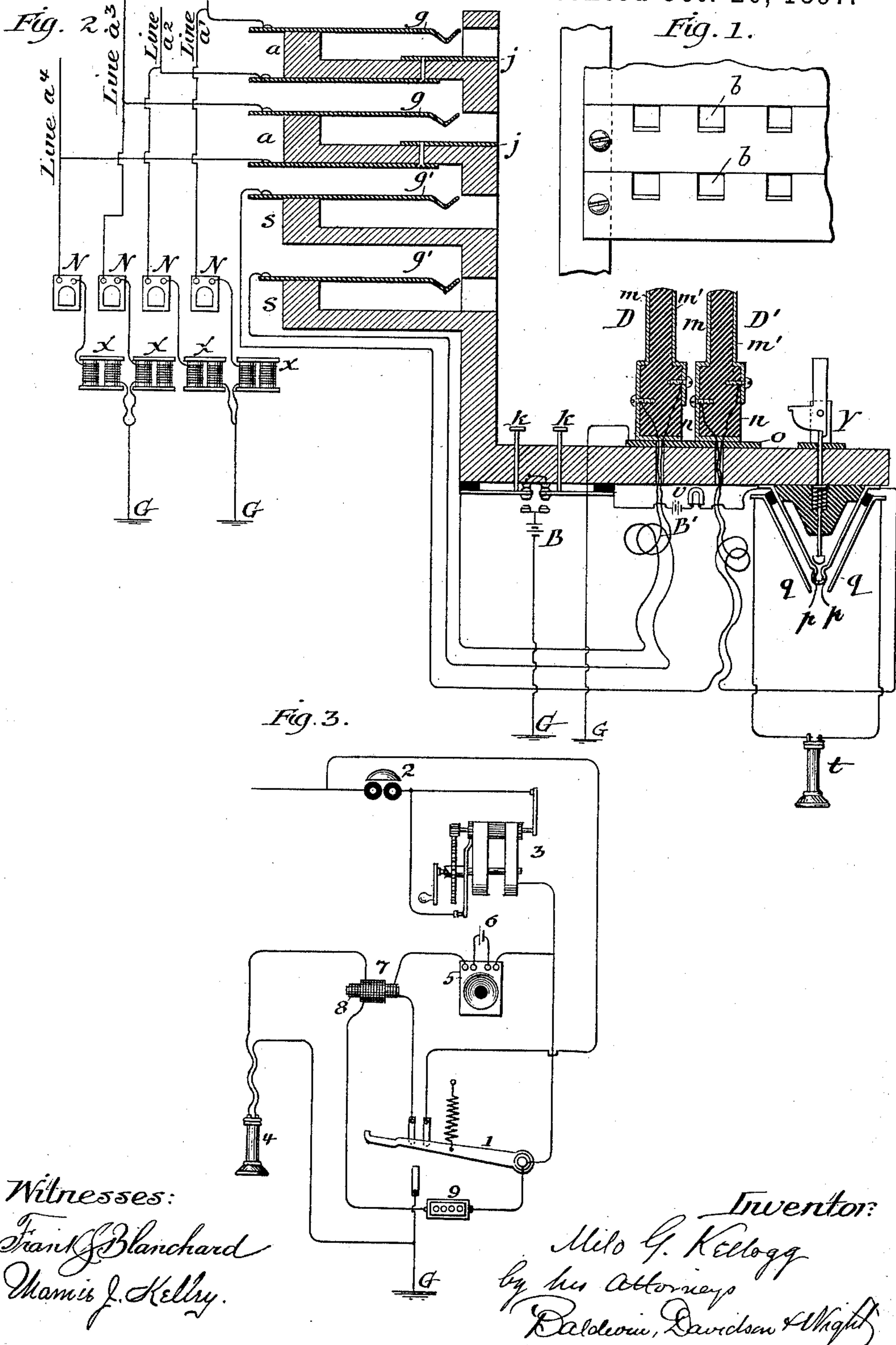


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,391.

Patented Oct. 26, 1897.





# 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. 592,391, dated October 26, 1897.

Application filed May 14, 1891. Serial No. 392,717. (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 Improvements in 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 telephone-exchange systems in which the lines are grounded at the central office and at their outer ends.

Certain features of the invention may be used with a multiple-switchboard system and also in switchboards which are not multiple.

Certain features of the invention may be used with lines which are not grounded at the central office.

In the organization shown I connect the telephone-lines with the different switches on the board or boards in pairs, there being one switch for each pair of lines on each board and each switch having two contact-pieces suitably placed and insulated, one of the lines of a pair of lines being connected with one of said switch contact-pieces and the other connected with the other contact-piece, in connection with switch-plugs, apparatus, and circuits, which I shall hereinafter describe, by which the operators may receive the calls of the lines and expeditiously and with few motions connect together any two lines which are connected at their boards.

The invention consists, primarily, in a clearing-out system applicable to such system of switching and connecting and to other systems of telephone-exchange operation.

Figure 1 is a front view of a section of one of the switchboards. Fig. 2 shows a sectional view of a board with four lines connected to it, four annunciators for the lines with their connection to their respective lines and the ground, and a pair of switch-plugs connected with the operator's apparatus and their own apparatus. Fig. 3 shows in diagram a subscriber's-station apparatus which may be used in the system.

The switches of the lines are marked *a a*. *b b* are the switch-holes through the front of the rubber strips of the shape substantially

as shown and on which the metal parts of the switches are mounted. These holes are preferably square or rectilinear. To one side of the centers of the holes are the contact-springs *g g*. On the opposite sides of the center of the holes and along the surface of the holes are placed the contact-pieces *j j*. There is one spring *g* and one contact-piece *j* for each switch.

Four lines are shown in the drawings. Line *a'* is connected to contact-spring *g* of one of the switches. Line *a<sup>2</sup>* is connected to contact-piece *j* of the same switch. Line *a<sup>3</sup>* is connected to contact-spring *g* of the other switch, and line *a<sup>4</sup>* is connected to contact-piece *j* of that switch.

*N N* are annunciators, and *x x* are retardation-coils, one annunciator and one retardation-coil for each line. Each line is connected to the ground through its annunciator and retardation-coil.

*D D'* are a pair of switch-plugs adapted each to be inserted into any of the switches and to form connection when inserted, as will hereinafter be described.

*n n* are the rubber insulations of the plugs, and *m m'* are the two contact-pieces of a plug.

When a plug is inserted into a switch, it may be inserted in such a direction that its piece *m* forms connection with spring *g* and its piece *m'* forms connection with contact-piece *j* of the switch, or in the reverse direction, so that *m* forms connection with *j* and *m'* with *g*.

For each plug there is a switching device, into which any other plug located at its board may be placed and which has a contact-piece *g'*, which connects with the contact-piece *m* of the plug thus inserted. The contact-piece of this switching device is connected through a flexible switch-conductor with contact-piece *m'* of its plug. These switching devices are marked *s s*.

The contact-pieces *m m* of a pair of plugs are connected together by a flexible-cord circuit, and in this cord-circuit are a battery *B'*, a clearing-out annunciator *v*, and the normally closed contacts of the two calling-keys *k k*.

*Y* is a looping-in switch, with contacts and connections, by which the operator's telephone



may be looped into the cord-circuit. The two contacts  $p p$  are normally in contact with each other and in the circuit of the pair of cords. When the plunger of the switch is depressed, that connection is opened and the two springs  $p p$  are pressed into connection with the two contacts  $q q$ , respectively, to which are connected the two sides of the operator's telephone  $t$ . The telephone may thereby be looped into the cord-circuit. When the plugs are in their normal position, their contact-pieces  $m$  rest on a ground-plate  $o$ , as shown.

There is one battery  $B'$ , one clearing-out annunciator  $v$ , two calling-keys  $k k$ , and one looping-in switch  $Y$ , for each pair of cords. The two keys  $k k$  are connected with their cord-circuit, with the two levers connected with the two contacts  $m m$  of the plugs. The lower contacts of the keys are connected through the calling-battery  $B$  to ground.  $t$  is the operator's telephone. Each operator has as many pairs of plugs as she may reasonably require for her work, and they are connected to their special apparatus and to the operator's apparatus substantially as hereinbefore described.

In the subscriber's-station apparatus shown in Fig. 3, 1 is the telephone-switch of the usual construction; 2, the signal-receiving bell. 3 is the call-generator. 4 is the subscriber's telephone. 5 is the transmitter. 6 is the transmitter-battery. 7 is the secondary, and 8 is the primary, of the induction-coil, and 9 is a resistance-coil.

From the line-circuit before it passes to the bell a wire of small resistance is run to a contact-piece with which the lever comes in contact when the telephone is taken from it. When, therefore, the telephone is on the lever, the circuit is through the bell and telephone-lever to ground. When the telephone is off the lever, the circuit is around the bell, through the lever, resistance-coil, secondary of induction-coil, and telephone to ground.

It is evident from the above description of the circuits and from the drawings that when the telephone is on the switch the signal-bell is in the circuit of the line, and the telephone, secondary of induction-coil, and resistance-coil are shunted or short-circuited, so that their resistance is practically switched from the circuit, and that when the telephone is off the switch the telephone, the secondary of the induction-coil, and the resistance-coil are in the circuit of the line, and the signal-bell is short-circuited, so that its resistance is practically switched from the circuit. In well-organized subscriber's telephone-station apparatus the resistance of the telephone and secondary of the induction-coil combined aggregate about four hundred ohms, while that of the signal-bell is about one hundred ohms. The resistance of the line-circuit while the subscriber's telephone is switched for use is therefore much greater than is the resistance while the telephone is not switched

for use. I utilize this difference in resistance in the clearing-out signals, as will hereinafter appear. If this difference in resistance is not enough to cause an easy adjustment of the apparatus for the operation of the clearing-out signals, such additional resistance as is needed may be included in the resistance-coil. It is evident that the needed difference in resistance may be obtained with other arrangements of apparatus and circuits.

The line-annunciators are preferably polarized annunciators and connected in their line-circuits in such a direction that they are not operated by the calling-battery when connected to their respective lines.

The operation of the system is as follows: When an operator observes a call on a line-annunciator, she places one plug of a pair into the switch to which the line is connected in such a position or direction that the contact-piece  $m$  of the plug forms connection with that contact-piece of the switch which is connected with the line. She then finds out by conversation what line is wanted. She then places the other plug of the pair into the switch of the line wanted in such a position or direction that the contact-piece  $m$  of the plug forms connection with the contact-piece of the switch connected with the line. Should there in either case be a switch-plug in the switch of the line, she inserts her plug in the switching device of that plug, thereby connecting her plug with the line.

The clearing-out annunciators should be of such a character and the cord-batteries of such strength that when they are together in circuit with any two lines and the subscribers' telephones are switched for use, thereby including a considerable resistance in the circuit, the annunciator will not indicate a call; but when the telephones are switched out of use by being placed on their switches and the resistance of the circuit is thereby considerably decreased the strength of the battery will operate the annunciator. Thereby the subscribers by the mere act of placing their telephones on their switches send in the clearing-out signal. The signal-bells at the subscribers' stations should be of such kind as to be operated by that polarity of current which is sent over the line for calling.

The retardation-coils and annunciators of the lines should preferably be of high resistance, so that enough battery-current will not pass through any line-annunciator when the lines are switched, as described, to operate the annunciator.

With this system and organization only one-half as many switches are required for a given number of lines and the switches for twice as many lines may be placed within a given space, as in the usual telephone-switchboard system. The system therefore doubles the capacity of a given-sized switchboard before the multiple system is required. For instance, if the multiple system is found desirable when an exchange has reached six hun-



dred lines it would in this system be no more necessary or desirable in exchanges of twelve hundred lines.

5 The method of switching and the connection of the annunciators and resistances in the line herein shown are disclosed and claimed in my application Serial No. 383,260.

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

10 1. In a telephone-exchange system, telephone-lines divided into pairs, annunciators for said lines, one annunciator for each line, and switches for said lines, one switch for each pair of lines, each switch having two  
15 contact-pieces to which the two lines of its pair are respectively connected and each line being grounded through its annunciator in combination with batteries and switching apparatus by which any two lines may be connected together in a circuit which includes a  
20 battery and does not include their annunciators, substantially as set forth.

2. In a telephone-exchange system, telephone-lines divided into pairs, annunciators  
25 and retardation-coils for said lines, one annunciator and one retardation-coil for each line, and switches for said lines, one switch for each pair of lines, each switch having two contact-pieces to which the two lines of its  
30 pair are respectively connected, and each line being grounded through its annunciator and retardation-coil, in combination with electric batteries and switching apparatus by which any two lines may be connected together in a circuit which includes a battery  
35 and does not include their annunciators and retardation-coils, substantially as set forth.

3. In a telephone-exchange system, two telephones temporarily connected together for  
40 conversation and a clearing-out annunciator and battery connected into the closed circuit with them while or as long as the operator leaves them connected together for conversation, in combination with resistances at  
45 each subscriber's station and switch apparatus and connections by which a greater resistance is included in the closed circuit when the subscribers' telephones are switched for use than when they are not thus switched,  
50 said battery and annunciator being so related to each other and the circuit and resistances that the annunciator is not operated while the telephones are switched for use and the additional resistance is thereby  
55 included in the closed circuit of the lines, but the battery causes the annunciator to indicate when the telephones are switched out of use, and the lesser resistance is in such closed circuit, substantially as set forth.

60 4. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation and in a clearing-out annunciator and battery connected by the act of switching the line for conversation into  
65 closed circuit with each line while and as long as they are left by the operator connected together for conversation, in combination

with resistances at each subscriber's station and switch apparatus and connections by which a greater resistance is included in the  
70 circuit when the subscribers' telephones are switched for use than when they are not thus switched, said battery and annunciator being so related to each other and the circuit that the annunciator is not operated while  
75 the telephones are switched for use and the greater resistance is included in closed circuit with them, but the battery causes the annunciator to indicate when the telephones are switched out of use and such greater resistance is not in such closed circuit, substantially as set forth.  
80

5. In a telephone-exchange system, telephone-lines, annunciators for said lines, one annunciator for each line, through which the  
85 line is permanently grounded and switches for said lines, each switch having a contact-piece to which its line is connected and each line being grounded through its annunciator, in combination with batteries and switching  
90 apparatus by which any two lines may be connected together in a closed circuit which includes a battery, said battery being included in the closed circuit of the two lines thus connected together while and as long as  
95 they are left by the operator connected together for conversation and does not include their annunciators, a clearing-out annunciator then in said circuit and apparatus at each subscriber's station coöperating with  
100 said battery at the will of the subscriber to operate the clearing-out annunciator.

6. In a telephone-exchange system, telephone-lines, annunciators and retardation-coils for said lines, one annunciator and one  
105 retardation-coil for each line, and switches for said lines, each switch having a contact-piece to which its line is connected, and each line being grounded through its annunciator and retardation-coil, in combination with  
110 electric batteries and switching apparatus by which any two lines may be connected together in a closed circuit which includes a battery while or as long as they are left by the operator connected together for conversation and does not include their annunciators and retardation-coils, a clearing-out  
115 annunciator then in said circuit and apparatus at each subscriber's station coöperating with said battery at the will of the subscriber to operate the clearing-out annunciator.  
120

7. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation, and a line-annunciator for  
125 each line, each annunciator being then or while the lines are thus connected together for conversation connected on one side to its line and on the other side to the ground, in combination with a battery and clearing-out annunciator in the closed circuit of said lines  
130 thus connected together, and apparatus at each subscriber's station coöperating with said battery at the will of the subscriber to



operate the clearing-out annunciator, said line-annunciators being so constructed and related to the battery and the circuits that the battery does not then cause either of them to indicate a call.

8. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation and a clearing-out annunciator and battery connected into closed circuit with them while and as long as and during the time they are left by the operator connected together for conversation, in combination with resistances at each subscriber's station and switch apparatus and connections by which a less resistance is at the will of either subscriber included in his line-circuit than is the resistance included therein while the line is being used for conversation, said battery and annunciator being so related to the circuit that the battery causes the annunciator to indicate a call on the less resistance being included by either subscriber in his line-circuit, but not otherwise, substantially as set forth.

9. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation and a clearing-out annunciator and battery then connected in their circuit, in combination with a line-annunciator for each line, each annunciator being connected on one side to its line while the line is switched for conversation and on the other side to the ground, resistances at each subscriber's station and switch apparatus and connections by which greater resistance is included in the circuit of the lines when the subscribers' telephones are switched for use than when they are not thus switched, said annunciators being so constructed and related to the battery and circuits that neither line-annunciator is caused by the battery to indicate a call, and the clearing-out annun-

ciator is made to indicate a call when the subscribers' telephones are not switched for use, but not otherwise, substantially as set forth.

10. In a telephone-exchange system, a telephone-line grounded at its outer end and at the central office and a polarized annunciator at the central office permanently in circuit with its line, in combination with a signal-receiving bell at the subscriber's station, a calling-battery at the central office grounded on one side and switch apparatus by which the other side of the battery may be connected to the line-circuit, said annunciator being then in circuit between the office ground of the line and said battery, and so connected in circuit as not to be operated by said battery, substantially as set forth.

11. In a telephone-exchange system, two telephone-lines temporarily connected together for conversation, and a line-annunciator for each line, each annunciator being then or while the lines are thus connected together for conversation connected on one side to the direct conductor of its line and on the other side to the return-conductor, in combination with a battery and clearing-out annunciator in the closed circuit of said lines thus connected together, and apparatus at each subscriber's station coöperating with said battery at the will of the subscriber to operate the clearing-out annunciator, said line-annunciators being so constructed and related to the battery and the circuits that the battery does not then cause either of them to indicate a call.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

FRANK S. OBER,  
EDWARD C. DAVIDSON.