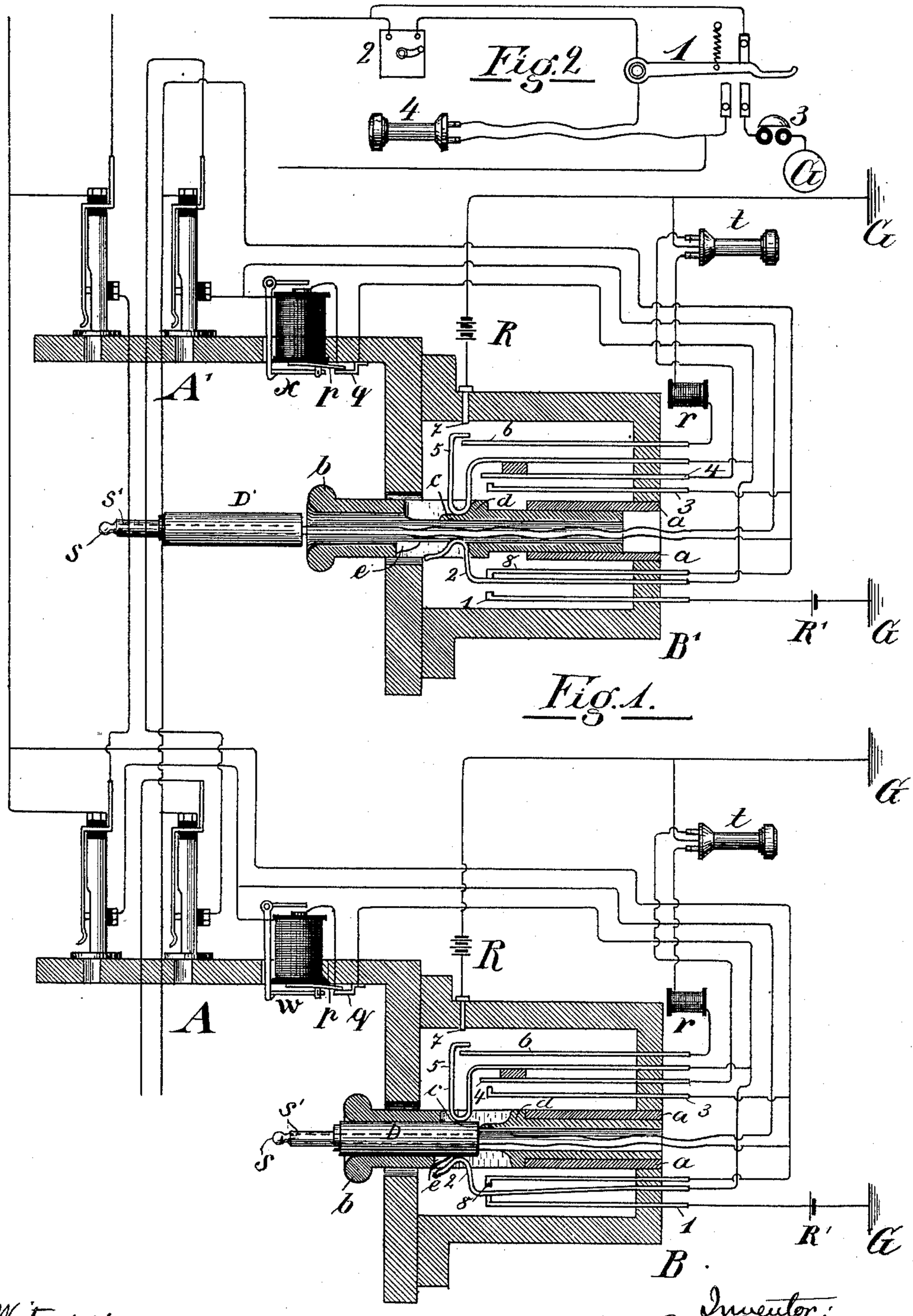
(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCHBOARD.

No. 592,371. Patented Oct. 26, 1897.



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UNITED STATES PATENT OFFICE.

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MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,371, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,080. (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 especially to a single-cord metallic-circuit multiple-switchboard telephone-exchange system.

In a single-cord telephone-exchange system each line is connected at the board where its calls are to be answered to a flexible switch-conducting cord which terminates in a switch-plug adapted to be placed for switching the line with another line into the switch of the line to be connected to. This system requires the insertion of but one plug into a line-switch in order to make the connection between two lines.

My invention consists in a system and organization of apparatus, circuits, and connections for a multiple-switchboard metallic-circuit single-cord telephone-exchange system whereby the operator at any board may expeditiously and with few motions connect her telephone to a line assigned to her to answer, when a call from the line is indicated, may test the line wanted to find whether it is already in use, may connect the two lines together and send a calling-current which will ring the bell of the line wanted, may leave the lines connected together for conversation, may at any time connect his telephone to their circuit to determine whether they are through conversation, may receive on the calling-annunciator of the line in which the call originated a signal to disconnect the connection, and may disconnect the two lines and leave their apparatus in condition to receive or make new calls. Said system and organization are, I believe, more simple and the operations required are less than in other systems.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram illustrating the central-office apparatus, circuits, and connections of the system. Fig. 2 shows in diagram a subscriber's-station apparatus to be used at each subscriber's station.

In the central office of the exchange are as many switchboards as are found necessary or desirable in order to properly operate the exchange.

In Fig. 1, A A′ represent sectional views of sections of two switchboards to which the same lines connect. On each board of the exchange 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 and is separated and insulated from the point when a plug is inserted into the switch and has a third contact-piece which is normally insulated from the other parts. This contact-piece is adapted to form connection with one of the contact-pieces of a loop-switch plug when the plug is inserted and to have a test-plug or contact-piece applied to it for testing. The switches shown in the drawings are of a well-known construction. For each line there is also a compound answering-switch located at the board where the plug and cord of the line are located and where its calls are to be answered. This compound answering-switch is operated on in part by the switch-plug when placed in its normal position and in part by the operator who answers the calls of the line. The construction, operation, and manipulation of these compound answering-switches will be explained in detail.

Two lines and their switches on the boards, their plugs and cords, their compound answering-switches, and their annunciators are shown in Fig. 1. The answering-switch plug and cord and annunciator of one line are shown as located at one board and that of the other line as located at the other board.

B B′ represent the two compound answering-switches of the lines, and D D′ their switch-plugs, to which the double insulated flexible conducting-cords are attached. These plugs are each adapted to be placed in any switch at its board and to be placed normally or when not in use in the compound answering-switch of its line and to operate the switch, as will be described. One plug is shown in its compound answering-switch, and the other plug

is shown out of its switch. In the said answering-switches B B′ *a a* are cylinders, preferably of metal, adapted to receive and guide the movable commutator and plug-supporting pieces *b b*. These pieces *b b* (one for each switch) may be of rubber and of the shape substantially as shown or of other shapes to correspond with variations which may be made in the construction, shape, and arrangement of the other parts of the switches.

1, 2, 3, 4, 5, 6, 7, and 8 are contact-pieces which are insulated from each other except through the contacts and connections which will be described. 2, 4, and 5 are elastic or spring contact-pieces. The other pieces may be without elasticity. The movable piece *b* has an axial hole or socket through its top adapted to receive the plug-handle. It has also two chambers at its side adapted to receive the bent portions of the spring-pieces 2 and 5 as shown, and has also a shoulder, adapted to rest on the cylinder-guide and supporting-piece *a* when the piece *b* is moved to its lower or inner position. In the chamber adapted to receive the bent part of spring 5 is a shoulder or projection *c*, on which the spring 5 bears when piece *b* is moved to its central position, and an angular projection *d*, on which the spring bears when the piece *b* is carried to its upward limit of motion. In the chamber adapted to receive the bent portion of spring 2 is a shoulder or projection *e*, on which the spring 2 bears when the piece *b* is in its lower position. These projections cause the contacts between different pieces to change, as will hereinafter be indicated. These movable pieces *b b* are adapted and intended to occupy three positions in the operation of the system. The lower position is shown in B, and the central position is shown in B′.

When the switch-plug is in its socket in the movable piece *b*, this piece should occupy its lower position, and the handle of the plug presses on the springs 2 and 5, so that spring 2 is brought into contact with piece 1 and spring 5 is pressed out of contact with piece 6, while spring 4, which is attached to, but insulated from, 5, is pressed out of contact with piece 3. When the plug is withdrawn from the socket by the operator, the springs 2 and 5 are released from the pressure of the plug-handle, and (the movable piece *b* being still in its lower position) the contact between 2 and 1 is broken and that between 3 and 4 and between 5 and 6, respectively, is established. Spring 2 cannot then pass into contact with point 8, because the shoulder *e* prevents it from doing so. When the plug is removed from the socket and the operator manipulates piece *b* and places it in its central position, contact between 8 and 2 is established and the shoulder *c* in the chamber of the piece *b* presses spring 5 out of contact with piece 6 and at the same time spring 5 carries spring 4 out of contact with piece 3. When the piece *b* is carried to its outer position, the shoulder *d* forces the spring 5 into contact with point 7. The shoulder *d* and spring 5 should preferably be so shaped and adjusted that when the piece *b* is carried by the operator to its upward position and is released the spring will force the piece *b* to its central position. When, therefore, the plug is in its socket and piece *b* is in its lower position, 1 and 2 are in contact with each other and the other contacts of the answering device are out of contact. When the plug is out of the socket and the piece *b* still remains in its lower position, 1 and 2 and 8 and 2 are out of contact and 3 and 4 and 5 and 6, respectively, are in contact. When the plug is out of the socket and the piece *b* is raised to its central position, 8 and 2 are in contact and all of the other three pairs of contacts are out of contact, and when the commutator-piece is raised to its upper position 1 2 and 5 7 are in contact.

The switch-plugs D D′ are of a usual construction of loop-switch plugs adapted to be used with the spring-jack switches. Each plug has two contact-pieces insulated from each other, one of them, *s*, being at the end of the plug-tip and the other, *s′*, being an insulated cylinder placed along the tip. When a plug is inserted into a switch, the piece *s* presses against the spring of the switch and forces it away from the contact-point and makes connection with the spring and the other piece, *s′*, of the plug forms connection with the third or insulated contact-piece of the switch.

The annunciators have two contact points or pieces which are normally, or when the annunciator does not indicate a call, in connection with each other, but which are separated while the annunciator indicates a call. One of them, *q*, is indicated as an angle-piece and the other, *p*, as a spring which is in contact with the piece *q* when the annunciator-drop does not indicate a call, but which is forced away from the piece *q* while the drop indicates a call.

t t are operators' telephones, R R operators' calling batteries or generators, and *r r* resistance-coils. Each operator may have one of each of said parts, and they are connected to each other and to the compound answering-switches substantially as shown and as will be described.

w and *x* are calling-annunciators, one for each line shown.

R′ is a test-battery which may be common to all the lines.

G G are ground connections.

The connections are substantially as follows: One side or branch of each line passes normally in succession through the pairs of contact-points of the switches of the line, passing in each case to the spring first. It then passes through the line-annunciator and the pair of contacts *p q* of the annunciator and is then connected to contacts 2 and 5 of the compound answering-switch of the line. This side or branch of the line is also connected through one of the conductors of a double-

conductor flexible cord to contact-piece *s* of the switch-plug of the line, the connection being made between the switches on the one hand and the line-annunciator on the other hand. The other side or branch of the line is connected to all of said third contact-pieces of the switches of the line and through the other conductor of the switch-cord to contact-piece *s'* of the switch-plug. It is also connected to contacts 3 and 8 of the compound answering-switch of the line. One side of the operator's telephone is connected through his resistance-coil *r* to contact 6 of the answering-switch and the other side of the telephone is connected to contact 4 of the answering-switch. The wire which connects the two coils of the telephone is connected to the ground. Contact-point 7 of the answering-switch is connected through the operator's calling generator or battery R to the ground. Contact-point 1 is connected through the test-battery R' to the ground.

In the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch. 2 is the subscriber's calling-generator. 3 is his signal-receiving bell, and 4 is his telephone. The contacts and connections are substantially as shown. When the telephone is on its switch, it is shunted or switched from the metallic circuit. The signal-receiving bell is an ordinary signal-receiving bell. It is in a circuit-wire which is grounded on one side and connected to the circuit of the line on its other side when the telephone is on its switch, but is not otherwise thus connected to the line.

The operation of the system is as follows: When the plug of a line is in its normal position in its compound answering-switch and the line is not switched at any board and its annunciator does not indicate a call, one side or branch of the line is grounded through the test-battery. When the line is in that condition and the subscriber's telephone is on its switch and the subscriber operates his generator, the calling-annunciator of the line at the central office will be operated. When the operator observes the call, he restores the drop and removes the plug from its normal position. By so doing the connection of the line to ground is broken by the opening of the contacts 1 2 and the operator's telephone is closed or bridged to the two sides or branches of the line by the closing of the contacts 3 4 and 5 6. The operator then finds out by conversation what line is wanted. He then tests the line wanted, (as will hereinafter be indicated,) and if he finds the line to be "free" or not in use he places the switch-plug in the switch of the line. By so doing the second line is disconnected from the ground and the two lines are connected together, and their circuit is bridged or cross-connected at the central office by a circuit which contains the operator's telephone. The operator will then move the piece *b* of the answering-switch of the line in which the call originated to its farthest limit of motion. The telephone is thereby disconnected from the circuit and the calling generator or battery, grounded on one side, is connected on its other side, through the connection between 5 and 7, to the circuit of the lines, and the bell of the subscriber wanted will be rung, and the bell of the calling subscriber will also be rung if he has replaced his telephone on its switch. The calling-circuit to the line of the subscriber wanted is as follows: from contact 7, through contacts 5, 2, and 8 to contact-piece *s'* of the switch-plug and also through the contacts of the line-annunciator of the calling-line to contact-piece *s* of the plug, thence through these two plug-contacts to the two sides or branches of the line wanted, and to ground at the subscriber's station through the ground-contact of the switch-lever and the signal-bell. The circuit to the calling-line is from contact 5 to one side or branch of the line through the contacts of the line-annunciator and to the other side or branch of the line through the contacts 2 and 8. The operator thereupon releases the piece *b* of the compound answering-switch and the piece *b* takes the position shown in B', when the circuit is connected with neither the operator's telephone nor his calling generator or battery and the lines are connected for conversation. When the lines are in this condition, their circuit is bridged or cross-connected by a circuit which contains the annunciator of the calling-line, and any disconnecting-signal sent by either subscriber will be indicated to the operator who made the connection. This cross or bridge connection of the annunciator is produced by the closing of the points 2 and 8 of the answering-switch and by the arrangement of circuits as described. The operator can at any time connect his telephone to the circuit of the two lines by moving piece *b* to its lower position.

To disconnect two subscribers connected together for conversation, the operator merely removes the plug from the switch and places it in its normal position in the answering-switch and places the piece *b* of the answering-switch in its normal position, as shown at B in Fig. 1. The lines are then ready to receive or to make any new calls.

The test system is as follows: When a line is not switched at any board and its annunciator does not indicate a call, it is grounded at the central office through the test-battery R'. When the line is in that condition and an operator, placing the tip *s* of the plug of another line on said third contact-piece of one of its switches, connects the line to his telephone, a complete circuit is established which contains the telephone and the test-battery, and the operator will hear a sound or click in his telephone. This test-circuit is as follows: from the ground through the test-battery, the contacts 1 2, the contacts *q p* of the line-annunciator, and the normally closed contacts of the line-switches on the several boards to the line, thence through the circuit

of the line by way of the subscriber's station to said third contact-piece of the switch at which the test is applied, and thence to ground through contacts 3 and 4 of the switching device and one coil of the operator's telephone. Should, however, the line be switched at any board either by the use of its plug or the insertion of a plug into one of its switches or should the annunciator of the line indicate a call, the circuit would be open to the test-battery and the operator would hear nothing. The operator can therefore determine on testing that either the line is switched for use or its annunciator indicates a call; or that it is neither switched for use nor its annunciator indicates a call. In the latter case he will be free to switch the line with another line.

It will be observed that when the operator's telephone is bridged across the two sides or branches of the line the annunciator is not also bridged across them, but the annunciator is only bridged across when by the movement of the piece *b* the telephone is disconnected from the circuit. The conversation through the telephone is thereby more distinct than it would be with the circuit bridged by both telephone and annunciator. Various arrangements and constructions of parts may be used by which this result is obtained.

The operations of answering a call and making the desired connection are, first, to remove the switch-plug; second, test the line wanted, (with the same plug;) third, place the plug in the switch of the line wanted, and, fourth, move the piece *b* of the answering-switch to its outer limit of motion.

It will be observed that, the lines being grounded at the subscriber's station when his telephone is not switched for use, part of the current from the test-battery will go to ground there when the telephone is not switched. Enough current will, however, pass through the operator's telephone to cause the line to test "free" when it is not switched and its annunciator does not indicate a call. The bell could be placed in the line-circuit, and in that case it would be preferable to have some other resistance placed in the ground connection at the subscriber's station.

A rheotome could be used in the place of the test-battery in the position shown for the battery, and the test-battery placed in any other position in the test-circuit normally established on testing.

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, a metallic-circuit line, one side or branch of which is normally grounded at the central office, in combination with switch-contacts in said side or branch by which said ground connection is broken when the line is switched for use and annunciator-contacts in said side or branch to break such ground connection whenever and during the time the line-annunciator indicates a call, substantially as set forth.

2. In a telephone-exchange system, a metallic-circuit line, one side or branch of which is normally grounded at the central office, and a test-battery in such normal ground connection, in combination with switch-contacts in said side or branch by which such ground connection is broken when the line is switched for use and annunciator-contacts in said side or branch to break such ground connection whenever and during the time the line-annunciator indicates a call, substantially as set forth.

3. In a telephone-exchange system, a metallic-circuit line, one side or branch of which is normally grounded at the central office, and a test-battery in such normal ground connection, in combination with switch-contacts in said side or branch by which such ground connection is broken when the line is switched for use, annunciator-contacts in said side or branch to break such ground connection whenever and during the time the line-annunciator indicates a call, and a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with the other side or branch of the line, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line, one side or branch of which is normally grounded at the central office, in combination with switch-contacts in said side or branch by which such ground connection is broken when the line is switched for use, annunciator-contacts in said side or branch to break such ground connection whenever and during the time the line-annunciator indicates a call, a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted to be brought into connection with the other side or branch of the line, and a test-battery in the circuit thereby established on testing, 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.