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M. G. KELLOGG.

MULTIPLE SWITCHBOARD FOR TELEPHONE EXCHANGES.

APPLICATION FILED NOV. 30, 1891. RENEWED OCT. 16, 1899.

NO MODEL.

Fig. 1

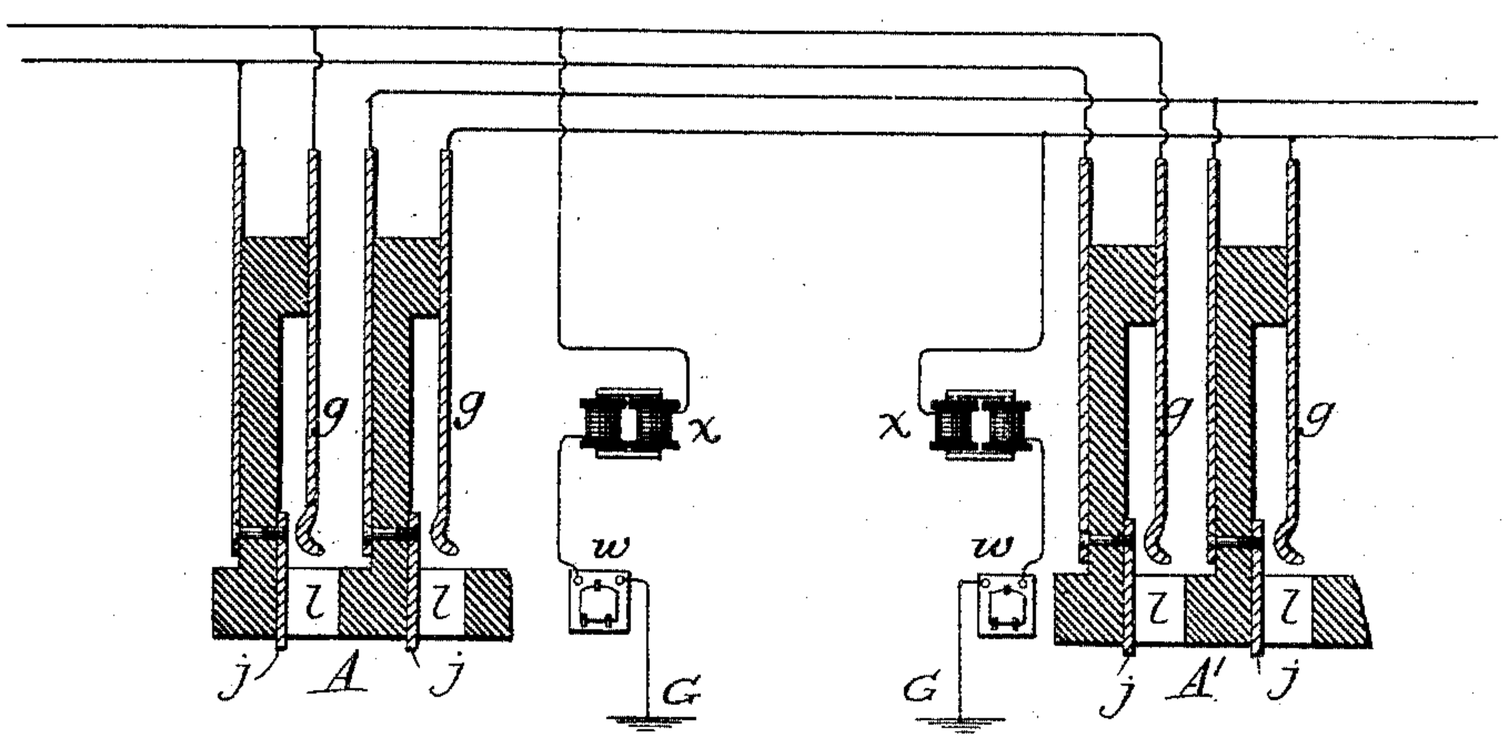


Fig. 2.

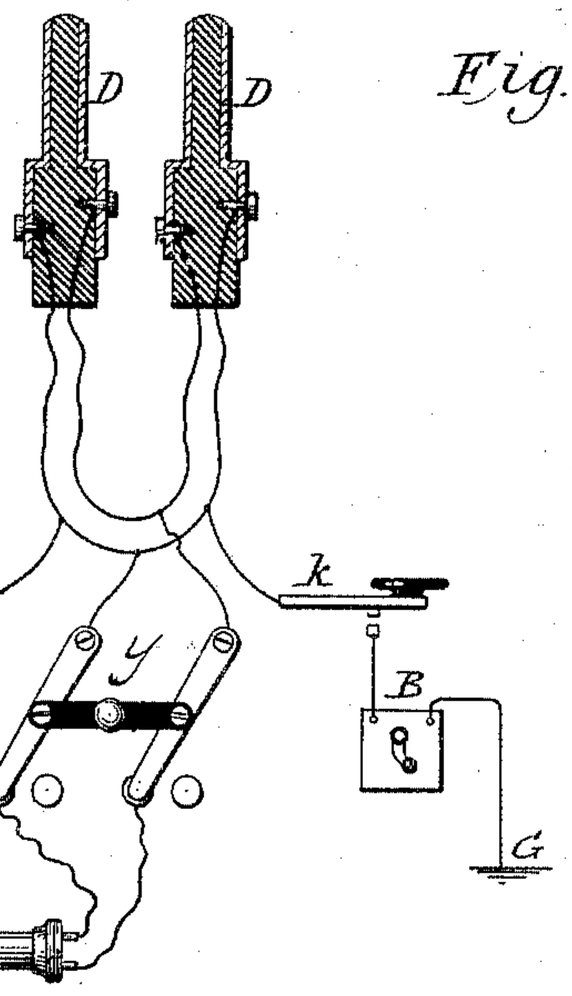


Fig. 3

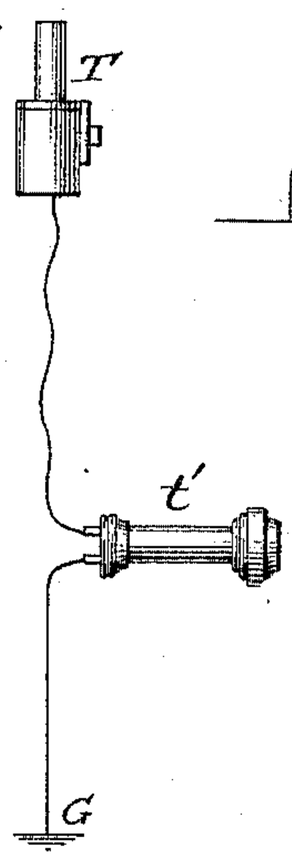


Fig. 4.

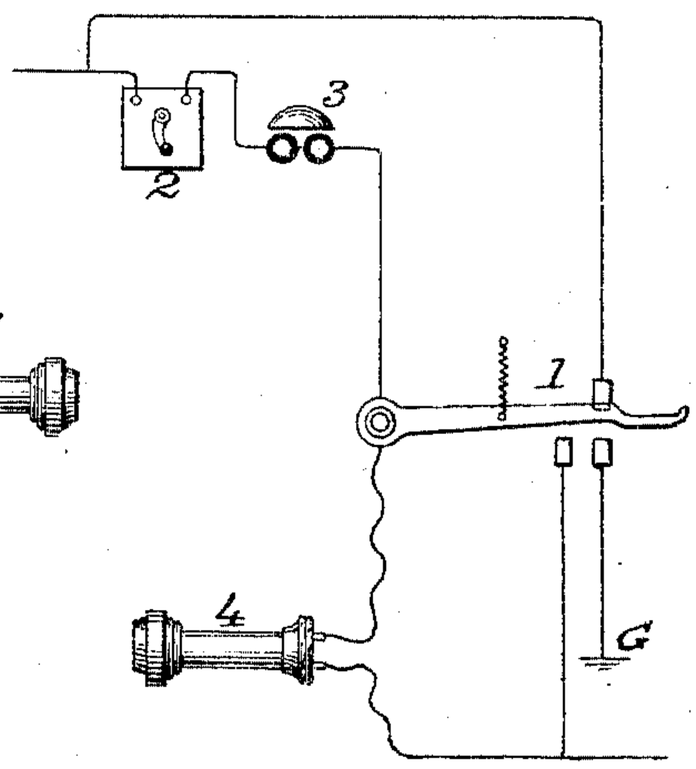
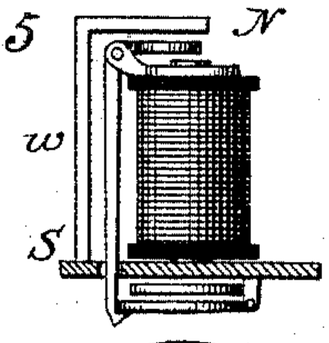


Fig. 5



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UNITED STATES PATENT OFFICE.

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MULTIPLE SWITCHBOARD FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 776,067, dated November 29, 1904.

Application filed November 30, 1891. Renewed October 16, 1899. Serial No. 733,824. (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, (temporarily residing at Geneva, in the Republic of Switzerland,) have invented certain new and useful 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,

My invention relates especially to a metallic-circuit telephone-exchange system in which each line is permanently grounded at the central office through its annunciator; and it consists of a system of calling, testing, clearing out, and switching for such an exchange or for such lines, which I shall describe and claim in detail.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram with sections of two switchboards to which the same lines are connected with two lines connected to the same and their central-office apparatus. Fig. 2 shows an operator's cord apparatus adapted to be used at any board. Fig. 3 shows an operator's test system adapted to be used at any board. Fig. 4 shows a subscriber's station apparatus for each line. Fig. 5 shows a polarized annunciator which may be used for each line.

In Fig. 1, A A′ are sectional views of sections of two switchboards. Each board has a switch for each line. Each switch has two contact-pieces insulated from each other (except by the circuit connections) and a switch-hole adapted to receive a loop switch-plug at its board. The contact-pieces of the switch are so placed and arranged that when a loop switch-plug (shown in Fig. 2 and marked D D) is inserted into the switch-hole the two contact-pieces of the plug form connection with the two contact-pieces of the switch, respectively. In the drawings one of the contact-pieces of each switch is a spring and is marked *g*, and the other contact is placed along the switch-hole and is marked *j*. The switch-holes are marked *l l*. The contact-pieces are mounted on rubber strips of the shape substantially, as shown through the fronts, of which are the switch-holes *l l*. Other forms of switches may be used which have two contact-pieces insulated from each other and adapted to receive loop switch-plugs and form connection between their contact-pieces and the contact-pieces of the plug. *w w* are line-annunciators, and *x x* retardation-coils, one annunciator and one retardation-coil for each line. One side or branch of each metallic-circuit line is connected to one of the contact-pieces of each switch of the line—say the springs *g g*. The other side or branch of the line is connected to the other contact-pieces of the switches—say *j j*. The side or branch of the line which is connected to the springs *g g* is permanently grounded through the annunciator and retardation-coil of the line. The connections shown in Fig. 1 are substantially as above described.

In Fig. 2, D D are a pair of loop switch-plugs, each plug adapted to be inserted into each switch at its board and when inserted to form connection between the contact-pieces of the plug and the switch, respectively. The two contact-pieces of one plug are connected with the two contact-pieces of the other plug, respectively, by two flexible switch-conductors. *l* is the operator's telephone; B, a calling-generator; *v*, a clearing-out annunciator; Y, a looping-in switch; *k*, a calling-key, and B′ a test-battery. Each pair of plugs has one switch, one clearing-out annunciator, and one calling-key. One test-battery and one calling-generator will answer for the exchange.

The connections of the cord system are substantially as shown. By means of the looping-in switch the operator can at will bridge or cross-connect her telephone between the pair of flexible conductors, and by means of the calling-key she can ground one of the conductors through the calling-generator. The same conductor is grounded through the clearing-out annunciator of the pair of plugs and the battery B′. Only one pair of plugs, with their special apparatus, is shown. Other pairs may be added to the operator's cord apparatus or system, substantially as shown, and in a way which will be apparent to those skilled in the art.

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 one contact-piece—say j—of each switch at its board. It is grounded through its test-receiving instrument. Each operator has a cord system and a test system suitably arranged at her board.

In the subscriber's station apparatus shown in Fig. 4, 1 is the telephone-switch, 2 is the calling-generator, 3 the signal-receiving bell, and 4 the subscriber's telephone. The circuits are substantially as shown. The line is on closed circuit at the subscriber's station and is grounded through the signal-receiving bell when the telephone is on the switch. When the telephone is off its switch for use, this ground connection is opened by the contact-points of the switch. The apparatus should be so connected into the line-circuit that the calling-generator is in the circuit between the normal ground at the subscriber's station when the telephone is on the switch and the permanent ground of the line at the central office.

The central-office calling-generators should preferably be so constructed as to send only one polarity of current to line, and the signal-receiving bells should be such as to respond to that polarity of current. The polarized annunciators should be so connected into their circuits as not to be operated by the current sent from the calling-generator.

The polarized annunciator shown in Fig. 5 is substantially a modification of the non-polarized annunciator most generally used for telephone-exchanges and shown and described in detail in the patent of James C. Warner, No. 266,405, and dated October 24, 1882. The modification consists, essentially, in the employment of a permanent magnet marked N S, attached at one end to the iron plate, which forms the pole-piece of the electromagnet of the annunciator and which therefore charges the cores of the electromagnet with one polarity of magnetism. The permanent magnet is bent so that its other end is in close juxtaposition to the armature of the annunciator and charges the armature by induction.

The operation of the system is as follows: When a subscriber wishes a connection, he operates his generator with his telephone on its switch. A calling-current passes from ground through one branch of his line to its ground connection through its annunciator and operates the annunciator. The subscriber then removes his telephone from its switch and by so doing removes the ground connection from his line and switches his telephone into the line-circuit. The operator on observing the call places one of her switch-plugs in the switch of the line and the switch Y of the pair of plugs being in position, so that her telephone is in a bridge across the two flexible conductors of the plugs, she finds out by conversation what line is wanted. She then tests the line wanted, as will hereinafter be indicated, and if she finds it is not switched for use she places the other plug of the pair into its switch. She then presses on the key k belonging to the pair of plugs, and a calling-current goes to line and to ground at the subscriber's station and rings his bell. The operator moves the switch Y, so that the telephone is disconnected from the circuit, and the lines are connected in a complete metallic circuit which does not contain any magnet except the subscriber's telephone apparatus. The plugs should preferably be inserted into the switches, so that the contact-pieces of the plugs, which are connected by the conductor, which is grounded through the clearing-out annunciator, are in contact with the contact-pieces j j of the switches. One side of the metallic circuit is then grounded through the annunciators and retardation-coils of the lines, and the other side of the circuit is grounded through the clearing-out annunciator of the pair of plugs and the battery B′. The battery B′ should be of such strength in relation to the clearing-out annunciator and the circuits that when it is connected as described and the subscribers' telephones are off their switches for use the annunciator will not be operated; but when the telephones are replaced on their switches and the lines are thereby grounded at the subscribers' stations the current from the battery will cause the annunciator to indicate a call. This result is easy to be obtained and depends on the fact that an electromagnet may be so constructed as not to be operated when in circuit with a battery and a certain resistance, but will be operated when the resistance is considerably reduced. By the means above described the clearing-out signal will be sent in by the mere act of the subscribers placing their telephones on their switches. The battery may be so related to the annunciator and the circuits that the annunciator will indicate a signal when only one of the telephones is replaced on its switch.

The test system is as follows: When a line is switched for use, it is grounded through the battery B′, and when a test is applied a circuit is established from the ground through the test-receiving instrument to the line at the point tested and from the line at the point where it is switched to the ground through the battery. The instrument will then respond, indicating that the line is in use. If when the test is made the line is not switched, no complete circuit is established which contains the test-receiving instrument and a battery, and the instrument will not sound. The operator can therefore determine on testing whether or not a line is switched for use. The resistance with the test-receiving instrument should be such that when the test is made as described and the line is switched

there will not be enough current to operate the clearing-out annunciator. The test-receiving instruments may be telephones and as much resistance placed in circuit with them as is necessary to accomplish this result. The switches Y Y may be so left that the telephone normally bridges the various pairs of flexible conductors, and in that case the operator has only to place one of her plugs in the switch of a line to connect her telephone into circuit with the line.

Instead of the annunciator *v* and retardation-coil *x* for each line an annunciator may be employed which has high resistance and high retardation to telephone-currents.

I claim as my invention—

1. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

2. In a telephone-exchange system two metallic-circuit lines switched in metallic circuit for conversation a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on said telephones being replaced on their switches substantially as set forth.

3. In a telephone-exchange system, two metallic-circuit lines each normally on closed circuit at the subscriber's station and switched in metallic circuit for conversation, a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

4. In a telephone-exchange system, two metallic-circuit lines each normally on closed circuit at the subscriber's station and switched in metallic circuit for conversation, a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on said telephones being replaced on their switches, substantially as set forth.

5. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, and the annunciator of one of the lines through which the circuit is grounded, a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

6. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, and the annunciators of said lines through which the circuit is grounded, a ground connection to said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, a switch at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

7. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, and a retardation-coil of one of the lines through which the circuit is grounded, a ground connection to said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, a switch at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch, and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

8. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, and the retardation-coils of said lines through which the circuit is grounded, a ground connection to said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close

the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch substantially as set forth.

9. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, a ground connection to one side of said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

10. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, a ground connection to one side of said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch, and said battery having such strength as to operate said annunciator when they are closed to each other on said telephones being replaced on their switches, substantially as set forth.

11. In a telephone-exchange system, two metallic-circuit lines each normally on closed circuit at the subscriber's station and switched in metallic circuit for conversation; a ground connection to one side of said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

12. In a telephone-exchange system, two metallic-circuit lines each normally on closed circuit at the subscriber's station and switched in metallic circuit for conversation, a ground connection to one side of said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on said telephones being replaced on their switches, substantially as set forth.

13. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation and the annunciator of one of the lines through which one side of the circuit is grounded, a ground connection to the other side of said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

14. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation and the annunciators of said lines through which one side of the circuit is grounded, a ground connection to the other side of said circuit at the central office, and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

15. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation, and the retardation-coil of one of the lines through which one side of the circuit is grounded, a ground connection to the other side of said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, in combination with a telephone, a switch and a ground connection at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to operate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

16. In a telephone-exchange system, two metallic-circuit lines switched in metallic circuit for conversation and the retardation-coils of said lines through which one side of the circuit is grounded, a ground connection to the other side of said circuit at the central office and a battery and special clearing-out annunciator in said ground connection, a switch at each subscriber's station, said switch having contacts to close the ground connection when the telephone is replaced on its switch and said battery having such strength as to oper-

ate said annunciator when they are closed to each other on either telephone being replaced on its switch, substantially as set forth.

17. In a telephone-exchange system, two metallic-circuit lines connected together into a metallic circuit for conversation, a circuit connection of one of said lines grounded on one side and permanently connected to the line on the other side, and the annunciator of said line in said circuit connection through which one side of the circuit is grounded, in combination with a clearing-out annunciator in a ground connection of the other side of the circuit, substantially as set forth.

18. In a telephone-exchange system, two metallic-circuit lines connected together into a metallic circuit for conversation, a circuit connection of each of said lines grounded on one side and permanently connected to its line on the other side, and the annunciators of said lines through which one side of the circuit is grounded, in combination with a clearing-out annunciator in a ground connection of the other side of the circuit, substantially as set forth.

19. In a telephone-exchange system, two metallic-circuit lines, connected together into a metallic circuit for conversation, a circuit connection of one of said lines grounded on one side and permanently connected to the line on the other side, and a retardation-coil of said line in circuit connection through which one side of the circuit is grounded, in combination with a clearing-out annunciator in a ground connection of the other side of the circuit, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

ANNA P. KELLOGG,

LEROY D. KELLOGG.