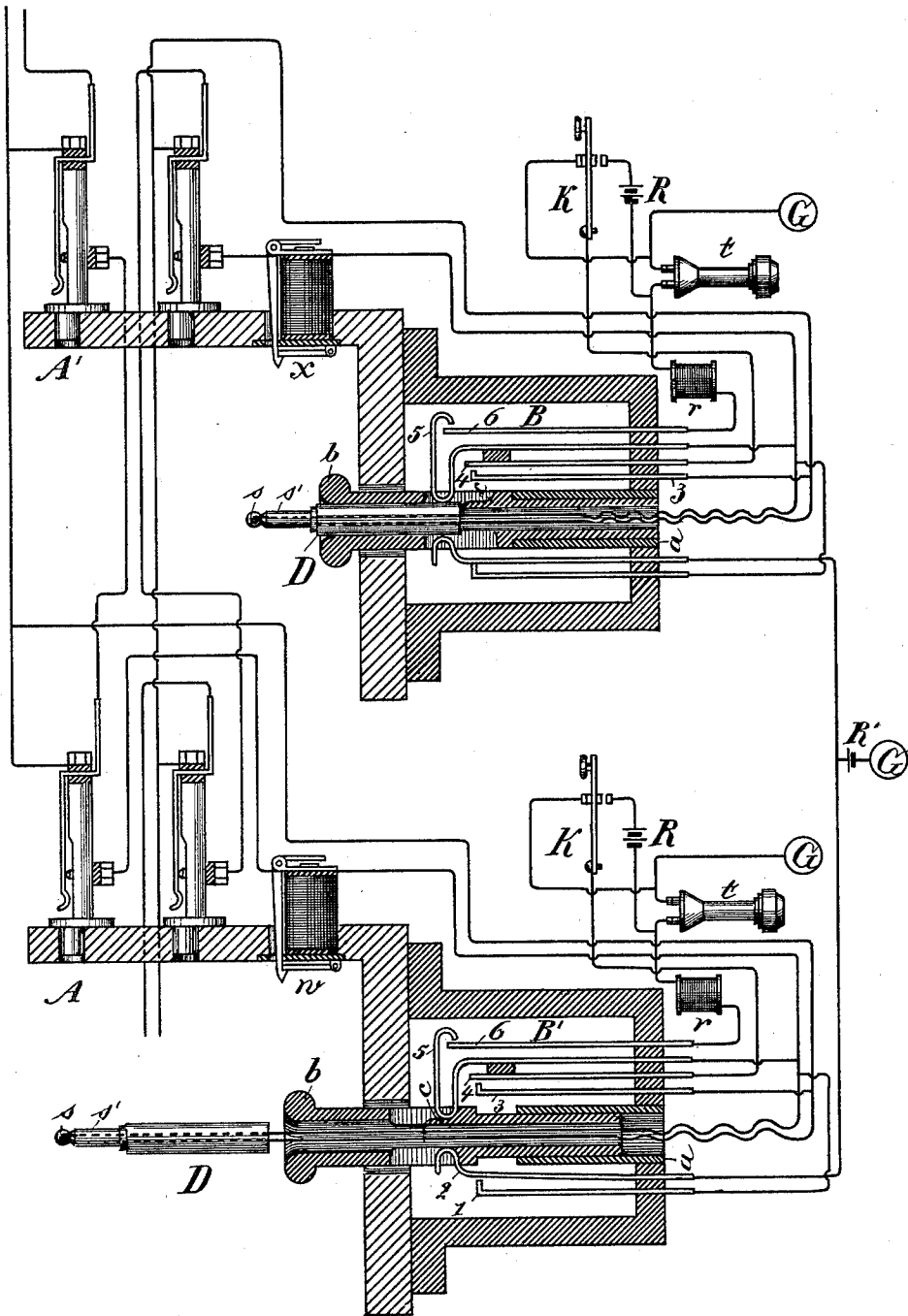


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,382.

Patented Oct. 26, 1897.



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. 592,382, dated October 26, 1897.

Application filed August 5, 1890. Serial No. 361,109. (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 drawing, forming a part of this specification.

My invention relates to a metallic-circuit telephone-exchange system in which there is a cord and a plug attached to the cord for each line, to which the line is normally connected. Said plug rests normally in a switching device, and when it is desired to switch the line with another line for conversation the plug is taken from its normal position and placed in the switch of the line wanted. Such a system is called a "single-cord" system.

My invention consists in a system of testing and in apparatus, circuits, and connections for each line whereby the operator may expeditiously and with few operations connect her telephone to the circuit of the line when its call is indicated, may test the line wanted to see whether it is in use, may connect the two lines together, may send signaling-current over the lines, may receive a clearing-out signal, may connect her telephone into the circuit to determine whether the subscribers are through conversation, and may disconnect the lines and place the line apparatus in readiness for receiving a new call. Said organization is more simple and the work required is less than in other systems devised for the same purpose.

In the accompanying drawing, illustrating my invention, A and A' represent sections of two multiple switchboards at the central office of the exchange to which the same lines connect. On each board 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 while a plug is inserted into it, and a contact-piece which is normally insulated from the spring and is connected with the plug while the plug is inserted into the switch. The contact-piece is adapted to

have a test-plug applied to it for testing. The spring-jacks shown in the drawing are of well-known construction.

For each line is a compound answering switching device, located at the board where the plug and cord of the line is located, and where the calls of the line are to be answered. This device is manipulated in part by the switch-plug when in the device and in part by the operator who answers the call. 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 switching devices are shown in the drawing. The drawing represents 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.

B B' represent the two compound answering-switches, and D D the two switch-plugs of the lines to which the double conductor flexible cords are attached and which are adapted to be placed in 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 answering-switches B B', *aa* are cylinders, preferably of metal, adapted to receive the movable commutator and plug-supporting piece *b*. This piece may be of rubber and is of the shape substantially as shown and may be of other shapes to correspond with variations in the construction of the other parts.

1, 2, 3, 4, 5, and 6 are contact-pieces insulated from each other, except as will hereinafter be described. 2, 4, and 5 are spring-pieces. The other pieces may be rigid. Pieces 1 and 2 are mounted parallel to each other and in close juxtaposition, so that contact between them will be made and broken by the operation of the switch-plug, as hereinafter indicated. The pairs of contacts 3 4 and 5 6 are mounted parallel to each other and in close juxtaposition, so that the contact of each pair is made and broken, as hereinafter described, by the operation of the plug.

Spring 4 is connected near its upper end to spring 5 by means of an insulation-piece fastened to both. It therefore moves back and forth as spring 5 moves. Springs 2 and 5 are constructed and adjusted to press toward the center of the piece *b* and will press against and be acted upon by the plug, as will be described.

The piece *b* has a hole or socket in which the handle of the switch-plug may be placed. It has also two chambers adapted to receive the bent portions of springs 2 and 5, as shown, and has a shoulder adapted to rest on the top of the cylinder *a* when it is moved to its lower position. In the chamber adapted to receive the bent part of 5 is a shoulder *c*, on which spring 5 bears when piece *b* is moved to its higher position and which causes the contacts to change, as will hereinafter be described. The pieces *b b* are adapted to occupy two positions, the upper position as shown in B' and the lower position as shown in B. When the switch-plug is in its socket in its piece *b*, the piece occupies its lower position and the handle of the plug presses on 2 and 5, so that spring 2 is in contact with piece 1 and spring 5 is out of contact with piece 6, while spring 4 (which is attached to but insulated from 5) is kept out of contact with piece 3. When the switch-plug is withdrawn by the operator from the socket, the springs 2 and 5 will be released from the pressure of the plug-handle and (the movable piece being still in its inner position) contact between 2 and 1 is broken and that between 3 and 4 and between 5 and 6 is established. When the plug is removed and the operator manipulates the piece *b* and places it in its outer position, the contact between 1 and 2 still remains broken and the shoulder *c* in the chamber of the piece presses spring 5 out of contact with piece 6 and spring 5 at the same time carries spring 4 out of contact with piece 3. When, therefore, the plug is in the socket and the piece *b* is in its lower position, 1 and 2 are in contact with each other and the other contacts of the device are out of contact. When the plug is out of the socket and piece *b* is still in its lower position, 1 and 2 are out of contact and the other pairs 3 4 and 5 6 are in contact, respectively, and when the plug is out of the socket and the piece *b* is raised to its outer position all of the three pairs are out of contact.

The switch-plugs D D are of a usual construction of loop-switch plugs adapted to be used with the spring-jack switches shown. The outsides of the handles have a rubber insulation. Each plug has two contact-pieces insulated from each other, one, *s*, at the end of the plug, and the other, *s'*, along the plug-cylinder tip. When a plug is inserted into any of the switches, the piece *s* presses against the spring of the switch and forces the spring away from the contact-point and forms con-

nection with the spring, and the other piece *s'* of the plug forms connection with the metal frame or socket of the switch.

*t t* are operators' telephones; R R, operators' calling-generators; *r r*, operators' resistance-coils; K K, calling-keys, and R' a test-battery. Each operator will have one of each of said parts and they will be connected to each other and to her answering-switches, substantially as shown and as will be described.

*w* and *x* are calling-annunciators, one for each line shown, and G G are ground connections. The connections are substantially as follows: One side or branch of each line passes normally successively through the pairs of contact-points normally in contact of its switches on the several boards, passing in each case to the spring first. It then passes through its line-annunciator and is then connected by one of the insulated conductors of the switch-cord to the contact-piece *s* of the switch-plug of the line. The other branch of the line is connected to all of the other or insulated contact-pieces of the switches of the line and is connected to the contact-piece *s'* of the plug through the other conductor of the cord. The first-mentioned side or branch of the line is also connected, after it passes through the annunciator, to both contact-pieces 1 and 5, and the other side or branch of the line is also connected to contact-piece 3. One side of the operator's telephone is connected to the ground and its other side is connected through the resistance-coil to contact-piece 6. The first-mentioned side of the telephone is also connected to the upper contact-point of the operator's calling-key and the lower contact-point of the key is connected through the calling-generator to the circuit-wire which connects her telephone and resistance-coil. The contact-spring 2 is connected through the test-battery R' to the ground. Contact-piece 4 is connected to the lever of the calling-key. Each line is connected to switches, compound answering-switch, cord and plug, and annunciator, substantially as described. Each compound answering-switch is connected to the operator's special apparatus and also to the ground through the test-battery, substantially as described. One battery will answer for all the lines of the exchange.

The two branches of the subscriber's line will be normally on closed circuit to each other at the subscriber's station and may be preferably normally open to the ground there, but closed to the ground by the subscriber while he is sending in a call, with his generator-armature in the circuit between the ground then established and the normal ground connection of the line at the central office. The calling-key K is a usual form of three-point key. The lever normally rests on the upper point, as shown, but when it is

depressed by the operator its connection with the upper point is broken and it comes into contact with the lower point.

Weights, as is usual, or other devices may be used to bring the switch-plugs in their normal position in the sockets of the compound answering-switches, and they may be such as will also cause the plugs to press the movable pieces of their respective switches to their normal lower or inner positions. The operation of the system may be described as follows: When the plug of a line is in its normal position in the socket of its compound answering-switch and the line is not switched at any board of the exchange, the line is grounded at the central office through the test-battery. When the line is switched at any board by the insertion of a switch-plug into its switch, or its plug is withdrawn from its normal position for insertion into any switch, the ground connection through the battery is interrupted. In the latter case the interruption is at the pair of contact-points 1 2 and in the former case at the pair of contact-points of the switch used. When the plug of a line is withdrawn from its normal position in its compound switch, the two sides or branches of the line are brought into a closed circuit with the operator's telephone in the circuit. This connection is automatically made by the closing of the two pairs of contacts 3 4 and 5 6, respectively. Such circuit is from contact-spring 5, which is connected to one side of the line, to contact-piece 6, and thence through the resistance-coil  $r$ , the operator's telephone  $t$ , the upper contact-point of the key  $K$  and the key-lever to contact-piece 4, and thence to contact-piece 3, which is connected to the other side of the line. The operator then by conversation finds out what line is wanted. She then tests the line wanted, as will be hereinafter described, and if she finds the line free she will place the switch-plug in the switch of said line at her board. When she has done this, the two lines are disconnected from their normal connection with the ground, are connected together in a metallic circuit, and their circuit is bridged or cross-connected at the central office by the circuit which contains the resistance-coil, the telephone, and the key. The operator then presses on the key, thereby disconnecting the lever from the upper contact and connecting it with the lower contact-point, and a circuit in the bridge or cross connection is established which contains the calling-generator and does not contain the operator's telephone. A calling-current is thereby directed in split current to both lines and the bell of the line wanted will be rung and the calling subscriber notified by the operation on his telephone or calling-bell that the connection is made and the subscriber wanted is rung up. The operator then pulls the movable piece  $b$  to its upper or outer position and the cross or bridge connection of the metallic circuit is interrupted by the opening of the

pairs of contact-points 3 4 and 5 6. When the operator desires to listen into the circuit to see whether the subscribers are through conversation, she presses the movable piece  $b$  to its lower position and the cross or bridge connection is again established and enough telephone-current, if the line is in use, will pass through her telephone so that she can hear the conversation. When the operator desires to clear out the connection, she takes the switch-plug from the switch and places it in its normal position in the socket and presses the piece  $b$  to its lower or inner position. The apparatus is then ready to receive and answer a new call on the line by the mere act of withdrawing the plug and making the other operations I have described.

The special use and function of the resistance-coil  $r$  is to prevent an undue amount of telephone-current from being diverted to the operator's telephone when she listens into a circuit to the detriment of the conversation which is passing over the main circuit, and this resistance may be made great or small as is found most desirable for the general conduct of the business.

The operation of the test system is as follows: When the operator tests any line, she places the tip of the plug of the line whose call she is answering on the metal socket or frame of the switch of the line tested to the contact-piece connected to the normally open end of the line. If, then, the line tested is not switched, a complete circuit will be established in which is the operator's telephone and the test-battery. This circuit is from the ground through the battery, the contact-points 2 1 of the answering-switch of the line, and the normally closed contact-points of its spring-jack switches to the line, through the circuit of the line to the contact-piece  $s$  of the plug used in testing, and thence through contacts 5 and 6 to the ground through the resistance  $r$  and telephone. The operator will hear in the telephone the click caused by the completion of the circuit and will know that the line is free. When the line is switched at any board, the circuit to the battery is interrupted and the operator, not hearing the click, will know that the line is switched for use.

When two lines are connected together, as above described, the calling-annunciator of the line in which the call originated is in their circuit and any clearing-out signal sent over the circuit will be indicated on it, and the annunciator of the other line is not in their circuit.

By the system and mechanism as above described for single-cord metallic-circuit systems the organization has fewer parts and is more simple than in other systems which have been devised for similar use, and the operations required of the operator in answering a subscriber and making a desired connection are reduced to a minimum. These

operations are merely to take the plug from its normal position, test the line wanted, (with the same plug which is already in her hand,) place the plug in the switch of the line wanted, press on the calling-key, and raise the movable piece of the calling subscriber's answering-switch.

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 loop-switch plug for a metallic-circuit line, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, and a plug switching device into which the plug is normally placed and which has two pairs of contact-points, one contact being a spring with which the plug on its insertion forms contact and which presses each pair 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 or branches, respectively, of the line, and the two other contact-points being connected to the two sides, respectively, of the operator's telephone, in combination with a commutator-piece for said switching device, adapted to be moved by the operator to open said pairs of automatically-closed contact-points, substantially as set forth.

2. In a telephone-exchange system, a loop-switch plug for a metallic-circuit line, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, in combination with a plug switching device into which the plug is normally placed and which has two pairs of contact-points, one contact being a spring with which the plug on its insertion forms contact and which presses each pair 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 or branches of the line, and the two other points being connected to an operator's circuit which is connected with the ground and contains the operator's telephone between such ground connection and a contact-piece of the switch-plug adapted to be brought for testing into connection with the test-bolts of the other lines, and a commutator-piece adapted to be moved by the operator to open such automatically-closed contacts, substantially as set forth.

3. In a telephone-exchange system, a loop-switch plug for a metallic-circuit line, to the

two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the lines, in combination with a plug switching device into which the plug is normally placed and which has two pairs of contact-points, each pair open while the plug is in the switching device but automatically closed on the withdrawal of the plug, two contact-points, one of each pair, being connected to the two sides or branches, respectively, of the line, and the other two points being connected to the two sides, respectively, of the operator's telephone, and a third pair of contact-points of said switching device closed while the plug is in the switching device but automatically opened on the withdrawal, one point of said pair being connected to one side or branch of the line and the other point to the ground, substantially as set forth.

4. In a telephone-exchange system, a loop-switch plug for a metallic-circuit line, to the two contact-pieces of which, respectively, are connected, through flexible conductors, the two sides or branches of the line, and a plug switching device into which the plug is normally placed and which has two pairs of contact-points, each pair 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 or branches, respectively, of the line, and the two other contact-points being connected to the two sides, respectively, of the operator's telephone, and a third pair of contact-points of said switching device which are closed while the plug is in the switching device but automatically opened on the withdrawal of the plug, one of said points being connected to one side or branch of the line and the other to the ground, in combination with a commutator-piece for said switching device, adapted to be moved by the operator to open said two pairs of automatically-closed contact-points, substantially as set forth.

5. In a telephone-exchange system, loop-switch plugs, one for each of the metallic-circuit lines, to the two contact-pieces of which are connected, through flexible conductors, the two sides or branches, respectively, of its line, and a switching device for each plug, into which it is normally placed and which has two pairs of contact-points, each pair open while the plug is in its device but automatically closed when the plug is withdrawn from the device, two contact-points, one of each pair, being connected to the two sides or branches, respectively, of its line, and the two other points being connected with the two sides of an operator's telephone, one of the contact-pieces of each switch-plug being adapted to be brought for testing into connection with the test-bolts of the other lines and the operator's telephone grounded with the telephone between the ground connection and the connection established with such contact-piece

of the plug on the withdrawal of the plug, and a third pair of contact-points of said switching device which are closed while the plug is in the switching device but automatically opened on the withdrawal of the plug, one of said points being connected with the line and the other with the ground through a test-battery, in combination with a commutator-piece adapted to be moved by the operator to open said pairs of automatically-closed contact-points, substantially as set forth.

6. In a telephone-exchange system, loop-switch plugs, one for each line of the metallic-circuit lines, to the two contact-pieces of which are connected, through flexible conductors, the two sides or branches, respectively, of its line, and a switching device for each plug into which it is normally placed and which has two pairs of contact-points, each pair open while the plug is in its device and automatically closed on the withdrawal of the plug, two contact-points, one of each pair, being connected to the two sides or branches, respectively, of its line, and the two other points being connected to the two sides, respectively, of an operator's circuit containing a telephone said circuit being connected to the ground with the telephone between the ground connection and a contact-piece of the switch-plug which is connected to the circuit on the withdrawal of the plug from its normal position and which is adapted to be brought for testing into connection with any of the other lines, and a third pair of contact-points which are closed while the plug is in the switching device but are automatically opened on its withdrawal, one of said points being connected to the line and the other to the ground, in combination with a commutator-piece adapted to be moved to open said pairs of automatically-closed contact-points, and a battery in the test-circuit normally established on testing, substantially as set forth.

7. In a telephone-exchange system, the combination of a metallic-circuit line, a switch-plug for the line a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, and a wire or connection grounded on one side and connected on its other side to the other point of said pair, substantially as set forth.

8. In a telephone-exchange system, the combination of a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the de-

vice but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, a wire or connection grounded on one side and connected on its other side to the other point of said pair, and a battery in said wire or connection, substantially as set forth.

9. In a telephone-exchange system, the combination of a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, the other side of the line being normally open at the central office, and a wire or connection grounded on one side and connected on its other side to the other point of said pair, substantially as set forth.

10. In a telephone-exchange system, the combination of a telephone-line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with the line, a wire or connection grounded on one side and connected on its other side to the other point of said pair, and a battery in said wire or connection, substantially as set forth.

11. In a telephone-exchange system, a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, and a wire or connection grounded on one side and connected on its other side to the other point of said pair, in combination with a test receiving instrument grounded on one side and connected on its other side to a test plug or device adapted to be brought for testing into connection with the line, and a battery in the circuit which may thereby be established on testing, substantially as set forth.

12. In a telephone-exchange system, a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the

plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, the other side of the line being normally open at the central office, a wire or connection grounded on one side and connected on its other side to the other point of said pair, and a battery in said wire or connection, in combination with a test receiving instrument grounded on one side and connected on its other side to a test plug or device, adapted to be brought for testing into connection with the normally open side or branch of the line, substantially as set forth.

13. In a telephone-exchange system, a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, and a wire or connection connected on one side to the other point of said pair, in combination with a test receiving instrument connected on one side to the other side of said wire or connection, and on its other side to a test plug or device adapted to be brought for testing into connection with the line, and a battery in the circuit which may thereby be established on testing, substantially as set forth.

14. In a telephone-exchange system, a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is normally placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, the other side of the line being normally open at the central office, a wire or connection connected on one side to the other point of said pair, and a battery in said wire or connection, in combination with a test receiving instrument connected on one side to the other side of said wire or connection, and on its other side to a test plug or device adapted to be brought for testing into connection with the normally open side or branch of the line, substantially as set forth.

15. In a telephone-exchange system, the combination of a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with

each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, and the other side or branch of the line being normally open, a wire or connection grounded on one side and connected on its other side to the other point of said pair, and a switch for the line having a pair of contacts normally closed but open when the switch-plug of another line is placed in the switch, said pair of contacts of the switch being in the circuit of the first-mentioned branch of the line between said pair of contact-points of the switching device, on the one hand, and the subscriber's station on the other hand, substantially as set forth.

16. In a telephone-exchange system, the combination of a metallic-circuit line, a switch-plug for the line, a switching device into which the plug is placed and on which it operates, a pair of contact-points of said switching device pressed into contact with each other by the plug when in the device but automatically brought out of contact with each other on the withdrawal of the plug, one of the points of said pair being normally connected with one side or branch of the line, and the other side or branch of the line being normally open, a wire or connection grounded on one side and connected on its other side to the other point of said pair, a switch for the line having a pair of contacts normally closed but open when the switch-plug of another line is placed in the switch said pair of contacts of the switch being in the circuit of the first-mentioned branch of the line between said pair of contact-points of the switching device, on the one hand, and the subscriber's station on the other hand and an annunciator in the circuit of said first-mentioned branch of the line between said pair of contact-points of the switching device, and said pair of contact-points of the switch, substantially as set forth.

17. In a telephone-exchange system, a switching device for a switch-plug for a line into which the plug is placed when it is not in use for switching, said device consisting substantially of the following parts, a pair of contact-points 1, 2, which are in contact with each other when the plug is in the device and out of contact when the plug is withdrawn, two pairs of contacts 3, 4, and 5, 6, of which 5 is a spring-contact connected with 4 by an insulation-piece which carries it, said two pairs of contacts being out of contact when the plug is in the device and coming automatically into contact when the plug is withdrawn from the device, a commutator-piece adapted to be moved by the operator to open said two pairs of automatically-closed contacts, and the insulations and supports for such parts, substantially as set forth.

18. In a telephone-exchange system, a switching device for a switch-plug for a line into which the plug is placed when it is not

in use for switching, said device consisting  
substantially of the following parts, a pair of  
contact-points which are in contact with each  
5 other when the plug is in the device and out  
of contact when the plug is withdrawn, two  
pairs of contact-points which are out of con-  
tact when the plug is in the device and come  
automatically into contact when the plug is  
withdrawn, a commutator-piece adapted to  
10 be moved by the operator to open said two

pairs of automatically-closed contacts, and  
insulations and supports for such parts, sub-  
stantially as set forth.

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

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,  
ABBOTT L. MILLS.