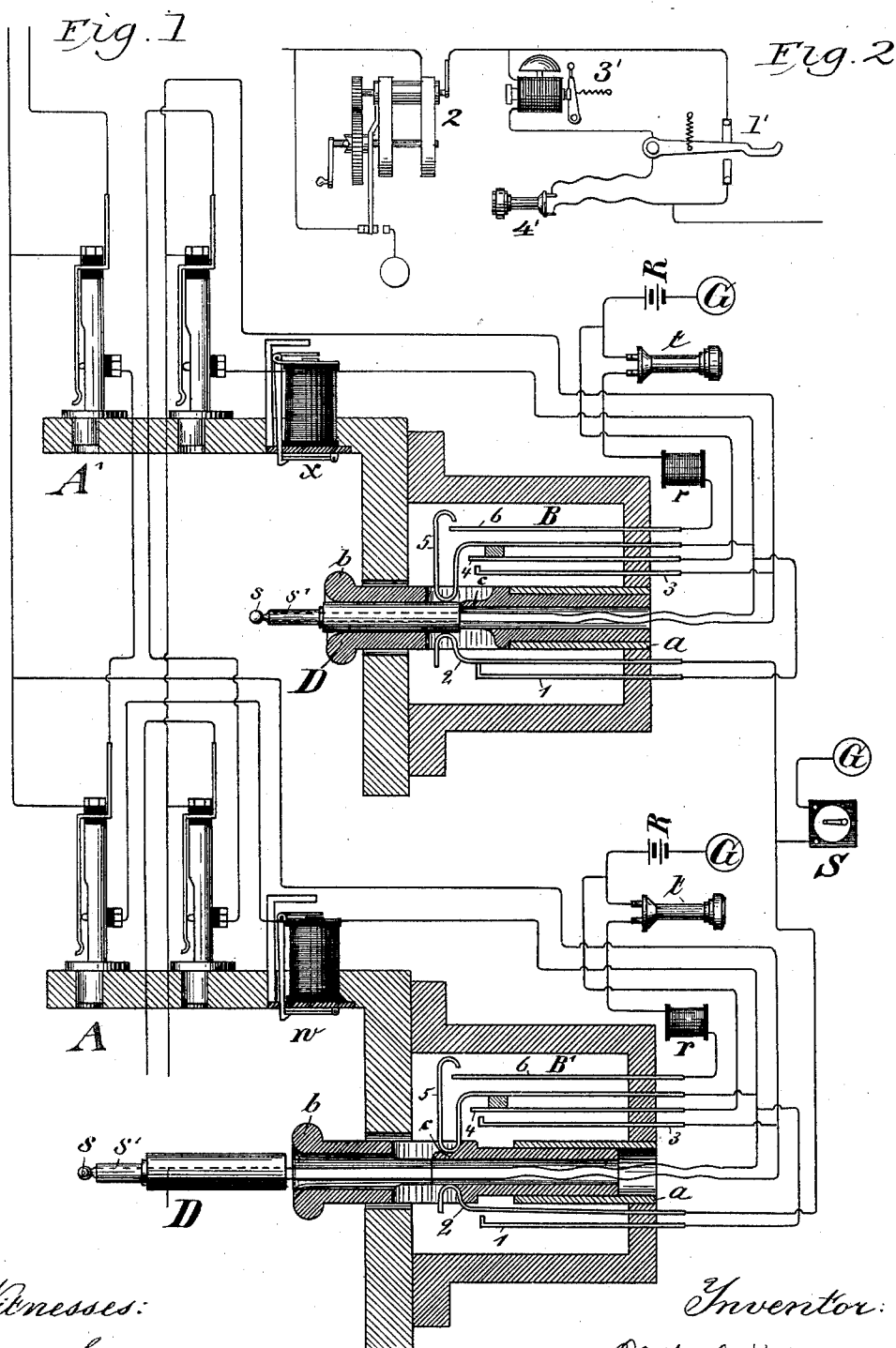


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,378.

Patented Oct. 26, 1897.



Witnesses:
Lucas Bros.
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. 592,378, dated October 26, 1897.

Application filed July 26, 1890. Serial No. 360,089. (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, have invented certain new and useful

5 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.
10 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 switch-
15 ing 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"
20 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
25 when its call is indicated, may test the line wanted to see whether it is in use and send a signal-current over the line, may connect the two lines together, may receive a clearing-out signal, may connect her telephone into the
30 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
35 less than in other systems devised for the same purpose.

In the accompanying drawings, Figure 1 is a diagram illustrating the central-office arrangement, and Fig. 2 shows the subscriber's-
40 station apparatus.

A and A' represent sections of two multiple switchboards at the central office of the exchange to which the same lines connect. On
45 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,
50 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. This contact-piece is adapted to have a test-plug applied to it for testing. The
spring-jacks shown in the drawings are of 55 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.
60 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
65 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 drawings. 70 The drawings represent 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
75 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
80 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', *a a* are cylinders, preferably of metal, adapted to receive the movable commutator and plug-supporting pieces *b b*. The piece may be of rubber and is of the shape substantially as shown,
85 and may be of other shapes to correspond with variations which may be made in the construction of the other parts. 90

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. 95

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
100 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 adapted to receive the bent portions of the 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 part of 5 is a shoulder *c*, on which 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* are adapted to occupy two positions, the upper position, as shown at *B'*, and the lower position, as shown at *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 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 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 outside 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.

tt are operators' telephones, *R R* operators' calling-batteries, and *rr* operators' resistance-coils. 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.

S is a rheotome, which may be of any usual construction and alternately makes and breaks the circuit in which it is placed. The rheotome shown contains a clock-movement actuated by a spring and has a pair of insulated contact-points, the contact between which is alternately made and broken by the movement of the verge or shaft. The contact-points are connected in the circuit indicated for the rheotome.

w and *x* are polarized 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 with 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 contact-piece 6 and the other side of the telephone is connected to contact-piece 4 of the answering-switch and also to the ground through her calling-battery. The resistance-coil is connected into the circuit with the telephone between contacts 6 and 4.

The contact-spring 2 is connected through the rheotome *S* to the ground.

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 a rheotome, substantially as described.

One rheotome 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, and will have in the line-circuit when the subscriber's telephone is not switched for use an electric bell of any ordinary construction, which will ring when a battery-current is alternately made and broken in its circuit. The organization may be as shown in Fig. 2, where 1' indicates the telephone-switch; 2', the generator of an ordinary construction and arrangement; 3', a common single-stroke electric bell, and 4' the telephone.

Weights, as is usual, or other devices may be used to bring the switch-plugs into their normal position in the socket 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 rheotome. 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 rheotome 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*, 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 places the tip *s* of the plug of the calling-line on the third or insulated contact-piece of the line wanted. If, then, the line wanted is not switched at any board, either by the insertion of a plug into its switch or by the withdrawal of its switch-plug from its normal position for use, there is a complete circuit established from the office ground through the operator's calling-battery and telephone to the line, thence through the circuit of the line and the subscriber's electric bell to the rheotome, and thence to the normal ground connection of the line, and the battery-current being alternately established and interrupted by the operation of the rheotome the subscriber's bell will ring and the operator will at the same time distinguish in her telephone the alternate make and break of the current and will know that the line is not

switched at any board. She then pushes the plug into the switch and by so doing disconnects the line from its ground connection through the rheotome and thereby stopping the ringing of the subscriber's bell and the vibration in her own telephone and at the same time leaving the two lines connected together in a metallic circuit with the circuit bridged or crossed, connected by a circuit which contains her telephone and resistance-coil. She then raises the movable piece *b* of the answering-switch of the line whose call she is answering, and by so doing disconnects her telephone from the circuit. The bridge is removed by the opening of the pairs of contacts 3 4 and 5 6.

When the operator desires to listen to the circuit to determine whether the subscribers are through conversation, she pushes the movable piece *b* to its lower position, thereby establishing again the bridge-circuit which contains her telephone and resistance-coil. She can then listen and determine whether they are through conversation. The resistance-coil in the bridge-circuit prevents an undue amount of any telephone-current which may be going over the circuit from being directed into the operator's telephone.

It will be observed that the subscriber's bell will ring just as long as the operator holds the tip of the plug on the insulated contact-piece of the switch without inserting the plug into the switch, and that when the plug is inserted the bell will stop ringing. It will also be seen that when a plug is applied to said contact-piece and the line is switched at any board, and thereby disconnected from its ground connection through the rheotome, the telephone will not sound and she will thereby know that the line is switched.

The calling-annunciators should preferably be polarized annunciators and should be connected into their respective circuits, and the operator's calling-batteries should be connected to the circuits in such a direction that the battery-current sent to the line-circuit, as indicated, to make the test and signal will not operate the annunciator, thereby giving a false signal to another operator that there is a call on the line.

The line-annunciators are distributed among the various boards of the exchange, and as the battery is a strong one to operate the signal-bells an annunciator at a distant board might be made to indicate a call when the test of a line is made, giving a false signal that the line is wanted, were it not that the annunciators are polarized and so connected as not to be operated by the battery used in calling and testing; but with this construction and connection false signals that the lines are wanted are prevented and confusion is avoided.

The operations required to answer any call and make the connections are as follows: first, to remove the plug from its normal position; second, place the plug on the contact-

piece of the switch of the line wanted and then push it into the switch, and, third, raise the movable piece of the calling subscriber's answering-switch. In order to listen into the circuit of the two lines connected together, the operator merely pushes in the movable piece of the answering-switch. In order to make a disconnection of the two lines, she merely takes the plug from the switch and places it in its normal position and presses the movable piece of the answering-switch to its normal 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, a metallic-circuit telephone-line one side or branch of which is normally grounded at the central office but is disconnected from the ground while switched for conversation and the other side or branch of which is normally open at the central office, in combination with a signal-bell normally in the circuit of the line at the subscriber's station, and a calling generator or battery grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the open end of the line, said generator or battery being of such strength and kind as to operate said bell when they are thus closed to each other, substantially as set forth.

2. In a telephone-exchange system, a metallic-circuit telephone-line one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office and which is normally disconnected from the ground at the subscriber's station, in combination with a signal-bell normally in the circuit of the line at the subscriber's station, and a calling battery or generator grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the open end of the line, said generator or battery being of such strength and kind as to operate said bell when they are thus closed to each other, substantially as set forth.

3. In a telephone-exchange system, a metallic-circuit telephone-line one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, and a polarized annunciator in said first-mentioned side or branch of the line, in combination with a calling-battery at the central office 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 end of the line, said annunciator and battery being so

connected in the circuit that the battery does not operate the annunciator, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line normally open to the ground at the subscriber's station, one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, a polarized annunciator in said first-mentioned side or branch of the line, in combination with a battery at the central office 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 end of the line, and the battery and annunciator being so connected that the battery does not operate the annunciator when they are thus included in a circuit, substantially as set forth.

5. In a telephone-exchange system, a metallic-circuit line normally open to the ground at the subscriber's station, one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, in combination with a signal-receiving bell normally in the circuit of the line at the subscriber's station, a polarized annunciator in the normally-grounded branch of the line at the central office, and a battery at the central office 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 end of the line, said battery being of such strength as to operate said bell, and said annunciator and battery being so connected that the battery does not operate the annunciator when they are thus included in a circuit, substantially as set forth.

6. In a telephone-exchange system, a metallic-circuit telephone-line normally open to the ground at the subscriber's station, one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, and an annunciator in said first-mentioned side or branch of the line, in combination with a signal-receiving bell normally in the circuit of the line at the subscriber's station and a battery at the central office 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 end of the line, said battery being of such strength as to operate said bell, and said annunciator and battery being so constructed and related that the battery does not operate the annunciator when they are thus included in a circuit, substantially as set forth.

7. In a telephone-exchange system, a metallic-circuit line, one side or branch of which is normally grounded at the central office and the other branch of which is normally open at the central office, and an annunciator in said first-mentioned side or branch of the line, in combination with a signal-receiving bell normally in the circuit of the line at the subscriber's

er's station and a battery at the central office grounded on one side and connected on its other side to a plug or device adapted to be brought into connection with the open end of the line, said battery being of such strength as to operate said bell, and the annunciator and battery being so constructed and related that the annunciator is not made to indicate when they are thus included together in a circuit, substantially as set forth.

8. In a telephone-exchange system, a metallic line one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, and a polarized annunciator in said first-mentioned side or branch of the line, in combination with a calling-battery and test receiving instrument at the central office in a circuit which is grounded at one end and connected at its other end to a plug or device adapted to be brought into connection with the normally open end of the line, said annunciator and battery being so connected that when thus included in a circuit the battery does not operate the annunciator, substantially as set forth.

9. In a telephone-exchange system, a metallic-circuit line one side or branch of which is normally grounded at the central office and the other side or branch of which is normally open at the central office, and a polarized annunciator in said first-mentioned side or branch of the line, in combination with 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 end of the line, and a battery in the circuit thereby established, said annunciator and battery being so connected that the annunciator is not caused to indicate when they are thus connected into a circuit, substantially as set forth.

10. In a telephone-exchange system, a metallic-circuit line, one side or branch of which is normally grounded at the central office but disconnected from the ground while switched for conversation and the other side or branch of which is normally open at the central office, in combination with 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 end of the line, a battery and a rheotome in the circuit thereby established, and a signal-receiving bell at the subscriber's station normally in the circuit of the line constructed to respond to the make and break of the current when on closed circuit with the battery and rheotome, substantially as set forth.

11. In a telephone-exchange system, a metallic-circuit line and a switch for the line located at a switchboard in the central office, said switch having a pair of contacts normally in contact and a third contact-piece adapted to have a plug applied to it, one side or branch of the line passing through said

pair of contact-points to ground and the other side or branch of the line connected to said third contact-piece, in combination with a signal-bell at the subscriber's station normally in the circuit of the line, a calling-battery (or generator) grounded on one side and connected on its other side to a contact-piece of a switch-plug adapted to be inserted into said switch to switch the line with another line and when inserted first to form connection between said contact-piece of the plug and said third contact-piece of the switch and then to separate said normally closed contact-points, said battery being of such strength and kind as to operate said bell when they are thus closed to each other, substantially as set forth.

12. In a telephone-exchange system, a metallic-circuit line and a switch for the line located at a switchboard in the central office, said switch having a pair of contacts normally in contact and a third contact-piece adapted to have a plug applied to it, one side or branch of the line passing through said pair of contacts to ground and the other side or branch of the line connected to said third contact-piece, in combination with a signal-bell at the subscriber's station normally in the circuit of the line, a calling-battery and a test receiving instrument in a circuit wire or connection grounded on one side and connected on its other side to a contact-piece of a switch adapted to be inserted into said switch and when inserted first to form connection between said contact-piece of the plug and said third contact-piece of the switch and then to separate said normally closed contacts, said battery being of such strength and kind as to operate said bell and test receiving instrument when they are thus closed to each other, substantially as set forth.

13. In a telephone-exchange system, a metallic-circuit line, a switch for said line on a switchboard, having a pair of contacts normally in contact through which one side or branch of said line normally passes to ground and a third contact-piece connected to the other side of said line, in combination with a signal-bell normally in the circuit of the line at the subscriber's station, a signal-battery at the central office grounded on one side and a switch-plug connected to the other side of said battery, adapted to be inserted into said switch and when inserted to first form connection with said third contact-piece and then to open said pair of contacts, said battery being of such strength as to operate said signal-bell when thus closed with it, substantially as set forth.

14. In a telephone-exchange system, a metallic-circuit line, switches for said line, one on each of the multiple boards, each having a pair of contacts normally in contact through which one side or branch of said line normally passes to ground, and a third contact-piece connected to the other side of said line, in combination with a signal-bell normally in

the circuit of the line at the subscriber's station, a signal-battery at the central office grounded on one side, and switch-plugs at each board connected to the other side of said battery, adapted to be inserted into said switch at their board and when inserted to first form connection with said third contact-piece and then to open said pair of contacts of said switch, said battery being of such

strength as to operate said signal-bell when thus closed with it, 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.