

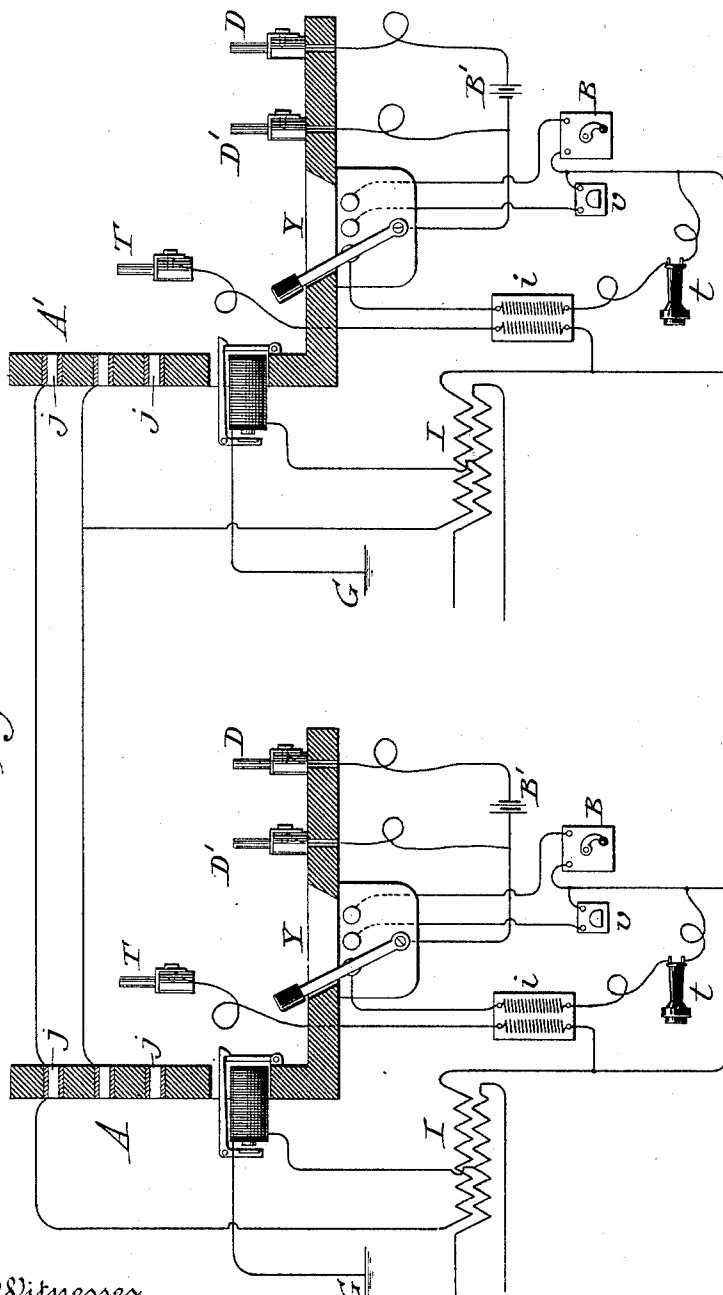
(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,408.

Patented Oct. 26, 1897.

Fig. 1.

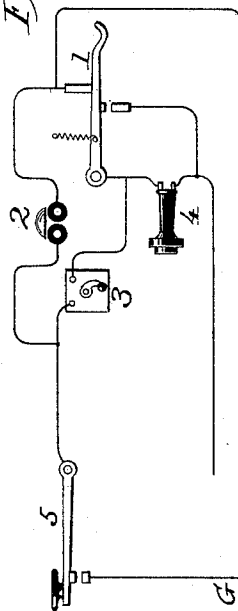


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Fig. 2.



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. 592,408, dated October 26, 1897.

Application filed August 31, 1891. Serial No. 404,336. (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 metallic-circuit telephone-exchange system in which induction-coil translators or converters, one for each line at the central office, are employed to translate the telephone-currents
15 from one circuit or line to another circuit or line.

It consists of a system for calling, switching, testing, and clearing-out signals for such an exchange which I shall describe and claim
20 in detail.

In the accompanying drawings, illustrating my invention, Figure 1 represents sectional views of two switchboards with the central-office switches and apparatus for two lines
25 of the exchange and the connecting and answering apparatus at each board for answering calls, connecting the translators of the two lines, testing to see whether the lines are in use, and receiving clearing-out signals for a connection which may be made. Fig. 2
30 shows in diagram a subscriber's-station apparatus to be used in the exchange system.

In Fig. 1, A A' are two switchboards. Other boards may be added and used as required
35 for the size of the exchange. Each board has a metal socket or switch contact-piece for each line. These sockets or contact-pieces are marked *j j* and are each adapted to receive the switch-plugs at the boards, and thereby
40 form contact with the contact-piece of the plug and also have the test-plug contact-pieces applied to them for testing. I I are induction-coil translators, one for each line. *i i* are induction-coils, and T T are test-plugs,
45 one of each for each operator. One coil of each of these induction-coils is in circuit with the telephone of the operator. The test-plug T is connected to a flexible conductor and is adapted to be brought for testing into
50 contact with each contact-piece *j* at its board and is connected through the other coil of the

induction-coil with the metal conductor hereinafter mentioned. *w w* are two annunciators, one for each line.

At each board there is a pair of plugs, 55 (marked D D'), a test-battery for the pair of plugs, (marked B'), a clearing-out annunciator for the pair of plugs, (marked *v*), an operator's telephone, (marked *t*), a switch for the pair of plugs, (marked Y,) and a calling-
60 generator, (marked B.)

The switch Y has a lever and three contact-bolts on which the lever may alternately be placed. The plugs of a pair are connected together by flexible conductors, and in the
65 circuit between them is their test-battery B'. Each plug is adapted to be placed in connection with each metal socket *j* at its board. The lever of the switch is connected to the circuit which connects the two plugs, preferably so that the battery B' is in circuit be-
70 tween the lever and the plug D. One side of the telephone, one side of the calling-generator, and one side of the clearing-out annunciator are connected with the three contact-
75 bolts, respectively, of the switch Y. The other sides of the telephone, calling-generator, and clearing-out annunciator are connected together by metal conductor and are connected by metal conductor with the same
80 side of the various other instruments of the same kind in the exchange. One side of one of the coils of each translator is connected by metal conductors with the same sides of these instruments. Only one pair of plugs, with
85 their special apparatus, is shown at each board. One telephone answers for each operator and one calling-generator may be used for the whole exchange. Other pairs of
90 plugs, with their special apparatus, may be added for each operator as she may need, and their connection to the other apparatus is substantially the same as has been described and is shown and as will be apparent to those
95 skilled in the art.

The other side of each translator-coil mentioned above is connected to the metal sockets *j j* of the line to which the translator belongs. The other coil of each translator is connected into circuit with its line. From the center
100 of the last-mentioned coil of each line a branch wire passes to ground through the

annunciator of the line. The connections of the first-mentioned coil are local to the central office and it may be called the "local" coil.

In the subscriber's station apparatus shown in Fig. 2, 1 is the telephone-switch; 2, the signal-receiving bell; 3, the calling-generator; 4, the subscriber's telephone, and 5 a calling-key. The circuits and contacts are substantially as shown and may be in other ways which will carry out substantially the operations which will hereinafter be described. When the key 5 is pressed, the line-circuit is grounded at the central office. Otherwise the line-circuit is not grounded there. When the generator 3 is operated, it is in the metallic circuit of the line. When the telephone is on the switch, the signal-bell is in the direct circuit of the line, and when the telephone is off the switch it is itself in the direct circuit of the line.

The operation of the system is as follows: When a subscriber wishes to make a call, he presses on his key 5 and while doing so operates his calling-generator. A calling-current then passes in a circuit from the ground at his station through that side or branch of the line in which the generator is to ground at the central office, through the line-annunciator, and operates the annunciator. Part of the current generated will pass through the complete metallic circuit of the line, but enough will pass through the ground-circuit traced above to operate the annunciator. When the operator to whom the annunciator is assigned observes the call, she places one of her switch-plugs D into the metal socket of the line at her board and moves the lever of the switch Y belonging to the plug so that her telephone is in connection with it. A complete metallic circuit is thus established in which is included the operator's telephone, the test-battery B', and the local coil of the translator of the line. The subscriber having taken his telephone from its switch, the telephone is included in a metallic circuit with the line and the other coil of the translator. The subscriber and operator may then converse and the subscriber give his call. The operator then tests the line wanted, as will be described, and if it tests not in use places the mate to the plug (marked D') into the metal socket of the line wanted. The local coil of the translator of the line wanted is thereby connected in a metallic circuit with the local coil of the calling-line, and this circuit has the test-battery B' of the pair of plugs in it and is bridged or cross-connected by the operator's telephone. The operator then moves the lever of the switch Y so that it is in connection with the calling-generator and the generator is in a bridge-circuit of the metallic circuit containing the two coils, and the generator being operated current goes through both coils and induced current is generated in the metallic circuit of both lines. The bell of the subscriber wanted will therefore be rung.

The operator then moves the lever of the switch Y so that it is in connection with the clearing-out annunciator, and the annunciator is thereby connected in a bridge or cross-connection of the metallic circuit which contains the two translator-coils. The subscribers can then converse, the telephone-currents being translated from one metallic-circuit line to the metallic circuit which contains the two local coils and from said circuit to the other metallic-circuit line.

When a subscriber wishes to send a clearing-out signal, he operates his calling-generator without pressing on his key 5. A current is thereby generated in his metallic-circuit line and an induced current is generated in the local coil of the line which will operate the clearing-out annunciator which is in circuit with such coil (being in a cross-connecting circuit to the circuit of the two local coils of the lines) and between the two coils.

When the contacts of two lines are connected together and the circuit of their induction-coils is bridged by a clearing-out annunciator, as above described, the battery B' of the pair of cords used is on closed circuit with the clearing-out annunciator, and although the current from the battery is not sufficiently strong to operate the clearing-out annunciator it nevertheless reinforces the clearing-out current sent from either operator's generator and insures the operation of the clearing-out annunciator when the clearing-out current is sent.

The operation of the test system is as follows: When the operator wishes to test a line wanted to determine whether it is in use, she places her test-plug T on the contact-piece j at her board of the line to be tested. If, then, the line has a switch-plug in one of its contact-pieces j at another board, a complete circuit is established, which contains one coil of the induction-coil i of the operator making the test and the battery B', which is in circuit with the switch-plug which is in said contact-piece j . This circuit may be traced as follows: from the metal conductor heretofore mentioned through the coil of the induction-coil to the test-plug T, thence to the contact-piece j , where the test is made, thence to the contact-piece j , in which the switch-plug is inserted, and thence through the battery in circuit with the plug and a local coil i , connected with it, to the metal conductor. A current will therefore pass through the coil of the induction-coil which will cause an induced current in the other coil of the induction-coil and make a click in the operator's telephone. The closed circuit of the telephone and secondary of the induction-coil when a test is made is, say, from plug D in the contact-piece of the calling-line, thence through the translator-coil of the line to the common wire which unites the translator-coils, thence through the telephone and secondary of the induction-coil i to the lever of the switch Y, and thence through the flexible

cord to D. If there is no plug in a contact-piece j of the line, no such complete circuit is established which contains the coil of the induction-coil i of the testing apparatus and a battery and no click will be made in her telephone. She can therefore determine on testing whether or not the line is in use.

The connections of the local coils of the translators and of the operator's apparatus to the same are all metallic and without ground connection or circuit, and therefore when two coils are connected together for purposes of conversation their circuit is not subject to interference from earth currents or connections. These advantages would to a certain extent be obtained should the metallic-circuit connection I have described be purposely or accidentally connected with the ground at a certain point.

The induction-coils i , with their telephones tt , may be considered as test receiving instruments. Other forms of test receiving instruments may be used.

It will be observed that when two of the local coils of translators are left connected into a complete metallic circuit for conversation between two subscribers the circuit is bridged between the coils by a clearing-out annunciator. This annunciator should preferably be of such a construction as to offer considerable retardation to the passage of telephone-currents. With such a construction no great amount of the telephone-current will be diverted from the complete metallic circuit of the two coils and the conversation will not be materially reduced. If for any reason the clearing-out annunciator should not be retained and still the bridge connection be retained, I prefer to place in the bridge connection some other form of retardation apparatus to telephone-currents.

I claim as my invention—

1. In a telephone-exchange system, multiple switchboards, metallic-circuit lines and translators at the central office 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 the line being connected together and connected to one side of the other coil of the translator, the other side of said coil being connected by metallic connection with the same side of the other like coils of the translators, switch apparatus at each board to connect together any two of said switch-contacts at the board, a clearing-out annunciator bridged across the circuit of the coils of two lines thus united and a calling-generator at either of the subscribers' stations operated in the circuit of his line to send a clearing-out signal, substantially as set forth.

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

which one side of the other coil of the line-translator is connected, a metallic connection between the other sides of said other coils of the translators, switch apparatus to connect together any two of said switch-contacts at the board, a clearing-out annunciator bridged across the circuit of the coils of two lines thus united and a calling-generator at either of the subscribers' stations operated in the circuit of his line to send a clearing-out signal, substantially as set forth.

3. In a telephone-exchange system, a switchboard, metallic-circuit lines and translators at the central office for said lines, one translator for each line, one coil of which is in the circuit of the line, in combination with switch-contacts on said board, one for each line, to which one side of the other coil of the line-translator is connected, an ungrounded metallic connection between the other side of said last-mentioned coil and the same side of the same coils of the other translators, switching apparatus to connect together any two of said switch-contacts, a clearing-out annunciator bridged across the circuit of the coils of two lines thus united and a calling-generator at either of the subscribers' stations operated in the circuit of his line to send a clearing-out signal, substantially as set forth.

4. In a telephone-exchange system, a switchboard, telephone-lines and translators at the central office 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 the board, connected to the one side of the other coil of the translator of the line, metallic connections between the other side of said last-mentioned coil and the same side of the same coil of each of the other translators, switching apparatus to connect together any two of said switch-contacts a clearing-out annunciator bridged across the circuit of the coils of two lines thus united and a calling-generator at either of the subscribers' stations operated in the circuit of his line to send a clearing-out signal, substantially as set forth.

5. In a telephone-exchange system, a switchboard, telephone-lines and translators at the central office for said lines, one translator for each line, one coil of which is in the circuit of the line and one side of the other coil of which is in a completely metallic connection with the same side of the same coil of each of the other translators, in combination with switch apparatus to connect together the other sides of any two of such coils of the translators a clearing-out annunciator bridged across the circuit of the coils of two lines thus united, a battery in circuit with said clearing-out annunciator, and a calling-generator operated at either of the subscribers' stations in the circuit of his line to send a clearing-out signal.

6. In a telephone-exchange system, a switchboard, telephone-lines and translators at the central office for said lines, one translator for each line, one coil of which is in the circuit

of the line and one side of the other coil of which is in ungrounded completely metallic connection with the same side of the same coil of each of the other translators, in combination with switch apparatus to connect together the other sides of any two of the last-mentioned coils of the translators, a clearing-out annunciator bridged across the circuit of the coils of two lines thus united, a battery in circuit with said clearing-out annunciator, and a calling-generator operated at either of the subscribers' stations in the circuit of his line to send a clearing-out signal substantially as set forth.

7. In a telephone-exchange system, multiple switchboards, metallic-circuit lines and translators at the central office 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 switch-contacts of a line being connected together and to one side of the other coil of the translator of the line and the other side of said coil being connected through metallic conductor to the same side of the same coil of each of the other translators, pairs of plugs at each board, the plugs of each pair being connected by a flexible conducting-circuit and each plug adapted to form connection with each of said switch-contacts at its board, a battery in circuit between the plugs of each pair, a clearing-out annunciator bridged across the circuit of the coils of two lines united by the plugs of a pair of plugs and a calling-generator operated at either of the subscribers' stations in the circuit of his line to operate the clearing-out annunciator substantially as set forth.

8. In a telephone-exchange system, multiple switchboards, metallic-circuit lines and translators at the central office 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 on each board for each line, said contacts of each line being connected together by metallic conductor and to one side of the other coil of the line-translator and the other sides of the same coils being metallically connected together, switching apparatus to connect together any two of said switch-contacts on any board, a battery between them when thus connected, a clearing-out annunciator bridged across the circuit of the coils of two lines thus connected and test

receiving instruments, one at each board, each connected metallically on one side to the last-mentioned side of the last-mentioned coils of the translators and on the 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.

9. In a telephone-exchange system, multiple switchboards, telephone-lines and translators at the central office 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 on each board for each line, said contacts of the line being connected metallically to one side of the other coil of the line, the other side of the coil being connected metallically with the same side of each the same coils of the other translators, switching apparatus to connect together any two of said switch-contacts on any board, a battery between them when thus connected, a clearing-out annunciator bridged across the circuit of the coils of two lines thus connected and test receiving instruments, one at each board each metallically connected on one side to the last-mentioned side of the last-mentioned coils of the translators and on the other side to a plug or device adapted to be brought for testing into connection with each of said switch-contacts at its board.

10. In a telephone-exchange system, 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 the line-annunciator of each line grounded on one side and connected on the other side to the center of said coil of the line, a calling-generator in the circuit of the line at the subscriber's station, switching apparatus at the subscriber's station to at will ground the line-circuit there, a switching apparatus to at will connect together the two other coils of any two translators, and a clearing-out annunciator bridged across the circuit thus established through said coils and from between said coils, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,
FRANCES D. KELLOGG.