(No Model.)

M. G. KELLOGG.

MULTIPLE SWITCHBOARD.

No. 592,387. Patented Oct. 26, 1897.

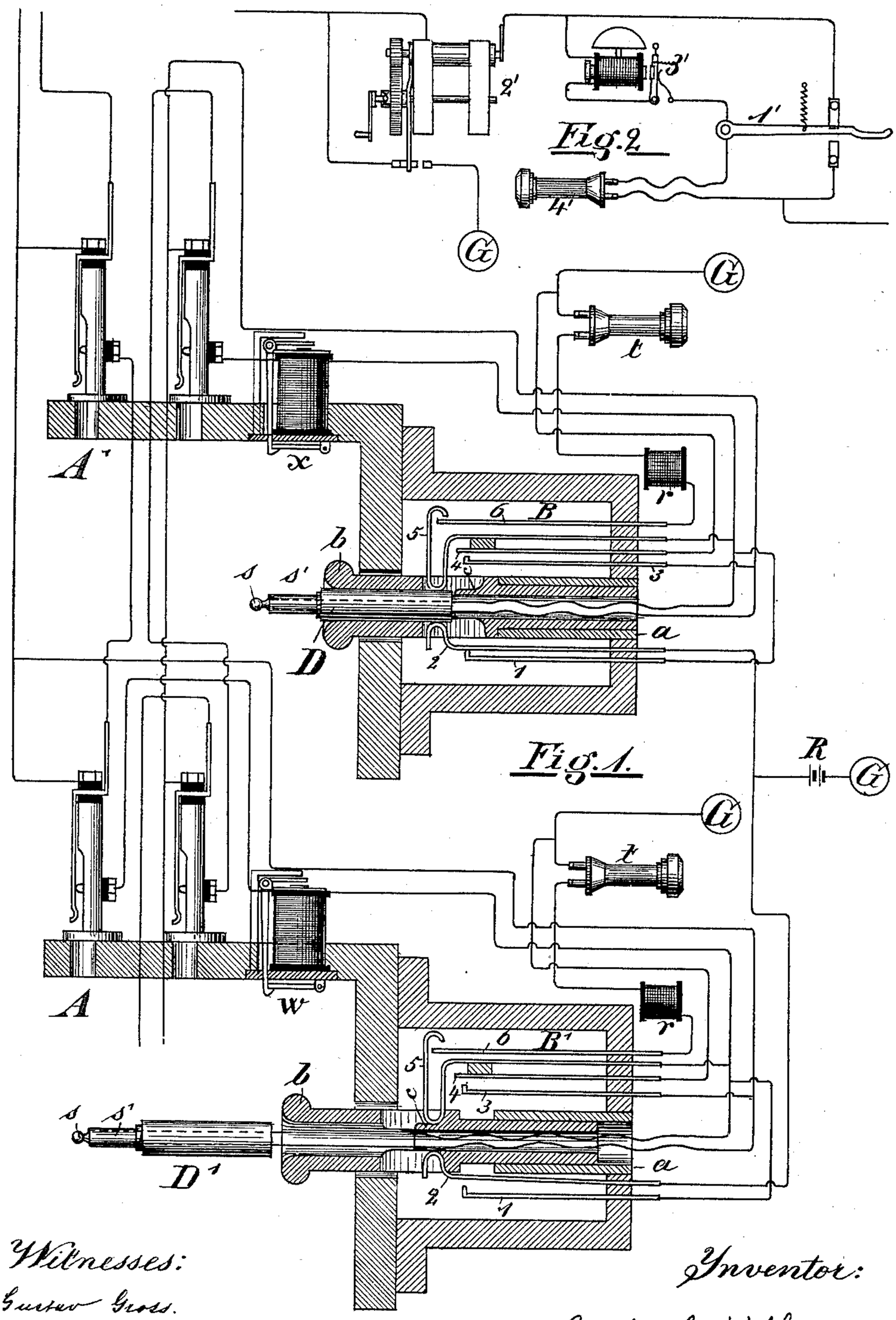

Fig. 2.

Fig. 1.

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MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,387, dated October 26, 1897.

Application filed August 5, 1890. Serial No. 361,114. (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 more especially 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 connected. Said plug is inserted into the switch of another line when it is desired to switch the two lines together for conversation. Said system is called a "single-cord" system. The plug generally rests normally (or when not in use for switching) in its own special switching device.

My invention consists in a system of testing and in apparatus, circuit, and connections for each line whereby the operator may expeditiously and with few movements connect her telephone to the circuit of the line when its call is indicated, may test the line wanted and at the same time ring the subscriber's signal-bell when the line is not in use, may connect the two lines together, may connect her telephone to their circuit to determine whether they are through conversation, and may disconnect the lines and place the apparatus in readiness to receive a new call. Said system and apparatus are more simple and the work required is less than in other systems devised for a similar purpose.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram illustrating two switchboards and the main-line central-office apparatus of her lines, and Fig. 2 shows in diagram a subscriber's apparatus for his office or station.

In Fig. 1, A A′ represent sections of two multiple switchboards at the central office of the exchange. On each board is a spring-jack 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 switch-plug is inserted into the switch, and has a third or insulated contact-piece which is insulated from the other parts, except by the circuit connections. This contact-piece is adapted to have a plug applied to it for calling and testing.

The switch shown in the drawings is of well-known construction.

For each line there is a compound answering switching device located at the board where the cord and plug of the line are located and where its calls 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 devices will hereinafter be explained in detail.

Two lines and their switches on the boards, their plugs and cords, their answering-switches, and their annunciators are shown in the drawings. The answering apparatus of one line is 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, and D D′ the two switch-plugs of the lines, to which their double flexible conducting-cords are attached, and which are adapted to be placed in any spring-jack switch at the board where they are located. One plug is shown in its switching device and one plug is shown out of its device.

In the answering-switches, *a a* are cylinders, preferably of metal, adapted to receive and guide the commutator and plug-supporting pieces *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, shape, and arrangement of the other parts of the switches.

1, 2, 3, 4, 5, and 6 are contact-pieces insulated from each other. 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 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 to receive the bent portions of the spring-pieces 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 portion of the spring 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 and intended 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 the springs 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 spring 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 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 4 is carried 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 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 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 connection 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, and *r r* resistance-coils. Each operator has one of each parts and they are 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 connected into their respective circuits, as will hereinafter be described. They are preferably polarized annunciators.

G G are ground connections.

R is a calling and testing battery of such strength and connected as will be described.

The connections are substantially as follows: One side or branch of each line passes normally successively through the pairs of contact-points of the line-switches, passing in each case to the spring first. It then passes through the line-annunciator and is then connected by one of the insulated conductors of the switch-cord to contact-piece *s* of the plug. It is also connected to contact-pieces 5 and 1 of the answering-switch of the line. The other branch of the line is connected to said third or insulated contact-pieces of its switches. It is also connected through the other conductor of the cord to contact-piece *s′* of the plug, and is connected to contact-piece 3 of the answering-switch. Contact-piece 2 of this switch is connected to the ground through the calling and testing battery R. One side of the operator's telephone is connected to contact-piece 4 of the answering-switch and also to the ground. The other side of the telephone is connected through the resistance-coil *r* to piece 6 of the switch.

In the subscriber's-station apparatus shown in Fig. 2, 1′ is the telephone-switch. 2′ is the calling-generator. 3′ is the signal-receiving bell, and 4 is the subscriber's telephone. The bell is an ordinary vibrating or automatic circuit-breaking bell which continually makes and breaks to its own circuit and rings while a battery of suitable strength is closed through its circuit. The contact-points and connections are substantially as shown, but may be of other forms and arrangements which shall perform practically the operation required. They should be such that the signal-receiving bell or its contact-points are switched or shunted out of the circuit of the line while the subscriber's telephone is off the switch for use, while they are in the line-circuit while the telephone is on the switch or not switched for use.

The operation of the system is as follows: When the plug of a line is in its normal position in the socket of its answering-switch and the line is not switched at any board, that branch of the line which passes through the several pairs of contact-points is grounded at the central office through the battery. When the plug is withdrawn from its normal position or a plug is placed in one of its

switches, this ground connection is removed. When the plug of a line is withdrawn from its normal position in the answering-switch, the two sides or branches of the line are brought into a closed circuit, with the operator's telephone in the circuit. The connection is automatically made by the closing of the two pairs of contact-points 3 4 and 5 6. The points 3 and 5 are connected to the two sides of the line, and 4 and 6 are connected to the two sides of the telephone. The operator then by conversation finds out what line is wanted. She then places the tip *s* of the plug of the calling-line on the third or insulated contact-piece of the line wanted, and if the line is not switched at any board (and its normal ground connection through the battery broken) and the subscriber's telephone is not switched for use a complete circuit is established, which contains the calling-battery and operator's telephone and the subscriber's circuit-breaking bell, and the bell will ring, calling the subscriber. This complete circuit is, say, from the ground through the operator's telephone and contacts 5 6 of the switching device of the plug used to contact-piece *s* of the plug, thence through the circuit of the line and its vibrating bell, the pairs of contacts of its line-switches, the contact-points 1 2 of its switching device, and battery R to ground. The operator also will distinguish in her telephone the make and break of a bell and will know that the line is "free" to be connected to. She will then push the plug into the switch, and by so doing disconnect the line from its normal ground connection. The test-circuit (from the operator's ground through her apparatus to the circuit of the line and through the line to its normal ground connection) will be broken and the bell will stop ringing. The two lines are thereby connected into a metallic circuit which is cross-connected or bridged by a circuit which contains the operator's telephone and resistance-coil, and the subscriber wanted has been called. The operator then raises the movable piece *b* of the answering-switch, and by so doing breaks the connections at 3 4 and 5 6 and removes the bridge connection. Should she wish at any time to listen into the circuit to determine whether the subscribers are through conversation, she will again establish the bridge connection by pressing in the piece *b*, and a part of any telephone-current passing over the circuit will be deflected through her telephone. The use of the resistance-coil is to prevent an undue amount of the current from passing through the telephone. It will be observed that the subscriber's bell will ring just so long as the operator holds the tip of the plug on his switch, and when the plug is pushed into the switch the bell stops ringing. It will also be seen that had the line been switched at any board by the use of its plug or through one of its switches or had the subscriber's telephone been switched for use and the bell thereby switched from the circuit the bell would not have rung and the operator would not have got the signal which indicates that the line is clear. She would not, therefore, have switched the line with the line which desired the connection. A subscriber's line, therefore, tests "busy" and is reserved to himself whether it is switched at any board or his telephone is switched for use, and the service is more satisfactory than it would be were the test "busy" made by only one of these operations. Had the subscriber taken down his telephone for use when the test was made, but the line had not been switched at the central office, the operator would hear a single "click" in her telephone, but not a succession of sounds. She would then know that the subscriber's telephone was switched for use, but that the line was not yet switched.

The operations to answer a call and complete a connection are these: first, to remove the plug from its normal position; second, to put the plug on the switch-contact of the line wanted and then push it into the switch, and, third, to raise or move up the piece *b* of the answering-switch.

In order to listen to the circuit of two lines connected together, the operator merely pushes down on the piece *b* of the answering-switch and her telephone is connected in a bridge to their circuit. The calling and testing battery R should be strong enough to operate the vibrating bell of any line when they are closed to each other through the circuit of the line, as heretofore described. The number of cells required will depend on the resistance of the circuit (including line, test receiving instrument, calling-annunciator, and bell) and also on the character of the bell and the number of convolutions of its electromagnet. As a general thing as many as twenty-five or thirty or even more cells will be required for this purpose.

The operator's telephone is used for the test receiving instrument. Other forms of test receiving instruments may be used, but they should be such that when closed, as described, to a vibrating bell and the calling-battery the instrument will respond to the vibrations of the bell. The calling-annunciators should be connected into their respective circuits, and the calling and testing battery R should be connected in the circuits in such a direction that the calling and testing current directed to any line will not operate the annunciator and give a false signal to its operator that the subscriber has sent in a call. The annunciators are distributed among the various boards of the exchange, and as the battery is a strong calling-battery an annunciator at a distant board might be made to indicate a call when a test is made were it not for this arrangement of annunciators and battery, and the operator at the distant board, seeing the indication, would understand that the subscriber had sent in a call and connect to the line, to the

confusion of the subscribers and the two operators. By the construction and connection of annunciators and battery which I have described these false signals are prevented and confusion is avoided. With electric batteries for signaling and testing and with ordinary polarized annunciators for receiving calls such connection is simple and easily understood by those skilled in the art.

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 telephone-line, one side or branch of which is normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with a vibrating bell normally in the circuit of the line at the subscriber's station and a test receiving instrument grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the normally open side or branch of the line, said battery being so strong as to operate said bell and the test receiving instrument being such as to respond to the vibrations of the bell when they are thus included in closed circuit with each other, 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 through a battery and the other side or branch of which is normally open at the central office, in combination with a vibrating bell normally in the circuit of the line at the subscriber's station, switching apparatus by which the bell is switched or shunted from the circuit while the subscriber's telephone is switched for use and a test receiving instrument grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the normally open side or branch of the line, said battery being so strong as to operate said bell and the test receiving instrument being such as to respond to the vibrations of the bell when they are thus included in closed circuit with each other, 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 through a battery and the other side or branch of which is normally open at the central office, in combination with switching apparatus by which such ground connection is broken while the line is switched for conversation, a vibrating bell normally in the circuit of the line at the subscriber's station but switched from the circuit while the telephone is switched for conversation, and a test receiving instrument grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the normally open side of the line, said battery being so strong as to operate said bell and the test receiving instrument being such as to respond to the vibrations of the bell when they are thus included in closed circuit with each other, 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 through a battery and the other side or branch of which is normally open at the central office, in combination with a vibrating bell normally in the circuit of the line at the subscriber's station and apparatus by which the operator may temporarily ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit line one side or branch of which is normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with a vibrating bell normally in the circuit of the line at the subscriber's station but switched or shunted from the circuit while the telephone is switched for conversation and connecting apparatus by which the operator may temporarily ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

6. In a telephone-exchange system, a metallic-circuit line one side or branch of which is normally grounded at the central office through a battery but disconnected from such ground connection while the line is switched for conversation and the other side or branch of which is normally open at the central office, in combination with a vibrating bell at the subscriber's station normally in the circuit of the line and connecting apparatus by which the operator may temporarily ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

7. In a telephone-exchange system, a metallic-circuit telephone-line one side or branch of which is normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with switching apparatus by which such normal ground connection is broken while the line is switched for conversation, switching apparatus for

grounding at the central office the normally open side or branch of the line, a vibrating bell normally in the circuit of the line at the subscriber's station and a switch with contacts and connections by which the bell is switched or shunted from the circuit while the subscriber's telephone is switched for use, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

8. In a telephone-exchange system, a metallic-circuit line one side or branch of which is normally grounded at the central office through a battery but which is disconnected from such ground connection while the line is switched for conversation and the other side or branch of which is normally open at the central office, in combination with a vibrating bell normally in the circuit of the line at the subscriber's station, a switch with contacts and connections by which the bell is shunted from the circuit of the line while the telephone is switched for conversation and connecting apparatus by which the subscriber may ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

9. In a telephone-exchange system, a metallic-circuit line which is normally disconnected from the ground at the subscriber's station and has a vibrating bell there in its circuit while the subscriber's telephone is not switched for conversation and only then, one side or branch of the line being normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with apparatus by which the operator may at will ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

10. In a telephone-exchange system, a metallic-circuit line which is normally disconnected from the ground at the subscriber's station and has a vibrating bell in its circuit there while his telephone is not switched for use and only then, one side or branch of the line being normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with switch apparatus by which such normal ground connection is broken while the line is switched for conversation and connecting apparatus by which an operator may at the central office ground such normally open side or branch of the line, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially as set forth.

11. In a telephone-exchange system, a metallic-circuit line one side or branch of which has a polarized annunciator in its circuit and is normally grounded at the central office through a battery and the other side or branch of which is normally open at the central office, in combination with a calling-generator at the subscriber's station, contacts and connections by which the subscriber may direct a current from his generator which will operate said annunciator, a vibrating bell at the subscriber's station normally in the circuit of the line, and connecting apparatus by which the operator may ground such normally open side or branch of the line, said annunciator and battery being so connected that when thus included in circuit the battery will not operate the annunciator, said battery being so strong as to operate said bell when they are thus included in closed circuit with each other, substantially 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.