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M. G. KELLOGG.

SWITCHBOARD FOR MULTIPLE EXCHANGES.

APPLICATION FILED AUG. 24, 1893.

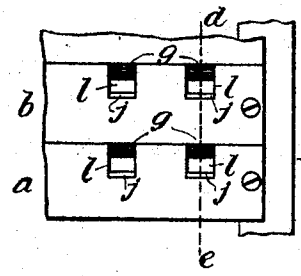

Fig. 1.a

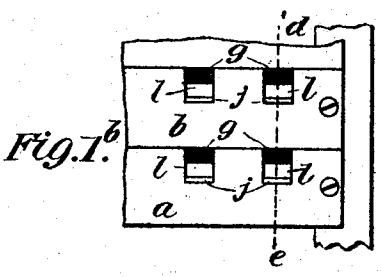

Fig. 1.b

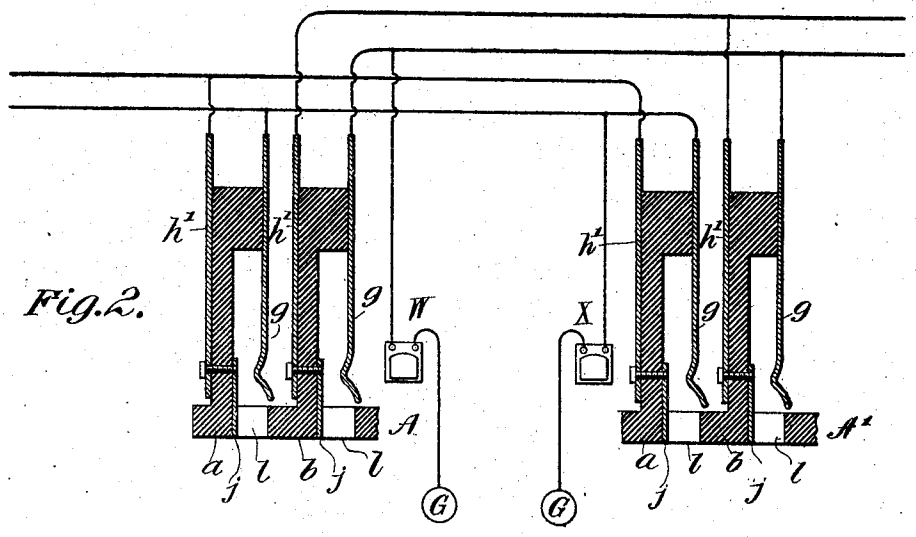

Fig. 2.

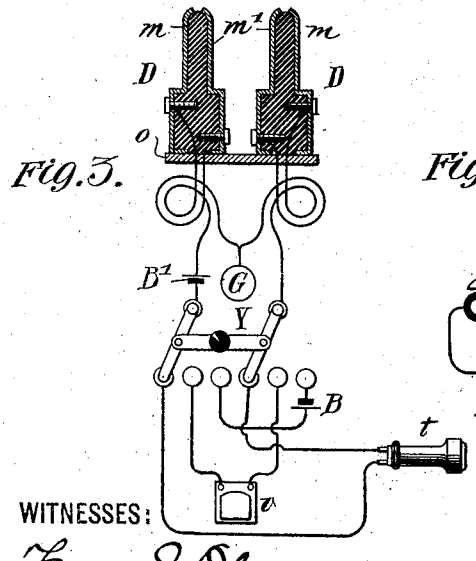

Fig. 3.

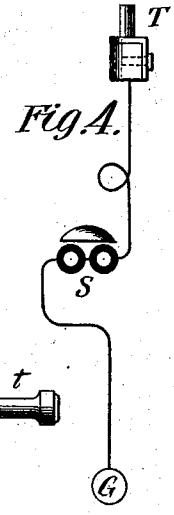

Fig. 4.

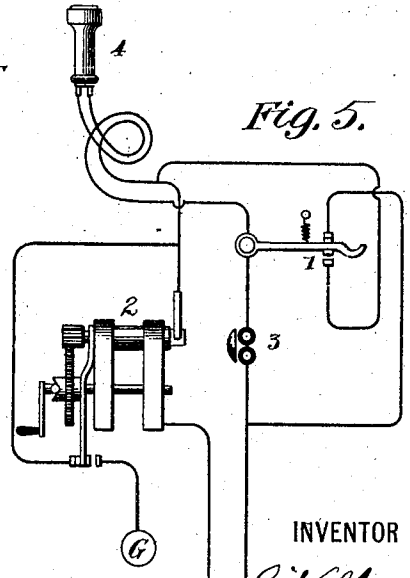

Fig. 5.

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SWITCHBOARD FOR MULTIPLE EXCHANGES.

No. 800,161. Specification of Letters Patent. Patented Sept. 26, 1905.

Original application filed December 31, 1889, Serial No. 335,534. Divided and this application filed August 24, 1893. Serial No. 483,933.

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Switchboards for Telephone-Exchanges, of which the following is a specification.

My invention is designed more especially for an exchange of metallic circuit-lines or one in which such lines are used; and it consists in a system of switching, calling, and clearing out hereinafter described and claimed.

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-piece, 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 characters 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*. *g g* represent the contact-springs of the switches, and *j j* the contact-pieces. *l l* are the switch-holes, *a b* the rubber strips on which the springs and contact-pieces are mounted, and *h′ h′* are connecting-strips for the contact-pieces *j j*. The insulated contact-pieces *j j* are so placed that a test-plug or similar device may readily be applied to them. When a switch-plug is inserted into a switch, the two contact-pieces of the plug are in contact with the two pieces *g j*, respectively. W and X are calling-annunciators—one for each line. Two metallic circuit-lines are shown in the drawings. The circuit connections of each line are as follows: One side or branch of the line is connected with all the contact-springs *g g* of its switches and through the line-annunciator to ground. The other branch of the line is connected with all the contact-pieces *j j* of its switches.

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, and B′ is a test-battery for them. *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. 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, and 4 is the subscriber's telephone. These parts may be the usual forms of apparatus and are connected as shown or in other ways so as to produce the required results. The generator, however, is modified and is as shown. The modification consists, essentially, in the number and arrangement of the contact-points of the automatic device. The automatic device shown is a modification of a

form very generally used. It consists in a V-shaped attachment to the hub of the driving-wheel, a pin in the shaft, which engages in this V-shaped arrangement, and a spring which presses against the wheel and brings the pin normally in the center of the V arrangement. The contact-points and circuits are substantially as shown. One side or branch of the line connects with the frame of the generator, as does also one end of the armature-coil and the spring of the automatic device. The other side or branch of the line connects to the insulated spring, which bears on an insulated piece on the armature-shaft, to which the other end of the armature-coil is connected. The contact-point with which the spring of the automatic device is pressed into contact when the generator is operated is connected to the ground. The side or branch of the line which is grounded at the central office is the one connected to said insulated spring of the generator.

When it is not in operation, the subscriber's line is open to the ground at his station. While it is being operated 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. When a subscriber operates his generator to send a call, his line is automatically connected to the ground with his armature-coil between such connection and the ground connection through the line-annunciator at the central office, and the line-annunciator will be operated, indicating his call.

When an operator places one of his loop switch-plugs into a switch for switching, he should place it so that the contact-piece m of the plug connects with the spring g of the switch and the contact-piece m' of the plug connects with the contact-piece f of the switch. When an operator receives a call, she places one of a pair of her switch-plugs in the switch of the line, 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 and the two lines are connected together into one circuit. The circuit is as follows: from the grounded cord connected to the contact-piece m' of one of the plugs to the line belonging to the switch in which the plug is placed, thence through the circuit of the line and the conductors connected with the contact-pieces m m of the plugs to the other line and through the line to the contact-piece m' of the plug inserted into its switch, and thence to the grounded conducting-cord. When two lines are connected together, the operator may, by operating the switch Y of the pair of cords used, connect at will her telephone, her calling-generator, or the clearing-out annunciator into the circuit.

It will be seen that when the two lines are connected together for conversation, one side of the combined circuit is grounded through the line-annunciators of both lines and has the clearing-out annunciator in its circuit between the ground connections of the lines through their two line-annunciators. The combined circuit of two lines connected together for conversation, therefore, has in the organization shown the clearing-out annunciator in its main or direct circuit and in one side or branch of the combined circuit, and the clearing-out annunciator shunts the two line-annunciators. The other side of the combined circuit is grounded through the conducting-cords of the plugs. The circuit of each line-annunciator connection to ground should be of such resistance that it is thereby shunted by a circuit of so small resistance that a signal current for clearing-out purposes sent from either station will not operate either line-annunciator, but will operate the clearing-out annunciator.

There is a test-battery B′ in the circuit with each pair of cords. When a plug is in a switch of a line, there will be battery-current on the line, and when the line is not switched there will be no current in the circuit of the line. When an operator places her test-plug on the test-bolt f of any line, her test-receiving instrument is connected to the line whether the line is switched or not. As her instrument is grounded at its other end and the line is grounded at some point her instrument will sound or respond if the line is switched, and therefore has a battery in circuit with it; but the instrument will not respond if the line is not switched and has no battery in circuit with it. The operator can therefore determine on testing whether or not any line is switched for use. The test-receiving instruments and batteries should be so related to each other that the instrument will sound when a test of a line is made and the line is switched for use. The batteries and the clearing-out annunciator should be so related to each other that the annunciator will not be operated when the two are connected together in a line-circuit. When a test of a line is made and it is connected with another line, there will be two branch or derived circuits between the two sides of the test-receiving instrument, in one of which only is the battery. The circuits are, however, of such resistance that the test-receiving instrument can readily be made to respond to the battery under the conditions named.

The test system shown and described is claimed in my application, Serial No. 335,534,

filed December 31, 1889, of which this case is a division.

From the foregoing description the system of calling and clearing out will be plain. The following points may, however, be noted: The line-annunciator of each line is permanently connected with its line and is in closed circuit with the subscriber's generator whenever it is operated to send either a calling or clearing-out signal. When two lines are connected together for conversation, the clearing-out annunciator is also in closed circuit with the generator when operated to send the clearing-out signal. When the subscriber's calling-generator is operated to send a call and the line is not switched for conversation at the central office, the current passes from, say, ground at the central office through the annunciator of the line, thence through the side or branch of the line to which the annunciator is connected, and through the armature of the subscriber's generator to ground through the pair of contact-points automatically closed while the generator is being operated. When the generator is operated to send a clearing-out signal and the line is switched with another line for conversation and a clearing-out annunciator is in their circuit, there are several derived circuits through which the clearing-out current divides according to the well-known law of the distribution of currents. The circuit can be traced as follows: Starting with the ground automatically established at the subscriber's station by the operation of the generator, it is thence through the armature of the generator and one side or branch of the line to the central office and thence to ground through three paths—one through the line-annunciator of the line to which the generator belongs and the others through the clearing-out annunciator and thence to ground through two paths, one being through the line-annunciator of the other line and the other being through the circuit of the other line by way of its subscriber's station to ground at the central office through the ground connection of the contact *m'* of the plug inserted into its switch. The remaining part of the combined metallic circuit of the two lines, which is between the ground connections of the pair of plugs used in making the connection and the automatic ground connection established when the generator is being operated, is at that moment short-circuited by the two ground connections, and very little of the current will pass over it. It is evident that with a sufficiently-high resistance in each line-annunciator and a sufficiently-low resistance in the clearing-out annunciator, a greater amount of the clearing-out current will pass through the clearing-out annunciator than through either of the line-annunciators, and the difference may be such that the clearing-out annunciator will be operated, while the line-annunciators will not be operated while the signal is sent for clearing-out purposes. As before stated, the path or circuit for the clearing-out current through the clearing-out annunciator is of such low resistance compared with the circuit through either line-annunciator or the circuit through both of them that invariably the clearing-out annunciator only will be operated when either subscriber sends the clearing-out signal. In this system also the two branches of a line are normally open to each other at each switch of the line and the two contacts of each switch are permanently connected with the two branches of the line. When, therefore, two lines are connected together into metallic circuit for conversation, the only separable contacts in said circuit are those at the two switches where the plugs are inserted. I avoid, therefore, the liability of imperfect contact, which exists in those systems in which the line passes through a series of separable switch-contacts. In this system also the subscriber only required to operate his generator in the same way for either calling or clearing out, and is not required to perform some additional operation—as, for instance, depressing a key when sending either the calling or clearing-out signal.

So far as I am aware the system of calling and clearing out in which the line-annunciators are permanently in circuit with their respective generators whenever the generator is operated and in which both line-annunciators of two connected lines and the clearing-out annunciator are in closed circuit with the generator of either subscriber when operated to send the clearing-out signal is generically new with me. Obviously it may be adapted to other organizations of switchboards and lines than that herein described and shown.

I claim as my invention—

1. The combination of two telephone-lines temporarily connected together for conversation, a calling and clearing-out generator at each subscriber's station, and the line-annunciators of the two lines and the clearing-out annunciator, said clearing-out annunciator being in the main or direct circuit of the combined circuit of the two lines and in one side or branch thereof, and shunting the line-annunciators all in closed circuit with either subscriber's generator when operated to send the clearing-out signal, the circuit through the clearing-out annunciator being of such less resistance than that through the two line-annunciators, or either of them, that the clearing-out annunciator only is operated when the clearing-out signal is sent.

2. The combination of multiple switchboards, two telephone-lines connected to the same, temporarily connected together at one of the boards for conversation, a calling and clearing-out generator at each subscriber's station, and the line-annunciators of the two lines and the clearing-out annunciator, said clearing-out annunciator being in the main or

direct circuit of the combined circuit of the two lines and in one side or branch of the combined circuit all in closed circuit with either subscriber's generator when operated to send the clearing-out signal, the circuit through the clearing-out annunciator being of such less resistance than that through the two line annunciators, or either of them, that the clearing-out annunciator only is operated when the clearing-out signal is sent.

3. The combination of two telephone-lines temporarily connected together for conversation, a calling and clearing-out generator at each subscriber's station, and the line-annunciators of the two lines and the clearing-out annunciator, said clearing-out annunciator being in the main or direct circuit of the combined circuit of the two lines and in one side or branch of the combined circuit all in closed circuit with either subscriber's generator when operated to send the clearing-out signal, said clearing-out annunciator being operated, but said line-annunciators not being operated or caused to indicate by the current sent when the clearing-out signal is sent.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:
J. G. KELLOGG,
FRANCES D. KELLOGG.