

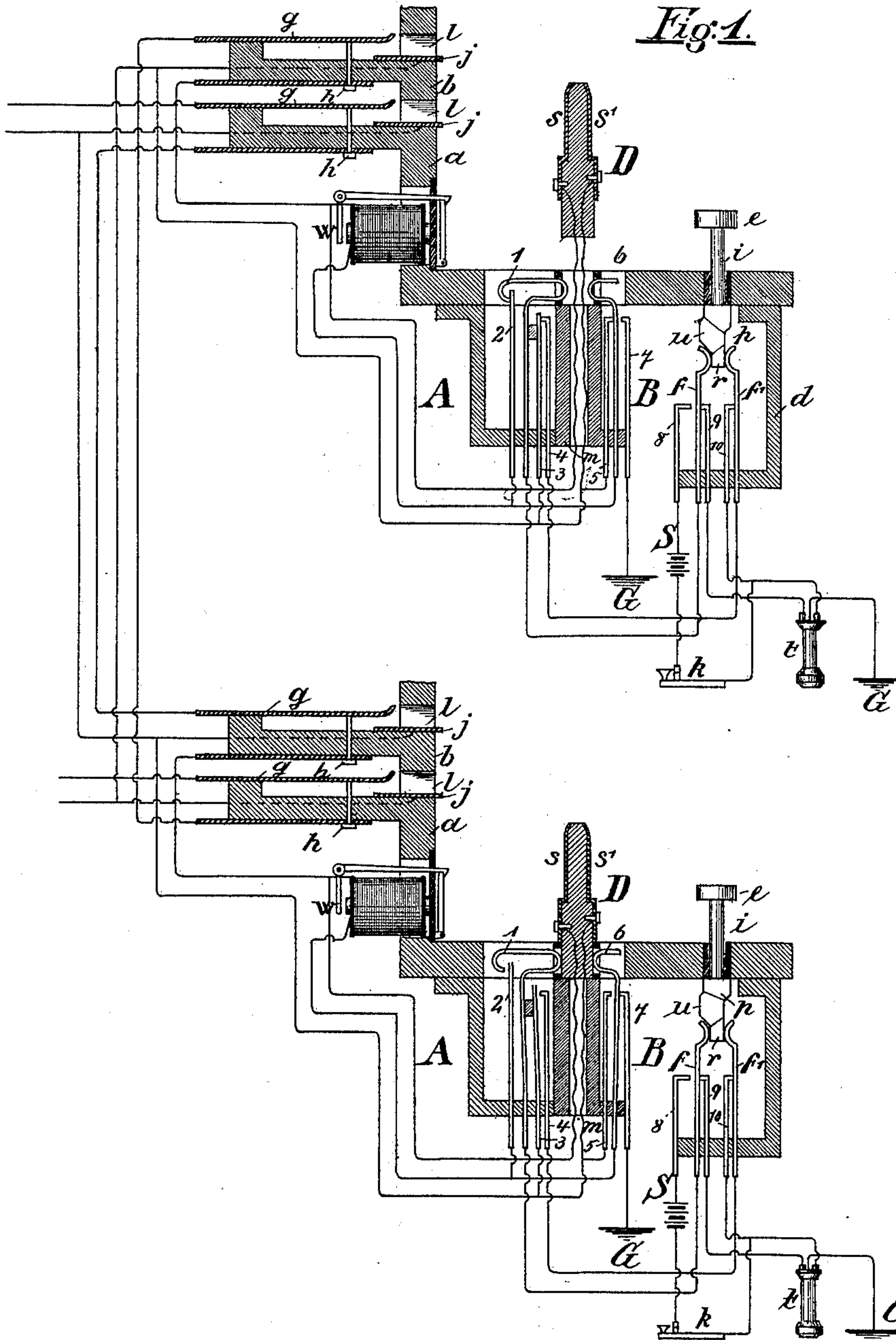
(No Model.)

2 Sheets—Sheet 1.

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,375.

Patented Oct. 26, 1897.



Witnesses:
Gustav Gross.
J. Chas. Dietz.

Inventor:
Milo G. Kellogg

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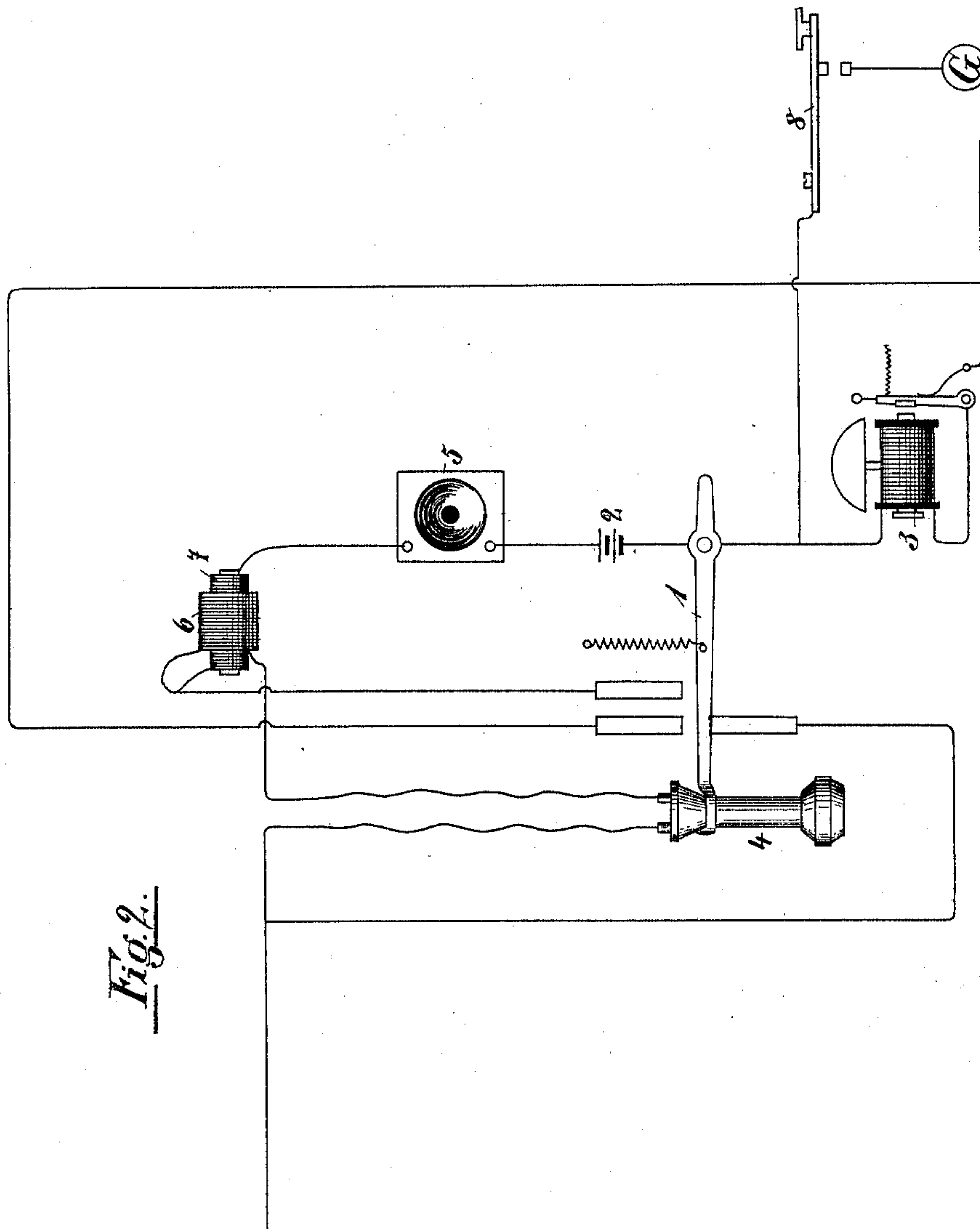


Fig. 2.

Witnesses:

Gustav Gross.

G. Chas. Dietz.

Inventor:

Milo G. Kellogg.

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. 592,375, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,085. (No model.) Patented in France March 25, 1890, No. 204,567; in England April 8, 1890, No. 5,368, and in Germany April 12, 1890, No. 60,250.

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.

This invention has been patented to me in Great Britain, No. 5,368, dated April 8, 1890; in France, No. 204,567, dated March 25, 1890, and in Germany, No. 60,250, dated April 12, 1890.

My invention is a metallic-circuit multiple-switchboard telephone-exchange system in which each line has a cord and a plug attached to it, to which the line is normally connected. The said plug rests normally in a switching device, and when it is desired to connect the line with another line for conversation the plug is removed from its normal position and placed in the switch of the line wanted. This system is called the "single-cord" system.

My invention includes a system of testing and apparatus, circuits and connections for each line, whereby the operator may quickly and with few motions connect her telephone to the circuit of the calling-line, may ascertain by a test whether the line wanted is already in use at another switchboard, may connect the two lines together, may send signaling-currents over the lines, may receive a signal for disconnection, may connect her telephone into the circuit to determine whether the two subscribers have finished talking, and may disconnect the lines and place the line apparatus in readiness for receiving a new call.

This system I claim to be superior to other telephone-exchange systems in simplicity and in speed of operation.

In the accompanying drawings, illustrating my invention, Figure 1 represents sections of two multiple switchboards at the central office of the exchange, and Fig. 2 represents a subscriber's-station apparatus.

On each switchboard is a spring-jack or similar switch for each line. Each switch has a contact-spring which is normally in contact with a contact-point, but is separated and insulated from the point when a plug is inserted into it, and a contact-piece which is normally insulated from the spring and which is connected with one contact-piece of the plug when the plug is inserted into the switch. The contact-piece of the switch is adapted to have a test-plug applied to it for testing.

The contact-springs are shown at *g g*, while *h h* are the contact-points; *j j*, the insulated contact-pieces; *l l*, the plug-holes, and *a b* are ebonite strips of the shape substantially as shown, on which the metal parts of the switch are mounted.

The switch-plugs are loop-plugs adapted to be inserted into the switch-holes. When a plug is inserted into a switch, its two contact-pieces form connection with the spring and contact-piece *j*, respectively, of the switch. One of the contact-pieces of each plug is marked *s* and the other *s'*.

In order to operate the disconnecting system as hereinafter described, the plugs should preferably be inserted into the switches, so that their pieces *s* form connection with the switch-spring.

Each line has a plug switching device and an operator's switching device, both at the same switchboard as the plug and cord of the line where the calls of the line are answered. The plug switching device is operated by the switch-plug and the operator's switching device is manipulated by the operator. The construction, operation, and manipulation of these switching devices will be hereinafter explained in detail.

Two lines and their switches on the boards, their plugs and cords, their answering-switches, their annunciators, and their plug and operator's switching devices are shown in Fig. 1. The drawings show the answering apparatus of one of the lines as located at one of the boards and that of the other line as located at the other board.

A A represent the two plug switching devices, and *D D* the two switch-plugs of the lines, to which double conductor flexible cords

are attached and which are adapted to be inserted into any spring-jack switch at the board where they may be located. One plug is shown in its switching device and one plug is shown out of its device ready to be inserted into the switch of any line.

In the plug switching devices, m is a piece which receives and guides the plug and furnishes support for the contact-springs and points. 1, 3, and 6 are contact-springs, and 2, 4, 5, and 7 are contact-points, all constructed and insulated substantially as shown and operating as follows: When the switch-plug is in the device, it presses or forces spring 1 out of contact with point 2, and spring 1 carries spring 3 out of contact with point 4, while spring 6 is pressed into contact with point 7. When the plug is taken from the device, springs 1 and 3 pass into contact with points 2 and 4, respectively, and spring 6 into contact with point 5.

The operator's switching devices are marked B B. d is a frame which supports and insulates the parts. $f f'$ are contact-springs, and 8, 9, and 10 are contact-points, while i is a movable rod terminating at one end in the knob e and at the other end in the irregularly-shaped ebonite piece $p u r$. The rod i , with the knob e and the ebonite piece $p u r$, move together as one piece and may be called the "movable commutator-piece" of the switch. The knob e and the piece p furnish stops which limit the inner and outer motions of the commutator-piece. The parts of the switching device are constructed, shaped, and mounted substantially as shown and so as to obtain the following switching connections: When the commutator-piece is in its outer position, springs f and f' are in contact with points 9 and 10, respectively. When it is moved to its central position, spring f is forced into contact with point 8. When it is moved to its inner position, the springs $f f'$ are not in contact with any of the switch-points.

k is a two-point key having a lever normally in contact with a contact-point, but separated from the point when pressed by the operator.

t is the operator's telephone; S, the calling generator or battery.

G in both drawings is an earth connection, and W W are line-annunciators, one for each line.

The connections of the lines and the central office apparatus are substantially as shown and as follows: One side or branch of the line passes normally in succession through the spring and contact-points $g h$ of its switches on the several boards, passing in each case first to the spring. It then passes through the line-annunciator and thence to contacts 2 and 6 of its plug switching device. Before passing through the annunciator the circuit branches to one of the contact-pieces s of the loop-plug of the line.

The other side or branch of the line is connected to contact-pieces $j j$ of the switches of the line and to points 3 and 5 of the plug switching device and also to the other contact-piece s' of the plug. Contact-point 7 is connected to earth.

Contact-springs f and f' of the operator's switching device of the line are connected to 1 and 4, respectively, of its plug switching device. One side of the operator's telephone is connected to point 9 and the other side to point 10. Point 8 is connected through the operator's calling generator or battery and the contact-points of the key to point 10. The junction-wire between the two coils of the telephone is connected to earth.

When the lines are not in use, their plugs rest in their plug switching devices and the commutator-pieces of the operator's switching devices are in their outer positions.

In the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch. 2 is the subscriber's battery. 3 is his signal-receiving bell. 4 is his hand-telephone; 5, his telephone-transmitter; 6, the secondary, and 7 the primary, of the transmitter induction-coil, and 8 his calling key or switch.

The subscriber's calling-key is a two-point key or switch having two points or contacts normally open or disconnected from each other, but brought into contact by the subscriber while he operates the key to send in a call. The various parts of the apparatus may be of any usual form for the purpose indicated.

The battery is normally, or when the telephone is not switched for use, in the circuit of the line. The circuit connection and contacts at the subscriber's station are such that when the telephone is on the switch (or not switched for use) the calling-bell is in the line-circuit and the hand-telephone and secondary of the induction-coil are switched or shunted from the circuit, and when the telephone is off the switch (or switched for use) the calling-bell is switched or shunted from the circuit, the hand-telephone and the secondary of the induction-coil are in the line-circuit, and the battery, the primary of the induction-coil, and the telephone-transmitter are in the line-circuit, but are shunted or bridged by a circuit of comparatively small resistance, so as to be in a local closed circuit at the subscriber's station. One of the contact-points of the subscriber's calling-key is connected to the ground and the other point of the key is connected to his line, with his battery between the connection and the normal ground connection of the line at the central office. All of the subscribers'-station batteries are connected into their line-circuits, so that the same poles of the batteries are connected to the sides or branches of the lines which are normally grounded at the central office.

The operation of the system is as follows:

When a subscriber desires to call, he depresses his calling-key, which establishes a closed circuit from his earth connection through his battery and one branch of his line and his annunciator at the central office, thereby operating his annunciator. The operator sees the signal and takes the line-plug from its normal position, thus connecting her telephone to the two branches of the line by the closing of the two pairs of contacts 1 2 and 3 4. At the same time the connection of the line to earth is broken by the opening of the pair of contacts 6 7. On learning which line is wanted the operator tests that line, as will be described hereinafter, and on finding it free or unswitched places the plug in the switch of that line, thus disconnecting it from its earth connection and connecting the two lines of the calling and called subscribers into a metallic circuit which is bridged or cross-connected at the central office by a circuit which includes the operator's telephone. The operator then presses the commutator-piece of the switching device to its inner position. While this is passing from one position to another and while spring *f* rests on part *u* of the ebonite piece, the spring is in contact with point 8 and the calling generator or battery is connected in a bridge or cross connection to the circuit of the two lines. A split current therefore passes to both lines, ringing the bell of the subscriber wanted as well as that of the calling subscriber if he has replaced his telephone on its switch.

When the commutator-piece is in its inner position, neither the telephone nor the calling generator or battery is connected to the circuit of the two lines.

When the lines are connected as described, their circuit is bridged or cross-connected by a circuit containing the annunciator of the calling subscriber. This is effected by the connections described and by the closing of the contacts 5 and 6, caused by the withdrawal of the plug from its normal position. This annunciator will therefore indicate any disconnection-signal from either subscriber. The annunciator is preferably of high resistance and constructed so as to offer considerable retardation to telephonic currents.

If the operator desires to determine whether the subscribers have finished talking, she depresses key *k* and while its contacts are open moves the commutator-piece to its outer position. This connects to the lines in a bridge-circuit the telephone of the operator, who can hear whether the conversation is finished or not. The opening of the key contact-points prevents any false signal being sent from the calling generator or battery in case the subscribers have already replaced their telephones on their switches.

When the subscribers have finished talking, they will replace their telephones on their telephone-switches and by so doing the shunt

or short circuits of their respective batteries will be open and the full battery-current will go to the line-circuit and cooperate to cause the annunciator which bridges their circuit at the central office to indicate a disconnecting-signal. The disconnecting-signal is therefore automatically made to the central office by the act of the subscribers replacing their telephones on their switches when they are through conversation.

The operation of the test system is as follows: The operator places one of the contact-pieces of the plug of the calling-line on the contact-piece *j* of the switch of the line wanted. If the line tested is free or unswitched, a closed circuit will be established from earth through a portion of the telephone-coil to the line tested and through the line to its normal earth at the central office, including the subscriber's-station battery, and the operator will hear a sound or click in the telephone. If the line tested is already switched at any board, this test-circuit will be open and the operator hears nothing. The test therefore shows whether the line is in use at any board.

The operations of making a connection are, first, to remove the line-plug from its switching device; second, to test with the same plug the line wanted; third, to insert the plug in the switch of the line wanted; fourth, to depress the commutator-piece to its inner position.

To disconnect two lines, the operator merely removes the plug from its switch and replaces it in its normal position and withdraws the commutator-piece of the calling-line to its normal or outer position.

I use the terms "bridge" and "cross-connect" in connection with a complete metallic circuit to describe a connection between one side or branch of the circuit and its other side or branch, and an instrument in a bridge or cross-connecting circuit to a metallic circuit is not in the direct circuit, but is in a circuit connection across the two sides or branches of the circuit.

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

1. In a telephone-exchange system, two metallic-circuit lines temporarily connected together for conversation and an annunciator at the central office bridged across their circuit, in combination with a battery at one of the subscribers' stations and switch-contacts and connections by which the current of the battery is automatically directed to the circuit of his line when he switches his telephone out of use, substantially as set forth.

2. In a telephone-exchange system, two metallic-circuit lines temporarily connected together for conversation and an annunciator at the central office bridged across their circuit, in combination with a battery at each of the subscribers' stations and contact-points and connections by which the current from each battery is automatically directed to the

circuit of its line when the subscriber switches his telephone from use and the current from the two batteries passes in the same direction through the circuit of the annunciator, substantially as set forth.

3. In a telephone-exchange system, a plug switching device for a metallic-circuit line, adapted to receive a loop-switch plug for the line when the plug is not in use, the two contact-pieces of the plug being connected through flexible conductors to the two sides or branches of the line, respectively, said plug switching device containing a pair of contact-points normally closed but automatically opened on the withdrawal of the plug, one of said contacts being connected to the ground and the other to the line, and containing two pairs of contact-points which are open while the plug is in the device but automatically closed on the withdrawal of the plug, two contact-points, one of each pair, being connected to the two sides of the line, respectively, in combination with another, to wit, an operator's switching device for said line, distinct from said plug switching device (except by the circuit connections) said operator's switching device having two pairs of contact-points normally in contact but opened at the will of the operator, two of such contact-points, one of each pair being connected to the two other contact-points, respectively, of the plug switching device, and the two other contact-points of the operator's switching device being connected to the two sides, respectively, of the operator's telephone, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line, a loop-switch plug for the line, to the two contact-pieces of which, respectively, are connected the two sides or branches of the line, a plug switching device into which the plug is placed, normally or when not in use and two bridge-circuits or connections for said line between the two sides of the line, one containing the line-annunciator and the other containing the operator's telephone, both bridge-circuits being normally open but automatically closed by the plug switching device on the withdrawal of the plug from its normal position, in combination with another switching device distinct or separate from

said plug switching device (except by the circuit connections) and having contacts operated at the will of the operator to open said bridge-circuit or connection which contains her telephone, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit line, a loop-switch plug for the line, to the two contact-pieces of which, respectively, are connected the two sides or branches of the line, a plug switching device into which the plug is placed normally or when not in use and two bridge-circuits or connections for said line, one containing the line-annunciator and the other containing the operator's telephone, both bridge-circuits being normally open but automatically closed by the plug switching device on the withdrawal of the plug from its normal position, a calling-generator and another switching device distinct from said plug switching device (except by the circuit connections) and having contacts operated at the will of the operator to switch her telephone out of and the generator into said second-mentioned bridge, substantially as set forth.

6. In a telephone-exchange system, a metallic-circuit line, a loop-switch plug for the line, to the two contact-pieces of which respectively, are connected the two sides or branches of the line, a plug switching device into which the plug is placed normally or when not in use and two bridge-circuits or connections for said line, one containing the line-annunciator and the other containing the operator's telephone, both bridge-circuits being normally open but automatically closed by the plug switching device on the withdrawal of the plug from its normal position, a calling-generator its circuit connections and a commutator-piece controlled at the will of the operator to at one motion operate contacts to switch her telephone out of and the generator into said second-mentioned bridge, substantially as set forth.

In witness whereof I hereunto subscribe my name this 23d day of June, 1890.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,
C. STRICH-CHAPELL.