

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,405.

Patented Oct. 26, 1897.

Fig. 1.

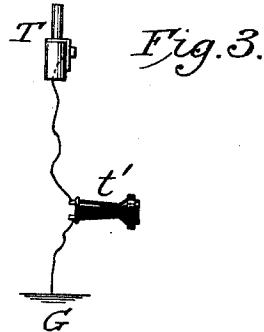
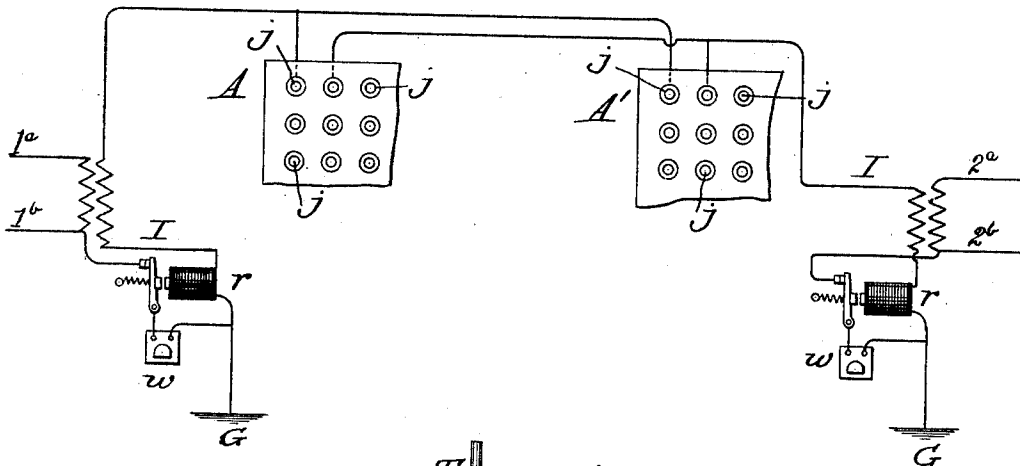


Fig. 2.

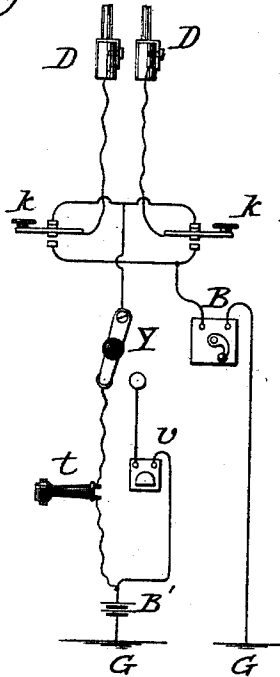
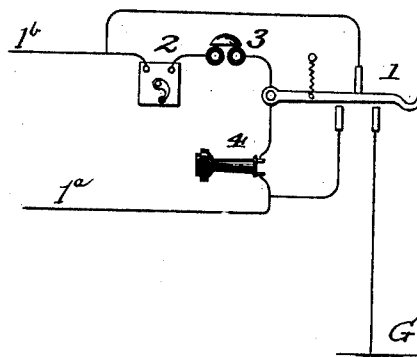


Fig. 4.



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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. 592,405, dated October 26, 1897.

Application filed August 25, 1891. Serial No. 403,714. (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 especially in a system of switching and of testing for a multiple-switchboard system of such an exchange
15 which I shall describe and claim in detail.

In describing my invention I have employed metallic-circuit subscribers' lines. It is, however, applicable to ground-circuit
20 lines.

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 there-
25 to. 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 the subscribers'-station apparatus to be used with each
30 line.

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
35 shown in Fig. 2 and marked D D. Those contact-pieces are marked *j j*. I I are induction-coil translators. *r r* are relays, and *w w* are annunciators, 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 and the relays of the ordinary form of back-contact relays which have the relay-contacts
45 closed when no current passes through the magnet and opened while a current is passing. One coil of each translator is in the circuit of its line. The contact-pieces *j j* of a line are connected together and grounded
50 through the other coil of the translator and

the line-relay. One of the contact-points of the relay is connected to the line 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 calling-keys; Y, a switch; *v*, a clearing-out annunciator; *t*, the operator's telephone; B', a battery, and B a calling-generator.
60 Each pair of plugs has two keys, one switch, and one clearing-out annunciator. 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 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 pressed away
70 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 key-lever. The two points against which the levers normally press are connected together and connected to the lever of the switch Y of the pair of plugs. The other contacts of the keys are grounded through the calling-generator.
75 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 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
80 is connected with the ground.

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
90 for testing into connection with any 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
95 as required by the operator and connected to the system substantially as described and as will be apparent to those skilled in the art. The connection of a clearing-out annunciator with a battery should not be through any
100

other clearing-out annunciator. Each operator has one cord system and one test system suitably arranged at her board.

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. 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 should preferably be connected into the line-circuit, so that the translator-coil at the central office 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: 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 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-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 clearing-out annunciator 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 line-relay is in closed circuit with the battery B' and the relay-armature be-

ing attracted the circuit of the line to ground through the annunciator is opened. When, 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, (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 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 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, however, 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, 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 operators can therefore determine on testing whether or not any line is in use. The clearing-out annunciators should preferably be constructed as to offer considerable retardation or self-induction to telephone-currents. In certain cases separate retardation-coils might be used, if desired. It will be seen that whenever a line is switched or connected for conversation the circuit connection to which its switch contact-pieces is connected is grounded through a battery and an electromagnet, (either the operator's telephone or a clearing-out annunciator.) The battery operates the test system, as will hereinafter be described, while the electromagnet in circuit with it offers retardation or impedance effect to rapidly-alternating telephone-currents, so that the same shall not be short-circuited. It will be seen that each line tests "busy" whenever and during the time it is switched for conversation, whether it is merely connected to an operator's telephone at the central office or is in connection for conversation with two subscribers. 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 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 connec-

tion 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 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 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, multiple switchboards, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of its line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected through the other coil of the translator to the ground, switch apparatus to connect together by a metallic connection, any two of said switch-contacts at any board, and thereby connect the two coils to which the contacts are connected into a complete circuit, a circuit connection grounded on one side and connected on its other side to said metallic connection at a point between the two coils, a test-battery and an electromagnet annunciator of self-induction in said circuit connection, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said switch-contacts at its board, substantially as set forth.

2. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, translators for said lines, one translator for each line, one coil of which is in the circuit of its line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected to one side of and through the other coil of the translator to the corresponding coil of each of the other translators, switch apparatus to connect together by a metallic connection any two of said switch-contacts at any board, and thereby connect the two coils to which the contacts are connected into a complete circuit, a circuit connection connected on one side to said metallic connection and on the other side to said coils on their other sides and at a point between them, a test-battery and an electromagnet annunciator of self-induction in said circuit connections, and test receiving instruments, one at each board, each connected on one side to said side of said coils, and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said

switch-contacts at its board, substantially as set forth.

3. In a telephone-exchange system, multiple switchboards, telephone-lines, translators for said lines, one translator for each line, one coil of which is in the circuit of its line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected to one side of the other coil of the translator and the other sides of such coils being connected together, switch apparatus to connect together by a metallic connection any two of said switch-contacts at any board and thereby connect the two coils to which the contacts are connected into a complete circuit, a circuit connection connected on one side to said metallic connection and on the other side to said coils on their other sides and at a point between them, a test-battery and an electromagnet annunciator of self-induction in said circuit connection, and test receiving instruments, one for each board, each connected on one side to the other side of the battery, and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said switch-contacts at its board, substantially as set forth.

4. In a telephone-exchange system, multiple switchboards, two metallic-circuit lines and translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected through the other coil of the translator to the ground, two of said contacts on a board being connected together for conversation by a circuit connection, a battery and a self-induction electromagnet connected from a point between the two coils as long as the contacts are thus connected in a third leg to ground to the circuit thereby established, and test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said contacts at its board, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, two telephone-lines and translators for said lines, one translator for each line, one coil of which is in the circuit of its line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected through the other coil of the translator to the ground, two of said contacts on a board being connected together for conversation by a circuit connection, a battery and a self-induction electromagnet connected from a point between the two coils, as long as the contacts are thus connected, in a third leg to ground to the circuit thereby established, and test receiving instruments, one at each

board, each grounded on one side and connected on its other side to a plug or device adapted to be brought for testing into connection with each of said contacts at its board, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, 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, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected through the other coil of the translator to the ground, two of said contacts on a board being connected together for conversation by a circuit connection, a battery and a self-induction electromagnet connected from a point between the two coils as long as the contacts are thus connected in a third leg to ground to the circuit thereby established, substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, two telephone-lines and translators for said lines, one translator for each line, one coil of which is in the circuit of its line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected through the other coil of the translator to the ground, two of said contacts on a board being connected together for conversation by a circuit connection, a battery and a self-induction electromagnet connected from a point between the two coils, as long as the contacts are thus connected, in a third leg to ground to the circuit thereby established, 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 the line, in combination with switch-contacts, one for each line, grounded through the other coil of the translator, and such contacts being temporarily connected together for conversation between the two subscribers by a circuit connection, and a battery and a self-induction electromagnet connected from a point between the two coils, as long as the contacts are thus connected, in a third leg to ground to the circuit thereby established, substantially as set forth.

9. In a telephone-exchange system, two telephone-lines, and translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with switch-contacts, one for each line grounded through the other coil of the translator, said contacts being temporarily connected together for conversation, by a circuit connection between the two subscribers, and a battery and a self-induction electromagnet connected from a point between the two coils, as long as the contacts are thus connected, in a third leg to ground to the circuit thereby established, substantially as set forth.

10. In a telephone-exchange system, multi-

ple switchboards, two metallic-circuit lines and translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected to one side of the other coil of the translator of the line, the other side of said coil being connected with the like side of the like coil of the other translator, two of said contacts on a board being connected together for conversation, by a circuit connection between the subscribers, a bridge as long as the contacts are thus connected to the circuit of the two coils, said bridge being from points between the coils, a battery and a self-induction electromagnet in said bridge, and test receiving instruments, one at each board, each connected on one side to the last-mentioned side of the translator-coils, and on its other side to a plug or device adapted to be brought for testing into connection with each of said contacts at its board, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, two telephone-lines and translators for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with switch-contacts, one for each line on each board, the contacts of a line being connected together and connected to one side of the other coil of the translator of the line, the other side of said coil being connected with the corresponding side of the corresponding coil of the other translator, two of said contacts on a board being connected together for conversation, by a circuit connection between the subscribers, a bridge connected as long as the contacts are thus connected to the circuit of the two coils, said bridge being from points between the coils, a battery and a self-induction electromagnet in said bridge, and test receiving instruments, one at each board, each connected on one side to the last-mentioned side of the translator-coils, and on its other side to a plug or device adapted to be brought for testing into connection with each of said contacts at its board, substantially as set forth.

12. 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 coils of the two translators being temporarily connected together into a complete circuit for conversation between the two subscribers by a circuit connection in combination with a bridge connected, as long as the last-mentioned coils are thus connected, to said circuit of the coils, said bridge being from points between the two coils, and a battery and a self-induction electromagnet in said bridge, substantially as set forth.

13. In a telephone-exchange system, two telephone-lines and translators for said lines, one translator for each line, one coil of which

is in the circuit of its line, the other coils of the two translators being temporarily connected together into a complete circuit for conversation between the two subscribers by
5 a circuit connection, in combination with a bridge connected, as long as the last-mentioned coils are thus connected, to said circuit of the coils, said bridge being from points between the two coils, and a battery and a

self-induction electromagnet in said bridge, so substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,
EDWARD S. FRASHER.