

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,406.

Patented Oct. 26, 1897.

Fig. 1.

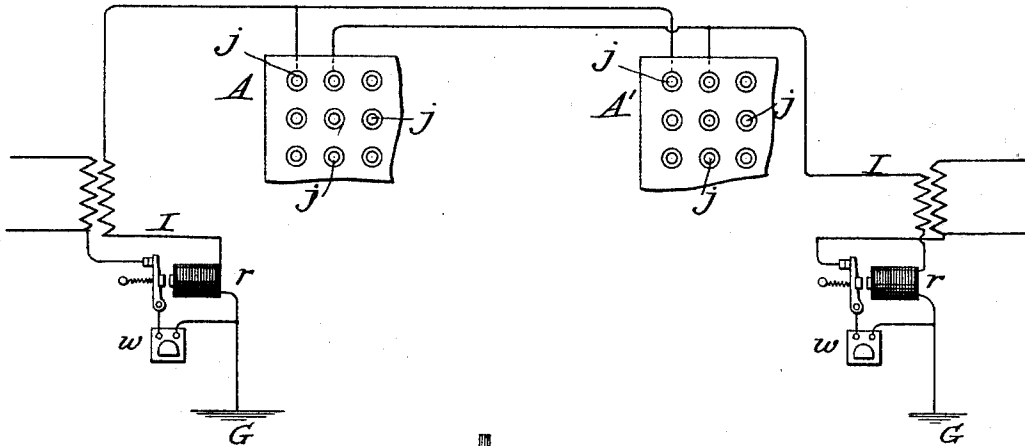


Fig. 2.

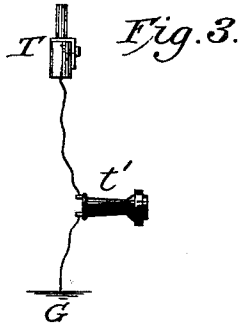
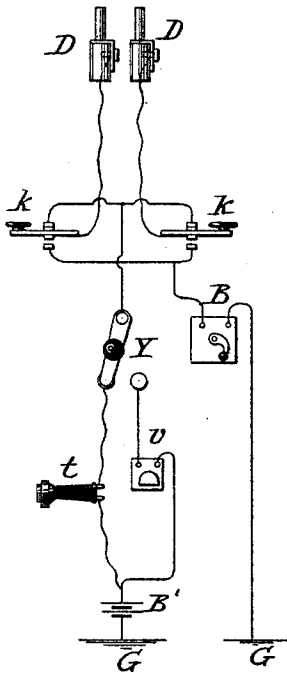
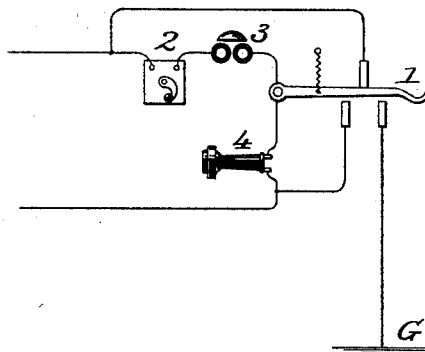


Fig. 4.



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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. 592,406, dated October 26, 1897.

Application filed August 25, 1891. Serial No. 403,715. (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; and it consists in a system of switching and calling apparatus which I shall describe and claim in
15 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, how-
20 ever, applicable to other kinds of lines and to other than the multiple system of operation.

In the accompanying drawings, illustrating my invention, Figure 1 shows a front view of sections of the boards to which the same lines
25 connect, with the central-office apparatus of two lines and the connections thereto. 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
30 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 contact-piece for each line, adapted to receive
35 and form connection with the switch-plug shown in Fig. 2 and marked D D. Those contact-pieces are marked j j. I I are induction-coil translators. r r are plugs, and w w are annunciators, there being one of each for each
40 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 closed when
45 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 through the other coil

of the translator and the line-relay. One of 50 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. 55 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. Each pair of 60 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 65 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 from the first- 70 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 75 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. One of the contact-bolts of the switch 80 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 85 battery 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 90 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.

Only one pair of plugs, with their special apparatus, is shown in Fig. 2. Other pairs 95 may be added 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 clear-

ing-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.

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 being 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, so that the clearing-out annunciators will be readily operated by the clearing-out currents sent from the subscriber's generator and translated from the circuit in which they are generated through the translator of the line at the central office to the circuit in which is the clearing-out annunciator. For the battery to thus reinforce the clearing-out signal sent by the subscriber to insure the operation of the clearing-out annunciator is of especial advantage, as it is well understood that the constructions of repeating-coils or translators which are best adapted to translate telephone-currents are not those best adapted to translate signal-currents. Thus the construction of the coils may be used which is well adapted to translate telephone-currents, and on account of the advantages obtained by the battery acting to reinforce the clearing-out signals the operation of such signals will at the same time be secured. The use of the battery to reinforce the clearing-out signal is of especial advantage, because the clearing-out signal generated by either subscriber after being translated into the secondary circuit at the central office divides into two parallel circuits, one being that containing the clearing-out annunciator and battery and the other that containing the translator-coil and relay-magnet of the other line. That the current thus divides is due to the fact that the clearing-out annunciator is not in the direct circuit which connects the translators of two lines connected together, but is in a bridge or cross-connecting circuit to such direct circuit. While the battery is thus advantageous to and is a feature of the clearing-out-signal system for translators

which I herein describe and claim, yet I do not limit the invention to the use of the battery for such purpose, as the system may be arranged so as to be operative without such use of the battery.

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 to telephone-currents. In certain cases separate retardation-coils might 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 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 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 successful operation of the system.

It will be observed that when a line is switched for conversation its ground connection through its annunciator is automatically broken, this being accomplished by the relay which is in circuit with the translator-coil of the line. This result can be accomplished with other forms of apparatus and circuits than those I have described and still obtain the switching and calling operations which I have described.

I claim as my invention—

1. 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, said contacts being temporarily con-

nected together for conversation between the two subscribers, a clearing-out annunciator and a battery in a third leg to ground to the circuit thereby established, and a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal substantially as set forth.

2. 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, said contacts being temporarily connected together for conversation between the two subscribers, a clearing-out annunciator in a third leg to ground to the circuit thereby established, and a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal substantially as set forth.

3. 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 between the two subscribers, a clearing-out annunciator, and a battery in a third leg to ground to the circuit thereby established, and a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal substantially as set forth.

4. 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 between the two subscribers, a clearing-out annunciator in a third leg to ground to the circuit thereby established, and a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal 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 switch apparatus to switch any two of the other coils of the translators into a complete circuit, a clearing-out annunciator in a bridge or cross connection to such complete circuit between the two coils, and calling apparatus at each subscriber's station to send a calling-current through the translator-coil in circuit with its line, substantially as set forth.

6. In a telephone-exchange system, telephone-lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with switching apparatus to switch any two of the other coils of the trans-

lators into a complete circuit, a clearing-out annunciator in a bridge or cross connection to said circuit between the two coils thus switched, and a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal 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 switch apparatus to switch any two of the other coils of the translators into a complete circuit, a clearing-out annunciator in a bridge to the circuit of the coils thus switched, a battery in circuit with the clearing-out annunciator to reinforce any clearing-out-signal current, and calling apparatus at each subscriber's station to send a calling-current through the translator-coil in circuit with its line, substantially as set forth.

8. In a telephone-exchange system, telephone-lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with switch apparatus to switch any two of the other coils of the translators into a complete circuit, a clearing-out annunciator in a bridge to such complete circuit between the two coils, a battery in circuit with said annunciator to reinforce any clearing-out-signal current, calling apparatus at each subscriber's station to send a calling-current through the translator-coil in circuit with its line, substantially as set forth.

9. 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, the two other coils of the translator being temporarily connected together in a complete circuit for conversation between the two subscribers, in combination with a clearing-out annunciator in a bridge or cross connection to said complete circuit, said bridge or cross connection being between the two coils, and a calling-generator operated in the closed circuit of either subscriber's line to send a clearing-out signal substantially as set forth.

10. 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, the two other coils of the translators being temporarily connected together in a complete circuit for conversation between the two subscribers, in combination with a clearing-out annunciator and a battery in a bridge or cross connection to said complete circuit, said bridge or cross connection being between the two coils, and a calling-generator operated in the closed circuit of either subscriber's line to send a clearing-out signal substantially as set forth.

11. 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, the two other coils

of the translators being temporarily connected together in a complete circuit for conversation between the two subscribers, in combination with a clearing-out annunciator in a bridge or cross connection to said complete circuit, said bridge or cross connection being between the two coils, and a calling-generator operated in the closed circuit of either subscriber's line to send a clearing-out signal substantially as set forth.

12. 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, the two other coils of the translators being temporarily connected together in a complete circuit for conversation between the two subscribers, in combination with a clearing-out annunciator and a battery in a bridge or cross connection to said complete circuit, said bridge or cross connection being between the two coils, said battery reinforcing any clearing-out current, and a calling-current in the closed circuit of either subscriber's line to operate the clearing-out annunciator substantially as set forth.

13. 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, grounded through the other coil of the translator, said contacts being temporarily connected together for conversation between the two subscribers, a clearing-out annunciator and a battery in a third leg to ground to the circuit thereby established, a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal, 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 into connection with said switch-contacts at its board, substantially as set forth.

14. 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, grounded through the other coil of the translator, said contacts being temporarily connected together for conversation between the two subscribers, a clearing-out annunciator and a battery in a third leg to ground to the circuit thereby established, a calling-generator operated in the closed circuit of his line at either subscriber's station to send the clearing-out signal, 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 into connection with said switch-contacts at its board, substantially as set forth.

15. In a telephone-exchange system, multi-

ple switchboards, metallic-circuit lines and translators, one for each line one coil of which is in the circuit of the line, in combination with switch apparatus, at each board, to switch
5 any two of the other coils of the translators into a complete circuit, a clearing-out annunciator in a bridge to the circuit of the coils thus switched, a battery in circuit with the clearing-out annunciator, calling apparatus
10 at each subscriber's station to send a calling-current through the translator-coil in circuit with its line, and test receiving instruments, one at each board, each connected on one side to one of the sides of each of the last-men-
15 tioned coils of said translators and on its other side to a plug or device adapted to be brought into connection at its board with the other side of each of said last-mentioned coils, substantially as set forth.

20 16. In a telephone-exchange system, multiple switchboards, telephone-lines and translators, one for each line, one coil of which is in the circuit of the line, in combination with

switch apparatus at each board, to switch any two of the other coils of the translators into
25 a complete circuit, a clearing-out annunciator in a bridge to such complete circuit between the two coils, a battery in circuit with said annunciator, calling apparatus at each subscriber's station to send a calling-current
30 through the translator-coil in circuit with its line, and test receiving instruments, one at each board, each connected on one side to one of the sides of each of the last-mentioned coils of said translators and on its other side to a
35 plug or device adapted to be brought into connection at its board with the other side of each of said last-mentioned coils, substantially as set forth.

In testimony whereof I have hereunto subscribed my name. 40

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,
EDWARD S. FRASHER.