

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,350.

Patented Oct. 26, 1897.

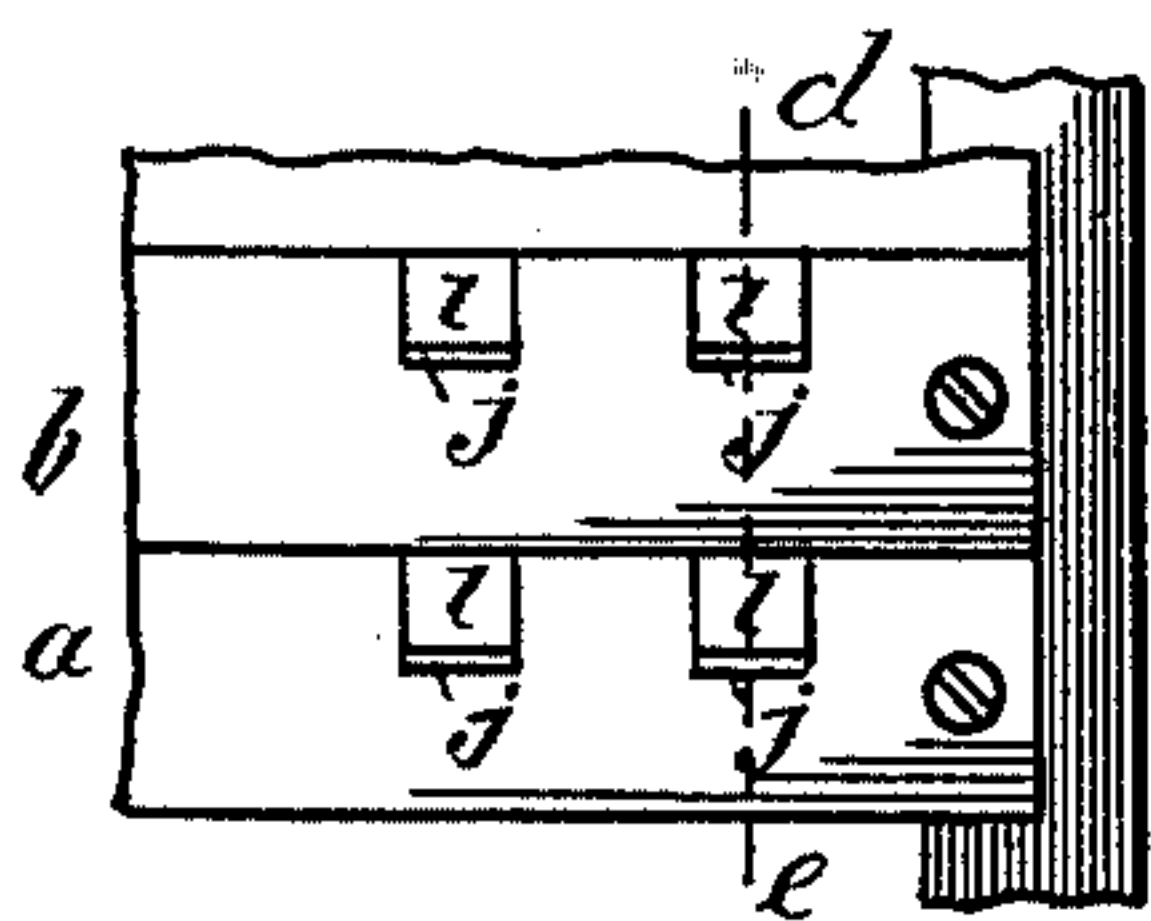


Fig. 1a

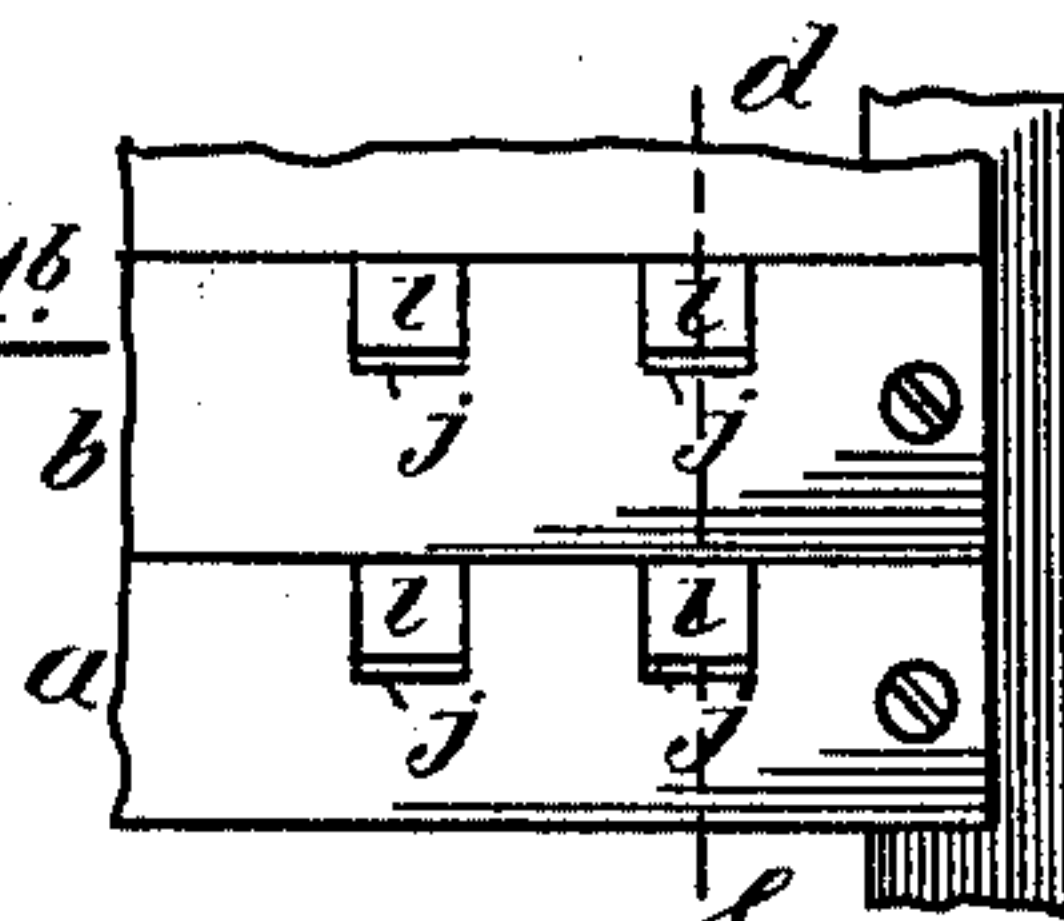
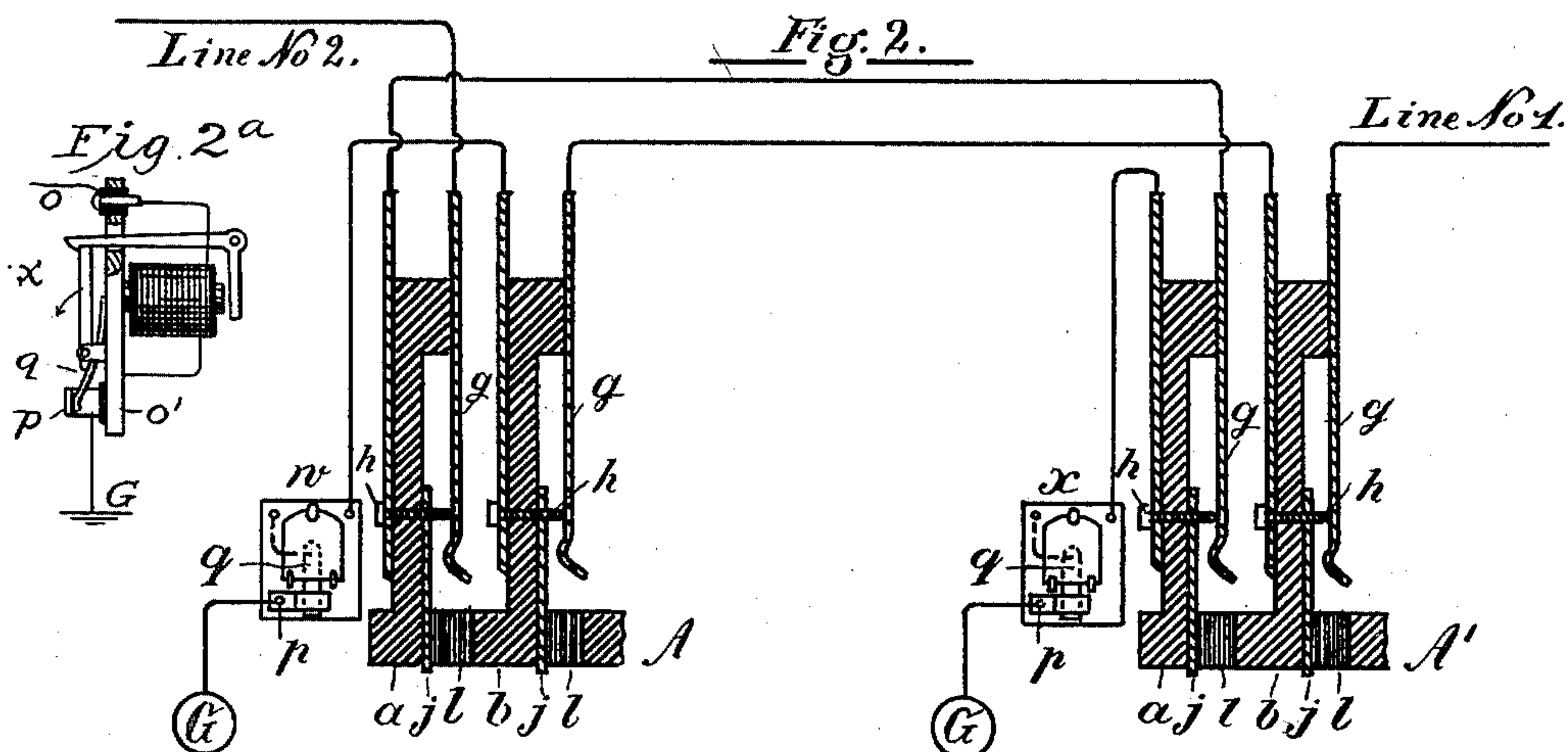


Fig. 1b



Line No. 2.

Fig. 2.

Line No. 4.

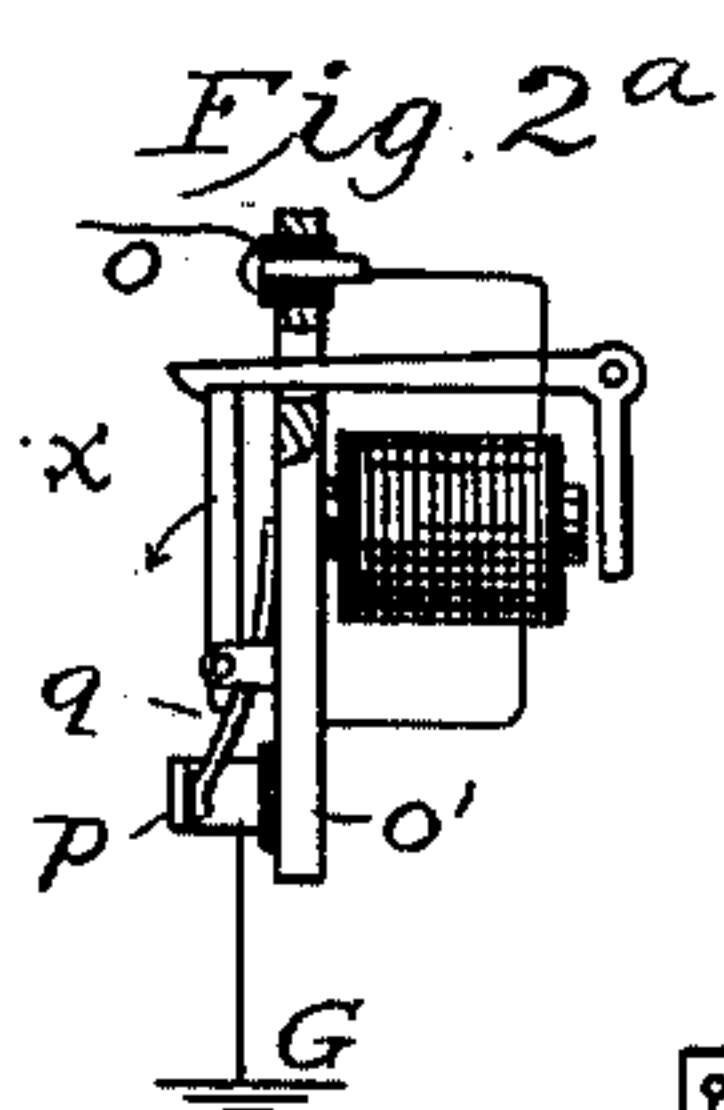


Fig. 2a

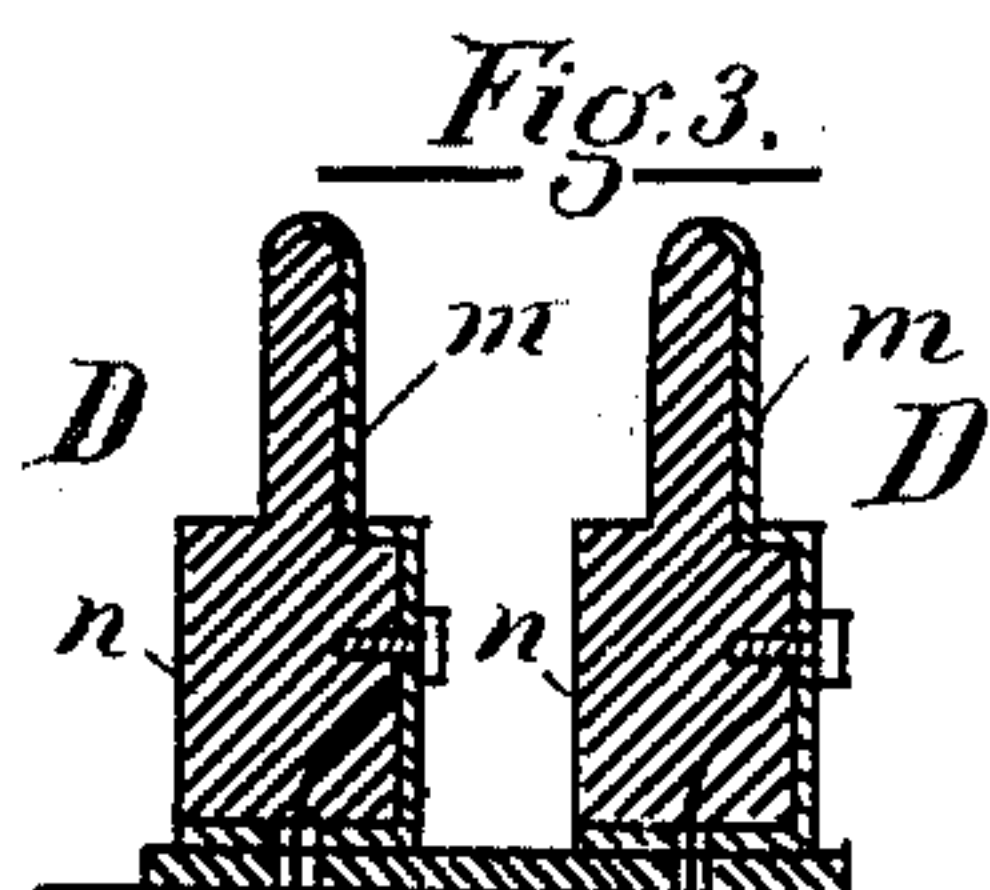


Fig. 3.

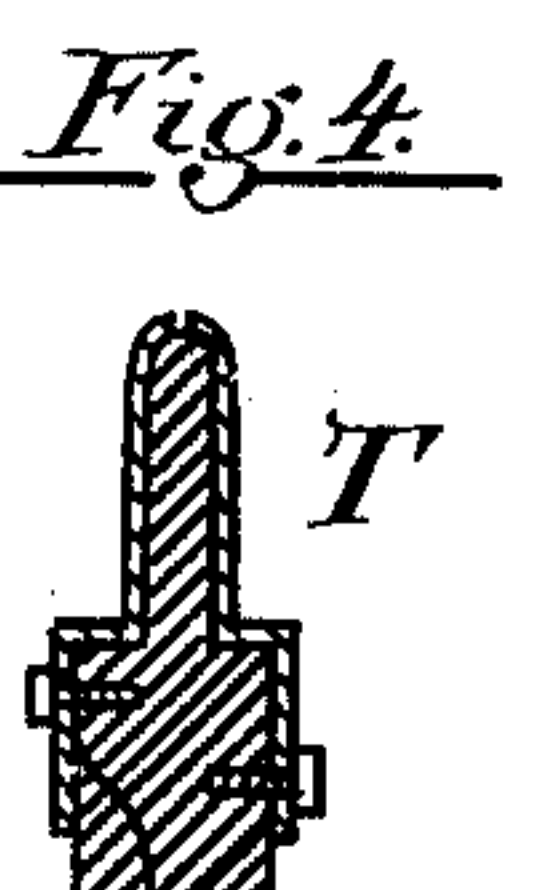


Fig. 4.

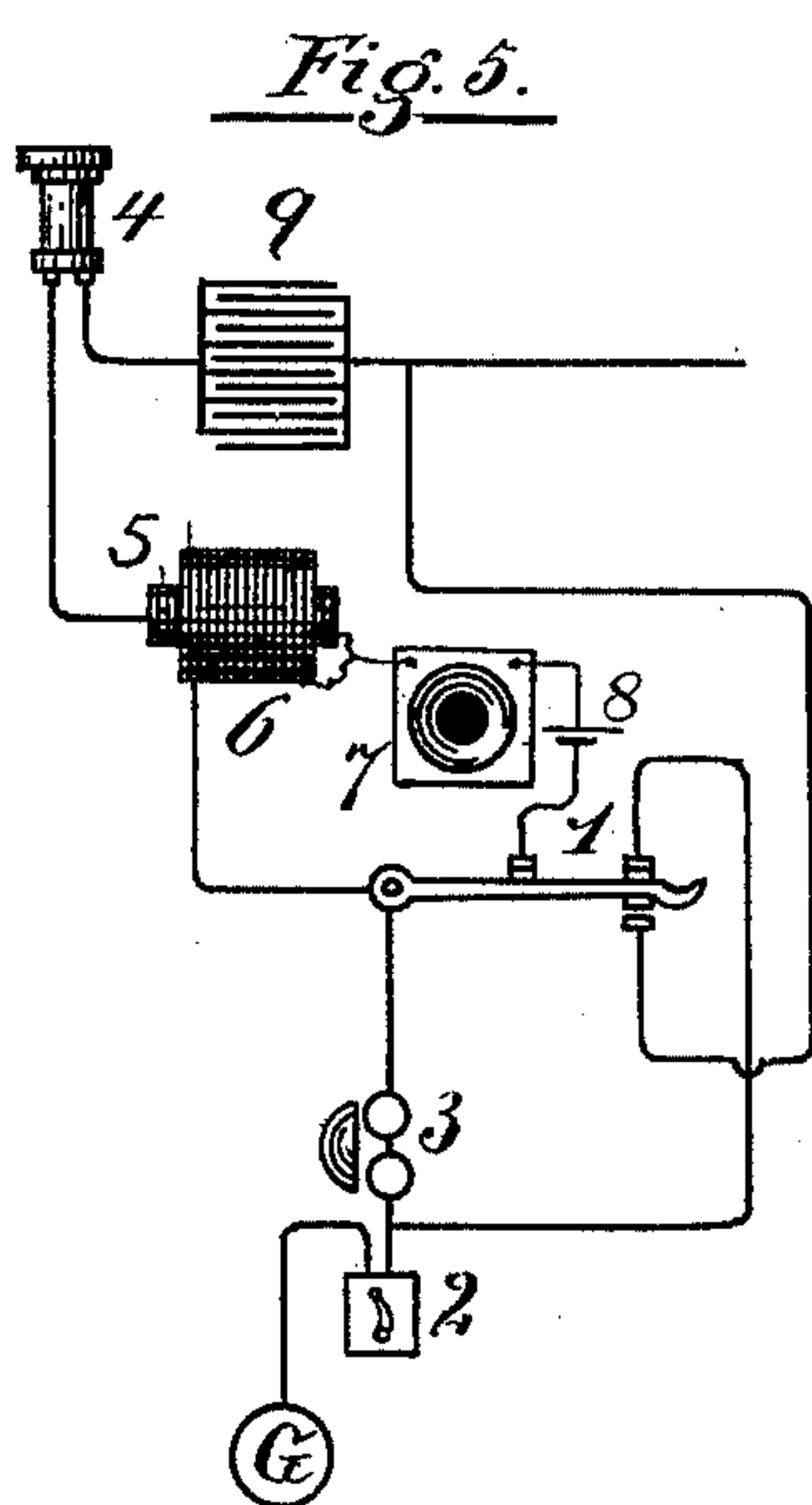


Fig. 5.

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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. 592,350, dated October 26, 1897.

Application filed January 2, 1890. Serial No. 335,700. (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 a telephone-exchange system in which the lines are single-circuit lines grounded at their outer ends; and it consists of apparatus for switching such lines of the exchange, in the operation of the exchange system, and a system of testing the lines to determine whether they are in use.

In the 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 main-line apparatus and connections necessary to illustrate my invention. Fig. 2^a is a detail view of one of the line-annunciators. Fig. 3 shows a diagram of an operator's cord system to be used in connection with the boards. Fig. 4 shows an operator's test system to be used at the boards. Fig. 5 shows a subscriber's-station apparatus.

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*.

I place as many boards in the central office as are found necessary or desirable in order to properly operate the exchange. On each board is a spring-jack or other suitable switch for each line. Each switch has a contact-spring which normally connects with an insulated contact-piece and is adapted to receive a loop-plug and, when a plug is inserted, to disconnect the spring from the contact-piece and connect the two contact-pieces of the plug with the spring and said insulated contact-piece, respectively. The switch is also adapted to receive a single-contact switch-plug and, when a plug is inserted, to discon-

nect the spring from the contact-piece and connect the spring with the contact-piece of the plug. In the construction of the switches, as shown and as will hereinafter be described, I prefer to have a contact-point electrically connected with the contact-piece and on which the spring normally bears, as there is less chance of poor connection when the spring bears on a point than when it bears on a surface adapted to be brought into connection with the plug-contacts.

In Fig. 2, *g g* represent the springs of the different switches, *h h* the contact-points on which the springs normally bear and *j j* the contact-pieces of the switches connected with the points *h h*. *l l* are the switch-holes. *a b* are the rubber strips on which the metal parts of the switches are mounted, as shown, and through the fronts of which are the switch-holes *l l*.

The contact-pieces *j j* are so placed along one of the surfaces of the plug-holes as readily to form connection with one of the contact-pieces of the loop-plugs.

The holes *l l* are adapted to receive the switch-plugs shown in Fig. 3 and marked D D, and when a plug is inserted into a switch it raises the spring *g* from the contact-point *h*, and the spring *g* and contact-piece of the plug are in contact. These holes are also adapted to receive the loop-plug shown in Fig. 4, and when a plug is inserted into a hole it raises the spring of the switch from the contact-point *h*, and the spring *g* and the contact-piece *j* of the switch are in contact with the two contact-pieces of the plug, respectively.

w and *x* are calling-annunciators, one for each of the lines shown. Each annunciator has a pair of contact-points normally (or when the annunciator does not indicate a call) in contact with each other, but which are separated by the annunciator while it indicates a call. The two contact-points of a pair are marked *p* and *q*, respectively. One of them, *q*, is a spring-contact which is pressed by the annunciator-drop when the drop falls away from its corresponding contact-point *p*. The contact-point *p* is represented as an angle-piece which passes over the spring *q* and is in contact with the spring when the spring is not actuated by the annunciator-drop.

The annunciator is shown in detail in Fig. 2^a. The line runs to an insulated bolt *o* at the top of the annunciator-plate *o'*, thence through the annunciator-coil to the plate, and thence normally through spring *q*, which is in electrical contact with the plate, to the insulated angle-piece *p*, against which spring *q* normally bears, and thence to earth.

Two lines are shown in the drawings, one marked line No. 1 and the other line No. 2. These lines are ordinary single-circuit lines grounded at their outer ends and having at the subscribers' stations any usual and appropriate subscriber's-station apparatus. Each line passes successively through the pairs of contacts of its switches on the several boards, passing to each spring first. It then passes through its line-annunciator and the pair of annunciator contact-points to the ground. The circuit of each line shown may thus be traced in Fig. 2.

In the operator's cord system shown in Fig. 3, *DD* are the switch-plugs of a pair of cords. *nn* are the rubber insulations of the plugs, and *mm* are their contact-pieces. These contact-pieces pass each to the bottom of its plug and are adapted to rest normally or when the plug is not in use on the metal piece *o*, which then connects it with the ground. Weights, as is usual, or similar devices may be used to bring the contact-pieces of the plugs into contact with the piece *o* and secure a good connection. These plugs are adapted to be inserted into any of the switches at their board, and when a plug is inserted it operates the switch, as above described. The plugs should be inserted so that the contact-piece *m* is in contact with the spring *g*. The connections of the lines might have been reversed, so that the lines pass first to the contact-piece *j* of each of their switches, and in that case the plugs should be inserted in such a position that their contact-pieces form connection with the pieces *j* of their switches. *Y* is the looping-in switch for the pair of cords shown. *k* is the calling-key, and *v* is a clearing-out annunciator. *t* is the operator's telephone, and *B* is her calling generator or battery. The circuits are substantially as shown.

The two levers of the looping-in switch are connected by means of flexible conductors to the two contact-pieces of the switch-plugs. The contact-bolts of one of the pair of the switch-bolts are connected together through the clearing-out annunciator, and the two other contact-bolts are connected together through the operator's telephone. The lever of the calling-key is connected to the circuit of one of the cords and the contact-point of the key is grounded through the calling generator or battery.

The operation of the system in connection with the switch-boards will be apparent to those skilled in the art.

It will readily be apparent that when a line is switched by the insertion of a plug into

its switch the line is disconnected from its normal ground at the central office and is connected into a circuit with the pair of cords. Only one pair of cords is shown, but the connection of such other pairs, with their accompanying apparatus, as the operator may need will be apparent to those skilled in the art. To each pair of cords, with its plugs, belong a looping-in switch, a clearing-out annunciator, and a calling-key. One telephone and one calling-generator will answer for her system of cords.

In the operator's test system shown in Fig. 4, *T* is a loop test-plug adapted to be inserted into any of the switches, and when inserted to operate them, as heretofore described. *B'* is a test-battery, and *S* is a test receiving instrument. The battery and instrument are connected in a loop which terminates in the two contact-pieces of the plug.

Each operator has one cord system and one test system, and they are conveniently mounted and arranged 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, and 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.

When the subscriber's telephone is on its switch, the signal-receiving bell is in the direct circuit of the line, and the telephone, the secondary of the induction-coil, and the condenser are shunted by a wire of small resistance, so as to be practically out of the circuit. When the telephone is off the switch, this shunt is removed and the telephone, the secondary of the induction-coil, and the condenser are in the direct circuit and the signal-bell is practically out of the circuit.

The line passes through the condenser 9, thence through the telephone and the secondary and primary of the induction-coil to the lever of the switch, and thence through the signal-bell and calling-generator to ground. A circuit-wire of small resistance passes from the line between the subscriber's station and the condenser to a contact-point, against which the switch-lever is in contact when the telephone is on the lever. Another wire of small resistance passes from the circuit between the signal-bell and the office ground to a contact-point against which the lever comes in contact when freed from the weight of the telephone. A third circuit-wire passes from the connection between the primary and secondary of the induction-coil, through the transmitter and battery, to a contact-point against which the switch-lever comes in contact when relieved of the weight of the telephone.

The test receiving instruments and test-batteries are then so adjusted to each other and the circuits that the instrument will sound or respond when it and its battery are looped into the closed circuit of any single line and the subscriber's telephone is not off its switch for use, so that the condenser is in the direct circuit, but will not respond if the test-circuit is open at any pair of points or if the subscriber's telephone is off its switch and the condenser is included in the direct circuit and the test-circuit is thereby opened at the condenser.

The operation of the test system is as follows: When an operator desires to test a line, she places her test-plug into the switch of the line, and by so doing disconnects the points *g* and *j* of the switch and connects them with the contact-pieces of the plug. If, then, the line is not switched at any board, and the annunciator does not indicate a call and the subscriber's telephone is on its switch, the test receiving instrument will sound or respond, indicating that the line is free to be switched to. If, however, the subscriber has taken his telephone from the switch for use, the line not being switched, the instrument will not sound, as the condenser in the circuit is open prevent it from doing so. If, again, the annunciator indicates a call, the circuit is open at the pair of contact-points of the annunciator and the instrument will not sound, because the line is switched at some board and again, the line is switched at the office the test is made in the cut-off portion of the line—that is, that portion which is between the switch used for switching and the office ground—the instrument will not sound, because the test-circuit is open at the pair of contact-points of the switch used for switching. If, again, the subscriber has taken his telephone down for use and the line is switched at any board with another line and the test is made in a switch between the one used for switching and the subscriber's station, the instrument will not sound on account of the condenser in the circuit.

When a test of a line is made and the test receiving instrument sounds, the operator knows that neither the line is switched for use nor the subscriber's telephone is switched for use nor the annunciator indicates a call, and when the instrument does not sound she knows that either the line is switched for use or the annunciator indicates a call, and is switched for use or the line is switched for use or the annunciator indicates a call, and she will not connect the line with any other line. By this system a subscriber's telephone is reserved to himself from the time he sends in his call or takes his telephone down for use. In the subscriber's apparatus shown in Fig. 60 when the telephone is on its hook the condenser is shunted, and when the telephone is then hooked the shunt around the condenser is then positively cutting or switching it out of circuit or by shunting it. Obviously, either plan may be adopted in this system, and the terms employed by me in the claims are intended to cover either plan.

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

1. In a telephone-exchange system, a telephone-line normally passing successively through pairs of switch contact-points, one pair on each of several boards, each pair normally closed, but open while the line is switched at their board and through an annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call, in combination with switching devices at each board to disconnect said pair of contact-points at the board and switch the line for conversation, a condenser and a switch at the subscriber's station with contact-points to switch the condenser into the circuit of the line while his telephone is switched for use and out of the direct circuit of the line when the telephone is not switched, and a loop test-plug in the two contact-pieces of which terminate the two sides of a loop containing a test receiving instrument and battery, said plug being adapted to be inserted into one of the switches and when which are normally in contact and connected to disconnect its said contact-points with the contact-pieces of the plug test-receiving instrument being so related adjusted that it will sound when looped the simple normal closed circuit of the circuit is open or the line is in circuit with the battery but will not sound when switched for use and the condenser is included in the circuit, substantially as set forth.

2. In a telephone-exchange system, a telephone-line grounded at its outer end and normally passing successively through pairs of switch contact-points, one pair on each of several boards, each pair normally open while the line is switched at their board and through an annunciator and a pair of contact-points normally closed but open while the annunciator indicates a call, in combination with switching devices at each board to disconnect said pair of contact-points at the board and switch the line for conversation, a condenser and a switch at the subscriber's station with contact-points to switch the condenser into the circuit of the line while his telephone is switched for use and out of the direct circuit of the line when the telephone is not switched, and a loop test-plug in the two contact-pieces of which terminate the two sides of a loop containing a test receiving instrument and battery, said plug being adapted to be inserted into one of the switches and when which are normally in contact and connected to disconnect the condenser from the circuit, substantially as set forth.

said test receiving instrument and battery being so related and adjusted that the instrument will sound when they are included in the normal closed circuit of the line (the subscriber's telephone not being switched for use) but will not sound when included in circuit with the line and the circuit is open or the line is in circuit with another line or the telephone is switched for use and the condenser thereby included in the circuit, substantially as set forth.

3. In a telephone-exchange system, a telephone-line normally on closed circuit and passing successively through pairs of switchboards, each pair normally in contact but open while the line is switched for conversation and a pair of contact-points normally closed but open while the annunciator indicates a call, in combination with switching devices at each board and a switch the contact-points at the board and switch the subscriber's station with contact-points of the condenser into the circuit of the switch while the condenser is switched for use and of the direct circuit of the line when the hone is not switched, a loop test-plug in contact-pieces of which terminate the instrument, said plug being adapted to be inserted into one of the switches and switch which are normally in contact and battery in the circuit established so related that the testing, said test receiving instrument will sound when they are included in the normal closed circuit of the line but not when the circuit is open at a point or the line is in circuit with the subscriber's telephone for use and the condenser is included in the circuit, substantially as set forth.

4. In a telephone-exchange system, a telephone-line normally on closed circuit and passing successively through pairs of switchboards, each pair normally in contact but open while the line is switched for conversation and a pair of contact-points normally closed but open while the annunciator indicates a call, in combination with switching devices at each board and a switch the contact-points at the board and switch the subscriber's station with contact-points of the condenser into the circuit of the switch while the condenser is switched for use and of the direct circuit of the line when the hone is not switched, a loop test-plug in contact-pieces of which terminate the instrument, said plug being adapted to be inserted into one of the switches and switch which are normally in contact and battery in the circuit established so related that the testing, said test receiving instrument will sound when they are included in the normal closed circuit of the line but not when the circuit is open at a point or the line is in circuit with the subscriber's telephone for use and the condenser is included in the circuit, substantially as set forth.

5. In a telephone-exchange system, multiple switchboards, switches for said lines, one on each board, each switch having a pair of contact-points normally in contact but open while the line is switched at their board, each line passing normally successively through the pairs of contact-points of its switches on the several boards and an annunciator and a pair of contact-pieces of each pair of switch-plugs at each board, the annunciator indicates a call, in combination with pairs of switch-plugs each connected by a flexible-cord circuit, each of said plugs being adapted to be inserted into any switch at its board and when inserted to disconnect the pair of contact-points of the switch which are normally in contact and connect the line piece of the plug, loop test-plugs, one at each board, each loop-plug having two contact-pieces in which terminate the two sides of a loop containing a test receiving instrument and battery, said test plugs being each adapted to be inserted into any switch at its board and when inserted to disconnect the contact-points of the switch and connect the contact-points to switch the condenser into the circuit of the line while his telephone is switched for use and out of the direct circuit of the line when the telephone is not switched for use and the condenser is included in the circuit, substantially as set forth.

6. In a telephone-exchange system, multiple switchboards, telephone-lines normally on each board, each switch having a pair of contact-points normally in contact but open while the line is switched at their board, each line passing normally successively through the pairs of contact-points of its switches on the several boards and

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