

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,356.

Patented Oct. 26, 1897.

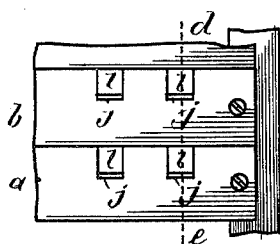


Fig. 1^a

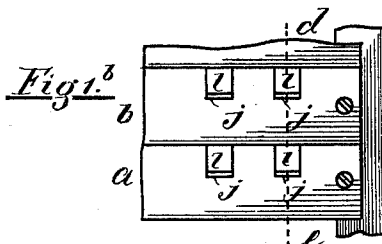


Fig. 1^b

Fig. 2

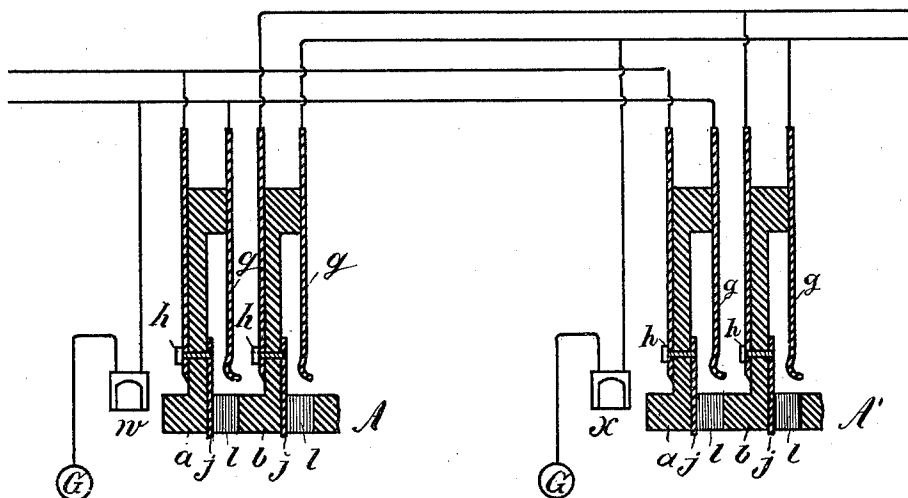


Fig. 3

Fig. 5

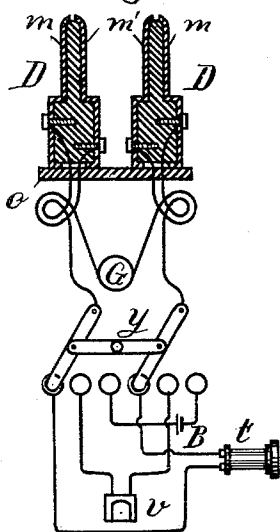
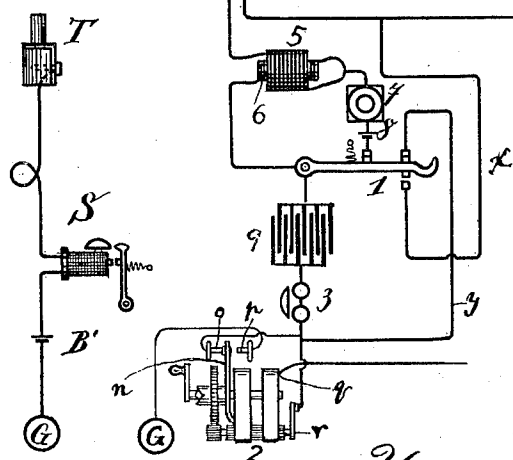


Fig. 4



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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. 592,356, dated October 26, 1897.

Application filed January 8, 1890. Serial No. 336,261. (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 Stuttgart, in the Empire of Germany, 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 to telephone-exchange systems in which the lines are metallic-circuit lines; and it consists in a system of testing such lines which I shall describe and claim.

I place as many boards in the central office as are found necessary or desirable in order to properly answer the calls and make the necessary connections and disconnections. On each board is a spring-jack or similar switch for each line. Each switch has a contact-spring and a contact-piece insulated from the spring, except by the circuit connections, and is adapted to receive a loop-switch plug and, when a plug is inserted, to connect the two contact-pieces of the plug with said spring and said contact-pieces, respectively.

In the accompanying drawings, illustrating my invention, Figures 1^a and 1^b represent sections of two multiple switchboards of the exchange to which the same lines are connected. Fig. 2 shows a diagram of the boards, with the line connections and apparatus necessary to illustrate my invention. Fig. 3 shows an operator's cord system to be used with the boards. Fig. 4 shows an operator's test system. Fig. 5 shows a subscriber's-station apparatus.

In the drawings like parts and apparatus are indicated by the same letters and figures of reference.

G in each case represents a ground connection.

In Fig. 2, A is a sectional view of the switchboard shown in Fig. 1^a, and A' is a sectional view of the switchboard shown in Fig. 1^b, each as indicated by the line *d e*.

In Fig. 2, *g g* represent the springs of the switches and *j j* the insulated contact-pieces of the switches. *ll* are the switch-holes. *a b* are the rubber strips on which the contact-

pieces are mounted, as shown, and through the fronts of which are the holes *ll*. The insulated contact-pieces *j j* of the switches are so placed that a test-plug or similar device may readily be applied to them.

W and X are calling-annunciators, one for each of the lines shown.

The circuit of a line is as follows and as shown: One side or branch of the line is connected with all the contact-pieces *j j* of its switches on the boards. The other branch of the line is connected with all the contact-springs *g g* of its switches on the different boards and through the line-annunciator to the ground.

In the operator's cord system shown in Fig. 3, D D are the loop-switch plugs. *m m'* are the two contact-pieces of each plug. These contact-pieces pass to the bottom of the plug-handles, as shown, and are adapted to rest normally (or when not in use) on the metal plate *o*, which then connects the two contact-pieces of the plug together. Y is a looping-in switch for the pair of cords shown. *v* is the clearing-out annunciator for the pair of cords. *t* is the operator's telephone, and B is her calling generator or battery. The circuits are substantially as shown.

Only one pair of plugs and cords, with their apparatus, are shown. Other pairs, as required, may be added to the system in a way which will be apparent to those skilled in the art.

In the subscriber's test system shown in Fig. 4, T is the test-plug, connected with a flexible cord and adapted to be brought for testing into connection with any contact-piece *j* at its board. S is the test receiving instrument, and B' is a test-battery. The parts are connected together and to the ground substantially as shown.

Each operator has a cord system and a test system, and they are conveniently placed and mounted for her work.

In the subscriber's-station apparatus shown in Fig. 5, 1 is the telephone-switch. 2 is the calling-generator. 3 is the signal-receiving bell. 4 is the subscriber's telephone. 5 is the secondary, and 6 is the primary, of the induction-coil. 7 is the transmitter. 8 is the transmitter-battery. 9 is a condenser. These parts

may be of usual forms of apparatus and are connected as shown or in other ways so as to perform practically the operations required and the operations hereinafter described.

- 5 The generator, however, is modified and is as shown. When it is not in operation, the subscriber's line is open to the ground at his station and is on closed circuit, the two sides of the line being closed at the contacts n o.
- 10 While it is being operated the spring n passes out of contact with o and into contact with p and the line is automatically connected with the ground, with the armature-coil between said connection and the connection of the line to the ground at the central office.

- 15 In the normal condition the armature of the generator is shunted thus: One side of the line is connected with the generator-frame at g , and spring n is connected with the frame and with one terminal of the armature-coil.
- 20 The other terminal of the armature is connected with a contact on the shaft upon which the finger r bears, the finger being connected with the other side of the line through the bell and condenser when the telephone is on its switch.

- When a subscriber operates his generator to send in a call, his line is automatically connected to the ground, with his armature-coil between the connection and the central-office ground connection of the line, and the line-annunciator will be operated, indicating his call.

- 25 The connections of the subscriber's-station apparatus and switch are such that when the subscriber's telephone is on its switch the signal-receiving bell and the condenser are in the circuit of the line and the telephone and the secondary of the induction-coil are shunted by a wire x of small resistance, so as to be practically out of the circuit. When the telephone is off the switch, the telephone and the secondary of the induction-coil are in the circuit and the signal-bell and condenser are practically out of the circuit, being shunted by wire y . The resistance of the telephone and secondary of the induction-coil combined aggregate, in well-constructed apparatus, about four hundred ohms and the resistance of the signal-bell amounts to about one hundred ohms. The resistance of the condenser is such that when the telephone is in its normal position on its switch the line is practically open to the current from any test-battery which is closed with it. However, the circuit is then such that this current of a magneto-generator sent over it will operate the signal-bell. I utilize this difference in resistance in the operation of the calling and test system, as will hereinafter appear.

- 30 When an operator receives a call, she places one of a pair of her switch-plugs in the switch of the line, the contact-piece m' being in connection with the spring g , and there is a complete circuit of the line established through the two branches of the line, the two contact-pieces of the plug used, the pairs of the

conductors of the cords, the two contact-pieces of the other plug of the pair, and the metal piece which then connects them together, and the operator can, by moving the switch Y connect her telephone with the circuit and find out what line is wanted. When on testing the line wanted she finds it to be free, she places the other plug of the pair into its switch, with the contact-piece m' in contact with the spring, and the two lines are connected together into one circuit. The lines are then connected in metallic circuit and the cord connection of the two contacts m' grounds the branches of the two lines connected with the springs g , and this ground is between the two ground connections in which are the two line-annunciators. When two lines are connected together, the operator may, by operating the switch Y of the pair of cords used, thus connect at will either her telephone, her calling-generator, or the clearing-out annunciator into the circuit between the two branches of the lines connected with the contact-pieces j .

It will be seen that when the switch-plugs are placed into the switches of two lines, as described, one branch of the circuit is grounded at the central office by two circuits through the line-annunciators of the two lines and that they are shunted by the circuit of the clearing-out annunciator. The latter circuit is of much smaller resistance, and the line-annunciators of high resistance are thereby shunted by a circuit of so small resistance that any signal sent over the lines will not operate the line-annunciators, and when two lines are connected in metallic circuit, as described, both line-annunciators are shunted (when the generator is operated and grounded at either subscriber's station) through the grounded cord connection.

When an operator receives a call on a line assigned to her, she places one of the switch-plugs of a pair in the switch of the line, and, moving the levers of the looping-in switch, connects her telephone into the circuit and finds out what line is wanted. She then tests the line wanted, and if she finds it is not busy she places the other plug of the pair in its switch. She then moves the levers of the switch so that the calling-generator is in the circuit and a signal-current is sent over the circuit. The calling-generator should be of such strength that it will operate the subscriber's signal-bell through the resistance of the two lines, including the condenser in circuit while the subscriber's telephone is not switched for use. The calling-generators generally used by operators are of such strength as to accomplish this. When the operator has sent a calling-current to the circuit, she moves the levers of the switch so that the subscribers are connected together with the clearing-out annunciator of the pair of cords in the circuit.

The clearing-out annunciator is of such resistance and the current passing in the metallic circuit of two connected lines when the

generator of either subscriber is operated is of such strength that the clearing-out annunciator will be operated, but the line-annunciators in the ground branches of the lines will not be operated.

The operator's test receiving instrument and battery should be so constructed and related that when they are closed to the contact-piece *j* of the switch of any line and the subscriber's telephone is not switched for use and the condenser is therefore in the circuit the instrument will not sound and that when the subscriber's telephone is switched for use and the condenser is not in the circuit the instrument will sound.

This construction and relation between the test receiving instrument and battery can be readily obtained. They depend on the fact that an electromagnet may be readily constructed so as to operate when a battery and a certain resistance are in circuit with it and not to operate when the resistance is very much greater. This operation can be made to depend on the style of the magnet, the number of convolutions of its coil, the size of the battery, and the adjustment of the retractile spring.

When an operator desires to test any line to determine whether it is free to be switched to, she places her test-plug on the contact-piece *j* of the line at her board. The test-circuit is from the ground through her test receiving instrument and battery to the line and through the circuit of the line back to its ground at the central office. If the subscriber's telephone is not switched for use, his condenser is in this circuit and the test receiving instrument will not sound because the circuit is practically open to the test-battery. If, however, the subscriber's telephone is switched for use, there is a circuit through his station apparatus independent of the condenser and enough current passes through the test receiving instrument to operate it. The operator can therefore determine whether or not the line is free to be connected with.

In this system only two contact-points are required for each line at each board.

I have described herein a system of clearing out in which the line-annunciators are shunted by a circuit connection containing a clearing-out annunciator. I do not, however, claim such subject-matter herein, as it is claimed in another pending application filed by me.

I claim as my invention and desire to secure by Letters Patent—

1. In a telephone-exchange system, a metallic-circuit telephone-line normally open at one end at the central office and permanently grounded at its other end at the central office and normally grounded there only, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched

for use and out of the circuit while the telephone is switched for use, and a test wire or circuit containing a test receiving instrument and battery grounded at one end and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with the normally open end of the line, substantially as set forth.

2. In a telephone-exchange system, two or more multiple switchboards at the central office, and metallic-circuit lines connected to them, each line being normally open at one end and connected to each board and at its other end permanently grounded and connected to each board, and normally grounded there only, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, and a test wire or circuit containing a test receiving instrument and battery grounded at one end, and connected on its other end to a test plug or device adapted, at the will of the operator, to be brought into connection with the normally open end of any line, substantially as set forth.

3. In a telephone-exchange system, metallic-circuit lines, multiple switchboards for the same and switches, one switch on each board for each line, each switch having two contact-points, one of which is permanently connected to one side of the line and is permanently connected with the ground and the other of which is connected to the other side of the line, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, test receiving instruments, one at each board, each instrument grounded on one side and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought for testing into connection with any of said second-mentioned contact-points of the switches at its board, and battery in the test-circuit established on testing, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit telephone-line normally open at one end at the central office and permanently grounded at its other end at the central office and normally grounded there only, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, a test wire or circuit containing a test receiving instrument grounded at one end and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection

with the normally open end of the line, and battery in the test-circuit normally established on testing, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit telephone-line normally open at one end at the central office and grounded at its other end at the central office when the line is switched for conversation and normally grounded there only, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, and a test wire or circuit containing a test receiving instrument and battery grounded at one end and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with the normally open end of the line, substantially as set forth.

6. In a telephone-exchange system, a metallic-circuit telephone-line normally open at

one end at the central office and grounded at its other end at the central office when the line is switched for conversation and normally grounded there only, in combination with a condenser at the subscriber's station and switching apparatus by which the condenser is switched into the circuit of his line while his telephone is not switched for use and out of the circuit while the telephone is switched for use, a test wire or circuit containing a test receiving instrument grounded at one end and connected on its other side to a test plug or device adapted, at the will of the operator, to be brought into connection with the normally open end of the line, and battery in the test-circuit normally established on testing, substantially as set forth.

In witness whereof I hereunto subscribe my name this 20th day of December, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
MARGARETHA RIEHL.