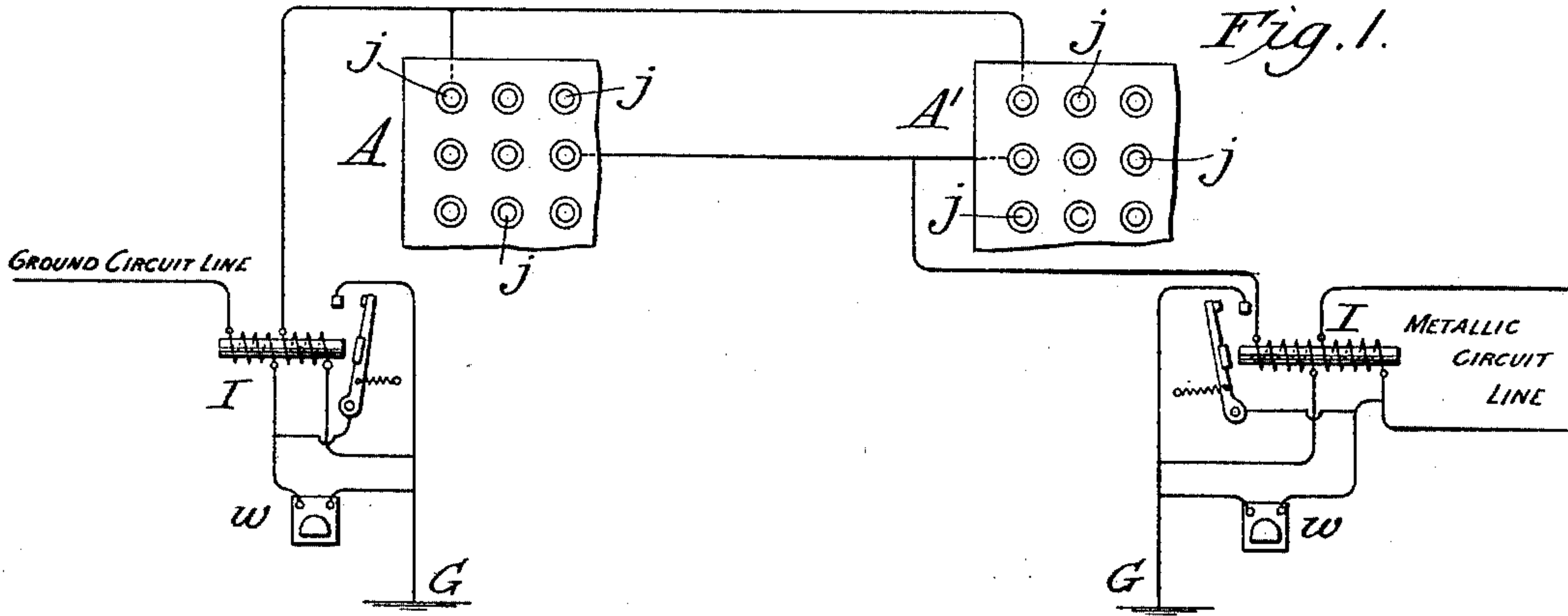
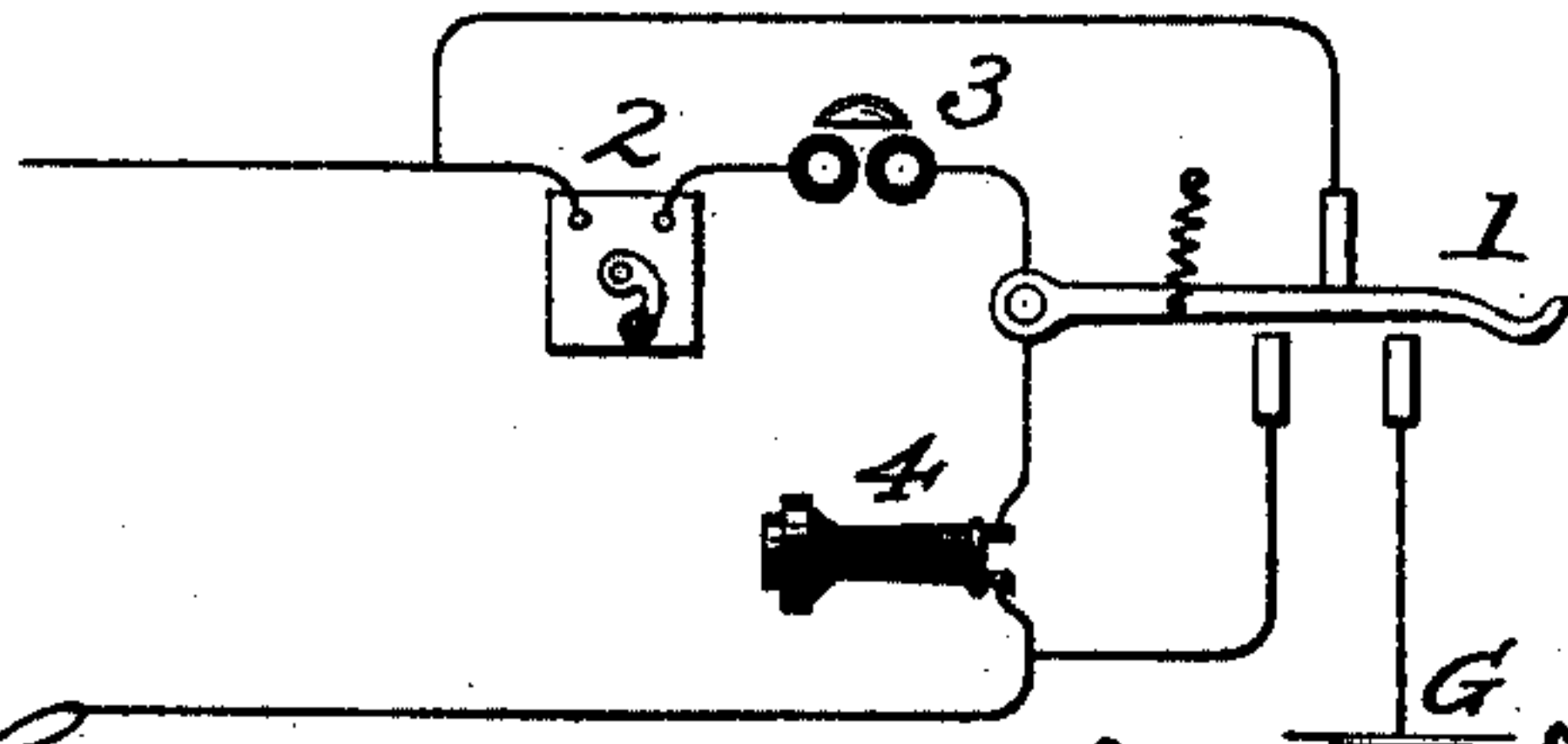


Fig. 4



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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. 592,410, dated October 26, 1897.

Application filed August 31, 1891. Serial No. 404,338. (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 more especially to a telephone-exchange system in which induction-coil translators are used at the central office, one for each line. It is applicable to metallic-circuit or to ground-circuit systems

15 or to a system in which the two kinds of lines are mixed.

My invention consists, first, in a system of line-annunciators and switching at the central office which I shall describe and claim in detail.

It consists, secondly, in an organization for answering calls, making connections, and testing at the central office which I shall describe and claim in detail.

25 In the accompanying drawings, illustrating my invention, Figure 1 shows a front view of sections of two boards to which the same lines connect with the central-office apparatus and connections of two lines, one a metallic-circuit line and one a ground-circuit line.

30 Fig. 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 a subscriber's-station apparatus to be used with each metallic-circuit line.

There are as many switchboards as required for the number of lines of the exchange. In Fig. 1 two boards are shown, (marked A A'.)

40 Each board has a metallic socket or 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*.

45 I I are induction-coil translators, one for each line of the exchange. These translators have each an iron core and two coils or helices wound around the core, one of which is connected in the circuit of the line and may be called the "main-line" coil and the other of

50 which is connected locally to the central office

and may be called the "local" coil. Each translator has a relay-armature which is attracted by the core when a current of sufficient strength is maintained in one of the coils, preferably the local coil. It has also a pair of contact-points normally open, but closed to each other when the armature is attracted and moved by the core.

w w are annunciators, of which there is one for each line. Each line is in circuit with the main-line coil of its translator.

The annunciator of each ground-circuit line is in the circuit of the line. The annunciator of each metallic-circuit line is in a ground connection to the line. One of the contacts of a line-translator is connected to one side of the line-annunciator, and the other contact is connected to the other side of the annunciator. When, therefore, the pair of contacts of the translator are closed to each other, the annunciator is shunted or short-circuited by the circuit which is established through the pair of contacts. One side of the local coil of each translator is connected to all the contacts *j j* of the line to which the contacts belong. The other sides of the local coils are connected to the ground.

In the operator's cord system shown in Fig. 2 two pairs of switch-plugs are shown, each marked D D. Each pair of plugs has two calling-keys, (marked *k k*,) a switch, (marked Y,) a clearing-out annunciator, (marked *v*,) and a retardation-coil, (marked *x*.) Each key has a lever normally in contact with a point and has another point against which the lever comes in contact when it is pressed away from the first-mentioned point.

t is the operator's telephone. B' is a battery, and B is a calling-generator. Each operator has a telephone. One battery and one calling-generator will answer for the exchange.

The plugs are adapted to be inserted into the switch-holes of the terminals *j j* at their board and form connection with the terminals.

The switches Y Y have each a lever and two contact-bolts, on which the lever may be alternately placed at the will of the operator.

One of the plugs of a pair is connected by a flexible conductor to one of the key-levers

of the pair, and the other plug is similarly connected to the other key-lever. The two points against which the levers normally press are connected together through the clearing-out annunciator of the pair. The other contacts of the keys are grounded through the calling-generator. The lever of the switch Y of the pair of plugs is connected to the circuit connection which connects the contact-points normally in contact with the key-levers, the connection being preferably between the two coils of the line-annunciator. One of the contact-bolts of the switch Y is connected through the retardation-coil of the pair of plugs to one side of the battery B'. The other contact-bolt is connected through the operator's telephone to the same side of the battery. The other side of the battery is grounded.

The retardation-coils $\alpha \alpha$ are electromagnetic self-induction coils with closed or practically or nearly closed magnetic circuits, and they offer very high impedance or self-induction effect to rapidly-alternating telephone-currents, while affording a path of comparatively low resistance to the straight currents of the test system. Other forms of electromagnetic coils might also be used which produce a high degree of self-induction to rapidly-changing currents.

In the operator's test system shown in Fig. 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 the test receiving instrument. Other pairs of plugs with their special apparatus may be added, as required, to the operator's system and connected to the same substantially as required and as will be apparent to those skilled in the art. Each operator has one cord system and one test system, each suitably mounted and arranged for her work.

In the subscriber's-station apparatus for metallic-circuit lines 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 connections are substantially as shown. 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 connection of the line at the subscriber's station is removed.

The subscriber's-station apparatus for metallic-circuit lines should preferably be connected into the line-circuit, so that the translator-coil at the central office is in the normal circuit from the subscriber's ground through his calling-generator to ground at the central office through the line-annunciator. The subscriber's-station apparatus for the ground-circuit lines may be the usual form of apparatus for such lines.

The operation of the system is as follows:

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 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 the battery B', the operator's telephone, the switch Y to the plug, and thence to ground through the translator-coil of the line. The operator can then converse with the subscriber, the telephone-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 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 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 subscriber's station. The operator then releases the key and moves the switch Y, so that the retardation-coil is connected in a third leg to the circuit of the two coils. The 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 therefore carry on conversation. When a plug is in the socket of any line, the local coil of the translator of the line is in closed circuit with the battery B', and the relay-armature being attracted the annunciator of the line is shunted or short-circuited by the closing of the contact-points, so as to be practically out of the circuit in which it is placed.

When a subscriber desires to send a clearing-out signal, he operates his calling-generator, (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 and will operate it. The line-annunciator will not be operated thereby, because it is shunted or short-circuited, so that sufficient current will not pass through it to operate it.

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, 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 is not necessary to the operation of the system that the central-office connections of the local translator-coils be made to ground as described. For instance, the translator-coils might be connected 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 preferable to this circuit connection instead 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 the retardation-coils of the two pairs of plugs used in making the connections. With properly-constructed apparatus and circuits the connections above described will not prevent the successful operation of the system. It will also be observed that when the local coils of two translators are left connected together for conversation between two subscribers there is a bridge-circuit across the circuit thereby established and between the two coils. This bridge-circuit, however, contains a retardation-coil, and therefore will not greatly decrease the amount of the telephone-currents which would otherwise pass through the complete circuit.

The operation relating to the line-annunciators whereby they are shunted or short-circuited when the local coils of the line-translators are switched for conversation may be obtained with other arrangements of circuits and apparatus than what I have described. For instance, there may be a separate battery in the circuit of each pair of cords, which will operate the armature of a translator when connected in circuit with one of its coils.

The prevention of the operation of the line-annunciator may be accomplished in other ways, one of which is shown in my application, Serial No. 403,714, where a branch circuit containing the line-annunciator is opened when the line is switched; nor, broadly considered, is this part of my invention confined to the use of converters.

The operation relating to the retardation-coils whereby when two pairs of local coils connected together into complete circuits for conversation between subscribers and the circuits are connected together through retardation-coils may also be obtained with other arrangements of apparatus and circuits than what I have described.

My invention is not therefore limited to the particular arrangements of circuits and apparatus which I have described.

I claim as my invention—

1. In a telephone-exchange system, a switch-board, telephone-lines, translators for said

lines at the central office, one coil of which is in the circuit of the line, switching apparatus to connect together any two of the other coils into a complete circuit for conversation between their two subscribers, and battery in circuit with any coil while thus connected, in combination with annunciators, one for each line, an armature for each translator, moved when its coil is thus connected with a battery, a pair of contacts for each armature, one connected to one side and the other connected to the other side of its line's annunciator, said contacts being normally open to each other but closed when the armature is thus moved.

2. In a telephone-exchange system, a switch-board, telephone-lines, translators for said lines at the central office, one coil of which is in the circuit of the line, switching apparatus to connect together any two of the other coils into a complete circuit for conversation between their two subscribers, and battery in circuit with any coil while thus connected, in combination with annunciators, one for each line, in the circuit of the line, an armature for each line, moved when its coil is connected with a battery, a pair of contacts for each armature, one connected to one side and the other connected to the other side of its line's annunciator, said contacts being normally open to each other but closed when the armature is thus moved.

3. In a telephone-exchange system, a switch-board, telephone-lines, translators for said lines at the central office, one coil of which is in the circuit of the line, switching apparatus to connect together any two of the other coils into a complete circuit for conversation between their two subscribers, and battery in circuit with any coil while thus connected, in combination with annunciators, one for each line, an armature for each line, automatically moved when its coil is thus connected with a battery, a pair of contacts for each armature, one connected to one side and the other connected to the other side of its line's annunciator, said contacts being normally open to each other but closed when the armature is thus moved.

4. In a telephone-exchange system, a switch-board, telephone-lines, translators for said lines at the central office, one coil of which is in the circuit of the line, switching apparatus to connect together any two of the other coils into a complete circuit for conversation between their two subscribers, and battery in circuit with any coil while thus connected, in combination with annunciators, one for each line, in a ground connection of the line, an armature for each line, automatically moved when its coil is thus connected with a battery, a pair of contacts for each armature, one connected to one side and the other connected to the other side of its line's annunciator, said contacts being normally open to each other but closed when the armature is thus moved.

5. In a telephone-exchange system, sub-

scribers' telephone-lines, annunciators, one for each line, each having its magnet permanently in circuit connection 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 having a different electromagnet than said annunciator-magnet of the line actuated when a current is established through it and preventing the operation of the line-annunciator by a current sent over the line, 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.

6. In a telephone-exchange system, multiple switchboards, subscribers' telephone-lines, annunciators one for each line, each having its magnet permanently in circuit connection 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 having a different electromagnet than said annunciator-magnet of the line actuated when a current is established through it and controlling the line-annunciator that it will not be then operated by a current sent over the line, 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.

7. In a telephone-exchange system, multiple switchboards, subscribers' telephone-lines, switches, one on each board for the talking-circuit of each subscriber and having each a contact-piece, electromagnetic devices one for each line, 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 connected on one side to said switch-conductors of said pairs 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.

8. In a telephone-exchange system, multiple switchboards, subscribers' metallic-circuit telephone-lines, switches, one on each board for the talking-circuit of each subscriber and having each a contact-piece not connected to the line, resistances, one for each line, 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 connected on one side to said switch-conductors of said pairs of plugs and connected on the other side in circuit connections, one through the resistance 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.

9. In a telephone-exchange system, the combination of a switch board or boards, subscribers' telephone-lines or talking-circuits, switches therefor on the board or boards, an individual annunciator permanently, that is whether the line is switched or not, included in closed circuit with each line and operated by calling-current sent through it, a clearing-out annunciator, means for connecting any two lines together for conversation and connecting the clearing-out annunciator with or into their circuit, a local circuit including a battery that is completed when any two lines are thus connected, a subscriber's calling-generator located in closed circuit with either subscriber's line thus connected and sending clearing-out currents operating said clearing-out annunciator, and electromagnetic means included in the local circuit and operated by the current from the battery therein, shunting the line-annunciator and thereby preventing the operation of the line-annuncia-

tors when clearing-out currents are sent over the line.

10. In a telephone-exchange system, the combination of a switch board or boards, subscribers' telephone-lines or talking-circuits, switches therefor on the board or boards, an individual annunciator permanently, that is whether the line is switched or not, included in closed circuit with each line and operated by calling-current sent through it, a clearing-out annunciator, means for connecting any two lines together for conversation and connecting the clearing-out annunciator with or into their circuit, a local circuit including a battery that is completed when any two lines are thus connected, a subscriber's calling-generator located in closed circuit with either subscriber's line thus connected and sending clearing-out currents operating said clearing-out annunciator, and electromagnetic means included in the local circuit and operated by the current from the battery therein, to prevent the operation of the line-annunciators when clearing-out currents are sent over the line.

11. In a telephone-exchange system, the combination of a subscriber's telephone-line, a call-annunciator included in said line, a

normally open short circuit around said annunciator, and means for closing such short circuit by the act of switching the line for conversation.

12. In a telephone-exchange system, the combination of a switchboard, two telephone-lines, each having a socket or switching connection on said board, a subscriber's generator at each subscriber's station, a call-annunciator included in or permanently connected with each line at said board, switch-plugs and their cord connections for placing said lines in communication for conversation, a clearing-out annunciator in the equipment of said cord connections, and adapted to be operated by a clearing-out current sent from either subscriber's generator, a normally open short circuit around the call-annunciator of each line, and means for closing such short circuits by the act of placing the lines in communication for conversation, substantially as described.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,
FRANCES D. KELLOGG.