

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,305.

Patented Oct. 26, 1897.

Fig. 1a

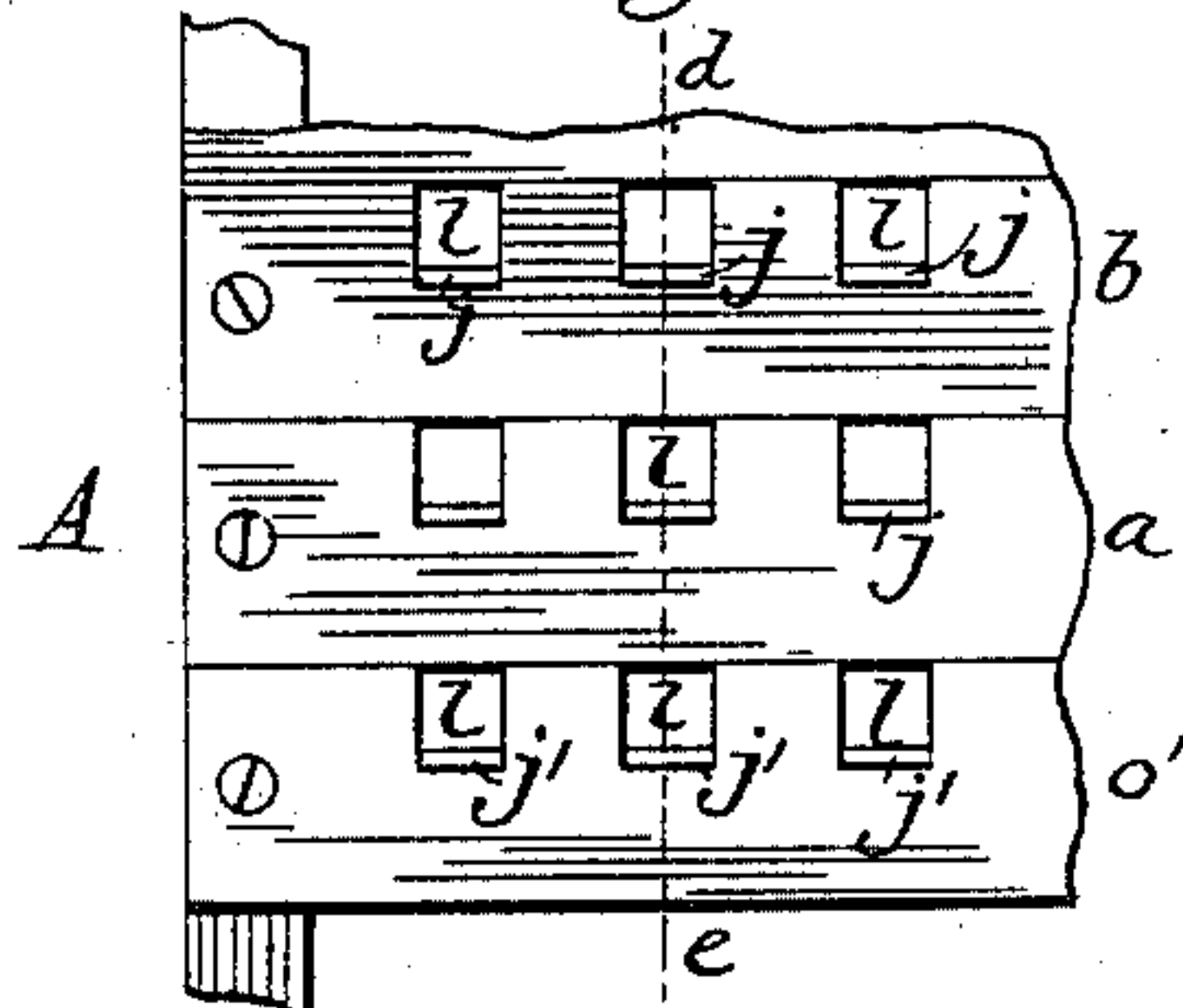


Fig. 1b

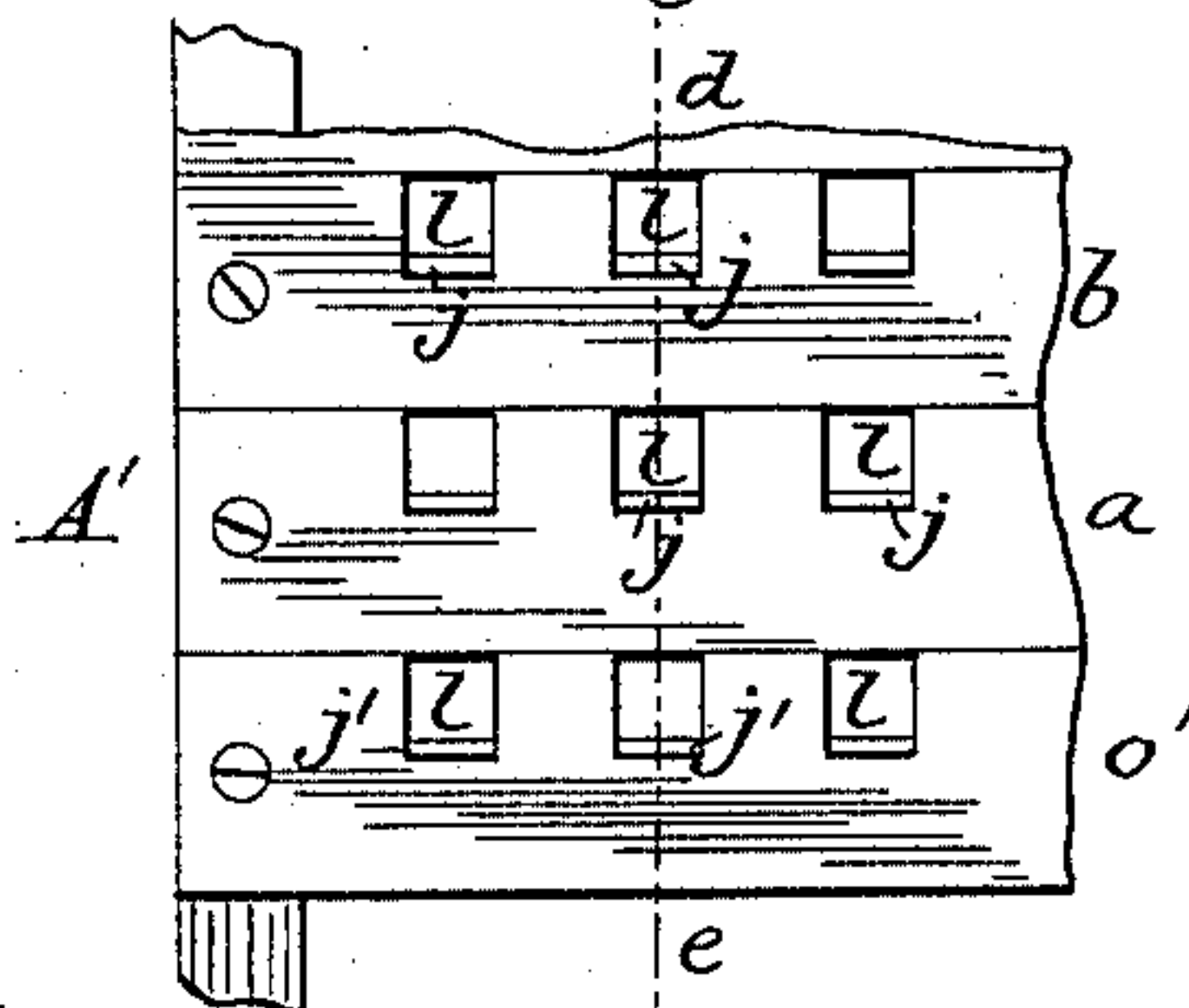
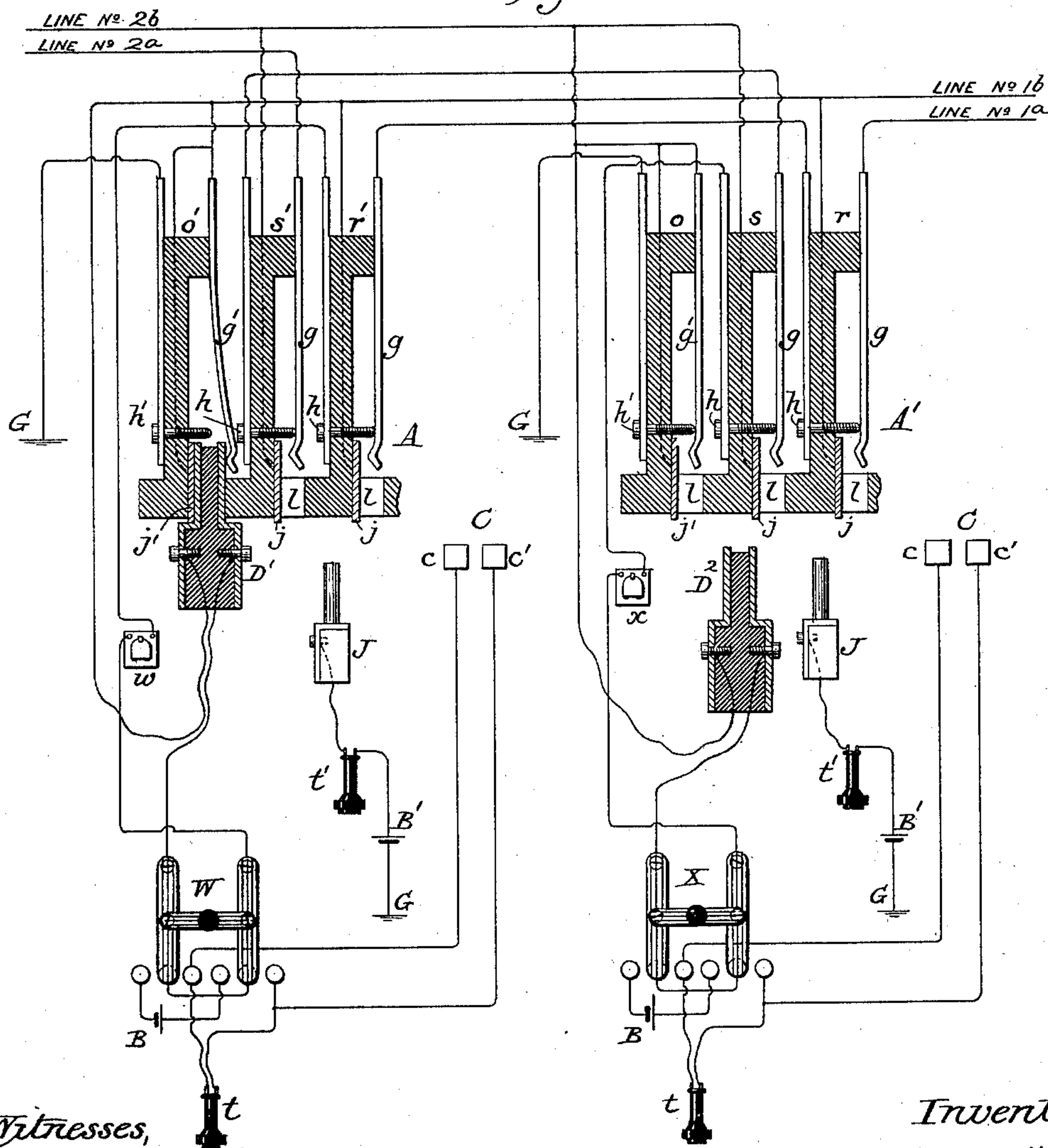


Fig. 2



Witnesses,

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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. 592,305, dated October 26, 1897.

Application filed April 1, 1893. Serial No. 468,658. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, (Hyde Park,) Illinois, 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 subscribers' lines are metallic-circuit lines; and it consists of apparatus for switching, calling in, and operating such an exchange.

In the accompanying drawings, illustrating my invention, Figures 1^a and 1^b are front views of sections of two multiple switchboards to which the same lines are connected. Fig. 2 shows in diagram one organization for practicing my invention.

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

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

I place as many boards at the central office as are found necessary or desirable in order to properly answer the calls and make the connections.

On each board is a spring-jack or other suitable switch for each line. Each switch has a contact-spring which normally bears on an insulated contact-point and has another contact-piece insulated from the rest of the apparatus (except by line connections) and is adapted to receive a loop-switch plug and when the plug is inserted to disconnect the spring from the contact-point on which it normally rests and connect the contact-pieces of the plug with the contact-spring and said insulated contact-piece of the switch, respectively.

For each line I use, or may use, a calling-annunciator at the central office, and these annunciators are distributed among the different boards, so that the calls may be readily answered and attended to.

The switching apparatus of a line on the

board where its calls are to be attended to is different and is connected differently from the switching apparatus of the line on the other boards. At this board the line terminates on both sides in a double or loop cord with a double or loop plug. This plug is normally (or when the line is not switched for conversation) placed in a switching device adapted to connect electrically the two contact-pieces of the plug. There are two contact-pieces of this switching device, (in which the plug of its line is normally placed,) which are separated by the insertion of the plug and are in contact when the plug is not inserted. One of these contact-pieces is connected with the line, and the other is connected with the ground. The pairs of switch points or pieces of the switches of a line which are normally in contact as described are all placed in circuit in one side or branch of the line. These pairs of points are connected in the circuit of the branch between the contact-piece of the switch-plug of the line and the subscriber's station, and are so constructed and connected that when a switch-plug is inserted into any switch it disconnects the said side or branch of the line from said contact-piece of its plug and connects said side or branch with one of the contact-pieces of the plug which is inserted. The other side or branch of the line is connected at each board to a contact-piece suitably placed and adapted to be brought into connection with a test-plug which forms the terminal of a test wire or circuit at that board. In this test-circuit is a test receiving instrument and a test-battery of suitable character.

The last-mentioned side of the line is also connected at its switch at each board to a contact-piece suitably placed and adapted to be brought into connection with the other contact-pieces of the double plug when the plug is inserted into the switch.

The contact-pieces to which the test-plugs are to be applied and the switch contact-pieces last mentioned may be one and the same piece, as shown.

The calling-annunciator of a line is connected into the circuit of one side or branch of the line and is placed between the switch

contact-points of the switches of the line and the contact-piece of the plug which is connected with that side of the line.

On each board I place in convenient positions one or more switching devices, each having two contact-pieces and adapted at the will of the operator to be brought into electrical connection with the two contact-pieces, respectively, of any loop-plug located at that board.

At each board I also place in convenient position switching devices adapted to loop a calling-generator or an operator's telephone into the circuit of any line which has its loop-plug located at that board.

In Fig. 2 of the drawings two metallic-circuit lines are shown, and they are connected to the switches and apparatus on the two boards shown in such a manner as to allow all the necessary operations of a telephone-exchange system, and at the same time show the principles of my invention. The two sides of one line are marked line No. 1^a and line No. 1^b. *r* and *r'* are the two spring-jack switches of this line. The two sides of the other line are marked line No. 2^a and line No. 2^b. *s* and *s'* are the two spring-jack switches of this line at the two boards.

a b, &c., are the rubber strips on which the metal parts of the switches are mounted.

g g, &c., are the spring contact-pieces of the switches. *h h*, &c., are the contact points or pieces on which the springs normally rest.

l l are the holes adapted to receive the switch-plugs.

j j, &c., are the contact-pieces of the lines on the different boards to which the test-plugs may be applied. They are also the pieces mentioned above, which form the connection between one contact-piece of a plug inserted into a switch and the other side of the line from that in which are the pairs of contact-points.

o o' are the switching devices in which the plugs are normally placed.

g' g' are contact-springs connected to their respective lines. *h' h'* on which the contact-springs rest when the plugs are not in the devices are connected with the ground. The pieces *j' j'* are connected with their corresponding springs *g' g'*.

There is one switching device *o o'* for each line, and it is located at the board where the double plug of the line is located, and the double plug is normally in position in the device which belongs to its line.

It will be seen that when a loop-plug is inserted into its switching device (which is its normal position) the two contact-pieces of the plug are bridged or electrically connected by means of the spring *g'* and the contact-piece *j'* of the device with which the contact-pieces of the plug are then respectively connected, the pieces *g'* and *j'* of each device being electrically connected, as shown.

It will also be seen that when a plug is withdrawn from its device the electric con-

nection above mentioned between its two contact-pieces will be broken and that the line will be then (or temporarily) grounded or connected with the test-circuit by the spring *g'* of the device coming in contact with the point *h'*.

As heretofore indicated, the line itself is normally (or when not switched for conversation) disconnected from the ground or test circuit. When it is switched for use by its plug being taken from its normal position, it is then temporarily connected with the ground or test circuit.

The operation of the switching device in connection with the loop-plug has two important functions in my invention. By bridging the contact-pieces of the plug when it is inserted and opening the contact between them when it is withdrawn there is afforded a normally-closed metallic circuit for the line for signaling on the line-annunciator from the subscriber's station, while the very act of removing the plug for switching opens the circuit, so that it can be looped with another circuit for conversation. The grounding of the line or its connection with a test-circuit when the plug is withdrawn and the removing of the ground or test circuit connection from the line when the plug is inserted in its normal position makes possible the test system hereinafter described. The mere placing of the plug in its normal position and the removing of it for switching produces all of these results.

w and *x* are calling-annunciators for the two lines, *w* being for line No. 1 and located at board A, where the double plug of that line is located and its calls are to be answered, and *x* being for line No. 2 and located at board A', where the double plug of that line is located.

D' and D² are two loop-plugs attached to double flexible cords, D' being for line No. 1 and D² for line No. 2.

W and X are looping-in switches for the lines, connected to their circuits and to the other apparatus substantially as shown.

B B at the two boards are calling generators or batteries, and *t t* are operators' telephones.

There should be one looping-in switch for each line, each at the board where the calls of the line are to be answered, and they should be connected to the operator's telephone and generator substantially as shown and as will be apparent to those skilled in the art.

J J at the two boards are test-plugs adapted to be brought into connection with the pieces *j j* at their respective boards. *t' t'* and B' B' are test receiving instruments and batteries, respectively, at the two boards, each instrument, with its battery, being in a test-circuit that may include the ground and is connected to its test-plug at one end.

G represents a ground connection.

C C are switching devices at the two boards, the contact-pieces *c c'* of which are connected

to the two sides of the operator's telephone at the two boards and are adapted at the will of the operator to be brought into connection with the two contact-pieces of any loop-plug located at her board. These switching devices may be as shown or of other suitable forms of construction.

The main-line connections are substantially as shown and as heretofore indicated. The lines are disconnected from the test-circuit, except when they are switched for conversation. In their circuits at the subscribers' stations may be the usual forms of subscriber's-station apparatus.

The operation of the system is as follows: When a subscriber operates his generator to send a calling-signal, the annunciator of his line indicates the call at the central office. The operator then removes the loop-plug of the line from its switching device *o*, and, placing its two contact-pieces on the two pieces *c c'* of its switching device *C*, finds out what line is wanted. She then tests to see whether the line wanted is busy, and if it is not she places the loop-plug in the spring-jack switch of the line wanted. The two lines are now connected together, and by means of the looping-in switch which belongs to the plug she can send a calling-signal through the circuit. It will be noticed that when the lines are thus connected the calling-annunciator of the line whose loop-plug is being used is in their circuit, and the annunciator of the other line is not in their circuit. Clearing-out signals may be received on the annunciator which is in the circuit.

The principle of my testing system is as follows: Each of the metallic-circuit lines is normally (or when the line is not switched for use) disconnected from the test receiving instruments at the several boards. When a line is switched for conversation, it is then temporarily connected with one side of each test receiving instrument. The other side of each instrument is connected with a test-plug adapted to be brought into connection with any line at its board. In the circuits of the test receiving instruments, between their test-plugs and the points where they are connected with the lines when the lines are switched, is a test battery or batteries.

It will be apparent from the above description of the test-circuits and apparatus that when a line is tested and is switched there will be a complete circuit established of which the test receiving instrument and battery of the operator testing is a part, and the instrument will sound or respond; but when the line is not in use and is tested there will be no such complete circuit, and the instrument will not respond.

For convenience in representing and carrying out the test system I have shown the connection above described between the test receiving instruments and lines (when the lines are switched) as formed in part by a ground-circuit.

The testing system is as follows: It will be noticed that when the loop-plug of any line is removed from the switching device a ground connection is made to the line, (*i. e.*, the line is connected with the test-circuit,) which remains until the plug is again inserted into the device. When this plug is inserted into the spring-jack switch of another line, the united circuit is thereby grounded, or, in other words, connected with the test-circuit. When an operator at any board applies her test-plug to the contact-piece *j j* of either line thus connected, the test-circuit is completed and the test receiving instrument responds, the test-circuit being from the ground, through her test receiving instrument and battery to contact-piece *j*, and thence through the line-circuit to the temporary ground on that circuit, as indicated. If, however, when she tests a line it is not switched for conversation, (either by its loop-plug being removed from its normal position or by the loop-plug of another line being in one of its switches,) there will be no such complete test-circuit, and her test receiving instrument will not respond. She can therefore tell whether or not any line tested is in use at another board.

Wherever the plug of a line is withdrawn from its switching device that line is connected with ground—*i. e.*, with one side of the test-circuit—and when the plug is inserted into the switch of any line the lines are connected together for conversation, and of course the combined circuit is grounded or connected with one side of the test-circuit. When, therefore, a test-plug connected with the other side of the test-circuit is placed on any test-contact of either line at any of the boards, there is a test-circuit to the ground connection established for the calling-line when its plug was withdrawn from its switching device.

The test receiving instruments are shown in the drawings as magneto-telephones. Of course such test receiving instruments may be used with any particular system, such that when the instrument is closed or connected for testing to any unswitched line it will not give a click or sound, through static capacity or escape, that might be misunderstood as the signal that the line is switched and therefore grounded at the central office. Otherwise test receiving instruments of known construction will be used which will not thus give a click or sound when an unswitched line is tested.

It will be noticed that when several pairs of lines of an exchange are switched for conversation their metallic circuits are in connection through the ground connection which connects them with one side of each test receiving instrument. This will not affect the efficiency of the telephone system, as it is well known that connection between circuits at one point only of the circuits does not affect the signals over the respective circuits. Of course a test-battery common to all the

test instruments may be employed, as is well understood by those familiar with this art. Where a metallic test-circuit is employed, the test-battery would be placed at a suitable point in the main wire of the test-circuit, and in a test-circuit partly formed by the ground, as herein shown, it could be placed in a wire, common to all the test-circuits, between the test receiving instruments and the ground, or it might be placed in the common ground-wire to which the lines are connected when switched for conversation.

As above stated, in the organization illustrated the grounding of the line, when switched, is done for the purpose of connecting the line to the test-circuit, and obviously it is immaterial to my test system whether or not the line be grounded when not switched, provided such ground does not complete the test-circuit from the line through the test-battery.

I do not herein claim the system of testing described herein, as the same forms the subject-matter of another application.

I claim as my invention—

1. In a telephone-exchange system, metallic-circuit lines, multiple switchboards for said lines, and switches for said lines, one switch for each line on each board, each switch containing a pair of contact-points which are normally in contact, each line passing through the pairs of contact-points of its switches on the different boards, in combination with loop-switch plugs, one for each line, the plugs being distributed among the several boards, and the two sides of each line terminating in the two contact-pieces, respectively, of its plug, and switching devices, one for each plug, in which the plug is normally placed, each switching device having two contact-pieces, electrically connected, with which the two contact-pieces of the plug when inserted are respectively in contact and thereby bridged, said plugs being adapted to be withdrawn from their normal positions and placed for switching in the switches of any line at their board, and when so placed to disconnect the two contact-pieces of the switch which are normally in contact and connect the two contact-pieces of the plug with the two sides respectively of the line to which the switch belongs; and a subscriber's generator and a calling-annunciator in the circuit of each line whereby the lines, when in their normal condition, are on closed metallic circuits, in which are included their respective subscribers' generators and calling-annunciators, and by the withdrawal of a plug from its normal position and the placing of it in the switch of another line, the closed circuits of the two lines are opened and the lines are temporarily connected together in one metallic circuit, substantially as set forth.

2. In a telephone-exchange system, metallic-circuit lines, multiple switchboards for said lines and switches for said lines, one switch for each line on each board, each switch

containing a pair of contact-points which are normally in contact, each line passing through the pairs of contact-points of its switches on the different boards, in combination with loop-switch plugs, one for each line, the plugs being distributed among the several boards and the two sides of each line terminating in the two contact-pieces, respectively, of its plug, switching devices, one for each plug, in which the plug is normally placed, each switching device having two contact-pieces electrically connected with which the two contact-pieces of the plug, when inserted, are respectively in contact and are thereby bridged, and subscribers' generators and calling-annunciators, one of each for each line, each calling-generator being in the metallic circuit of the line at the subscriber's station, each annunciator being located in one of the branches of its line between the plug and the line-switches, each of said plugs being adapted to be withdrawn from its normal position and placed for switching in the switch of any line at its board, and when so placed to disconnect the contact-points of the switch which are normally in contact and connect the two pieces of the plug with the two sides, respectively, of the line to which the switch belongs, whereby the lines, when in their normal condition, are on closed metallic circuit with their annunciators in their circuits, and by the withdrawal of a plug from its normal position and the placing of it in the switch of another line the closed circuits of the two lines are opened and the lines are temporarily connected in one metallic circuit with the annunciator of the line to which the plug belongs in that circuit, substantially as set forth.

3. In a telephone-exchange system, two metallic-circuit lines normally disconnected from each other and each in a closed metallic circuit, and each with its subscriber's generator and calling-annunciator normally in such closed circuit, in combination with a double or loop plug for one of said lines, the two contact-pieces of which are connected to the two sides or branches of its line, respectively, a switching device for said plug in which the plug is normally placed, said device having two contact-pieces electrically connected with which the two contact-pieces of the plug when inserted are, respectively, in contact and are thereby bridged, and a switch for the other line with two contact-points in the circuit of the line which are normally in contact, said plug being adapted to be withdrawn from its normal position and placed in said switch and when so placed to disconnect the contact-points of the switch which are normally in contact and connect the two contact-pieces of the plug with the two sides or branches, respectively, of the line to which the switch belongs; whereby the two lines, when in their normal condition, are on closed metallic circuits, with their subscribers' generators and calling-annunciators, and by the withdrawal of the plug from its normal position and plac-

ing of it in said switch, the closed circuits of the two lines are opened and the lines are temporarily connected together into one metallic circuit, substantially as set forth.

5 4. In a telephone-exchange system, two metallic-circuit lines normally disconnected from each other and each in a closed metallic circuit, with the subscriber's generator in such circuit, in combination with double or
10 loop plugs, one for each line, the two sides of each line terminating in the two contact-pieces, respectively, of its plug, switching devices, one for each plug, in which the plug is normally placed, each switching device
15 having two contact-pieces electrically connected with which the two contact-pieces of the plug when inserted are, respectively, in contact and are thereby bridged, switches, one for each line, each switch having two
20 contact-points normally in contact in the circuit of the line, and annunciators, one for each line, in the circuit of the line between its switch and plug, each of said plugs being adapted to be withdrawn from its normal
25 position and placed in the switch of the other line and when so placed to disconnect the contact-points of the switch which are normally in contact and connect the two contact-pieces of the plug with the two sides or
30 branches of the line to which the switch belongs; whereby the two lines, when in their normal condition, are on closed metallic circuits with their annunciators and generators in their closed metallic circuits, and by the

withdrawal of a plug from its normal position 35 and the placing of it in the switch of the other line, the closed circuits of the two lines are opened and the two lines are connected together in one metallic circuit with the annunciator of the line to which the plug belongs only in that circuit, substantially as set forth. 40

5. In a telephone-exchange system, a metallic-circuit line normally on closed circuit, a signaling-generator and a calling-annun- 45 ciator in the normally closed circuit of said line, and a loop-switch plug in the two contact-pieces of which the two sides of the line respectively terminate, in combination with a switching device in which said plug is nor- 50 mally placed, said switching device having electrically-connected contact-pieces with which the two contact-pieces of the plug make contact to electrically connect or bridge the contact-pieces of the plug when the plug is 55 inserted therein; whereby when the plug is placed in its normal position the line is on closed metallic circuit for signaling and when the plug is withdrawn from its normal position the closed metallic circuit of the line is 60 opened for looping with another circuit.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

EMILIE S. WALKER,
HENRY M. WALKER.