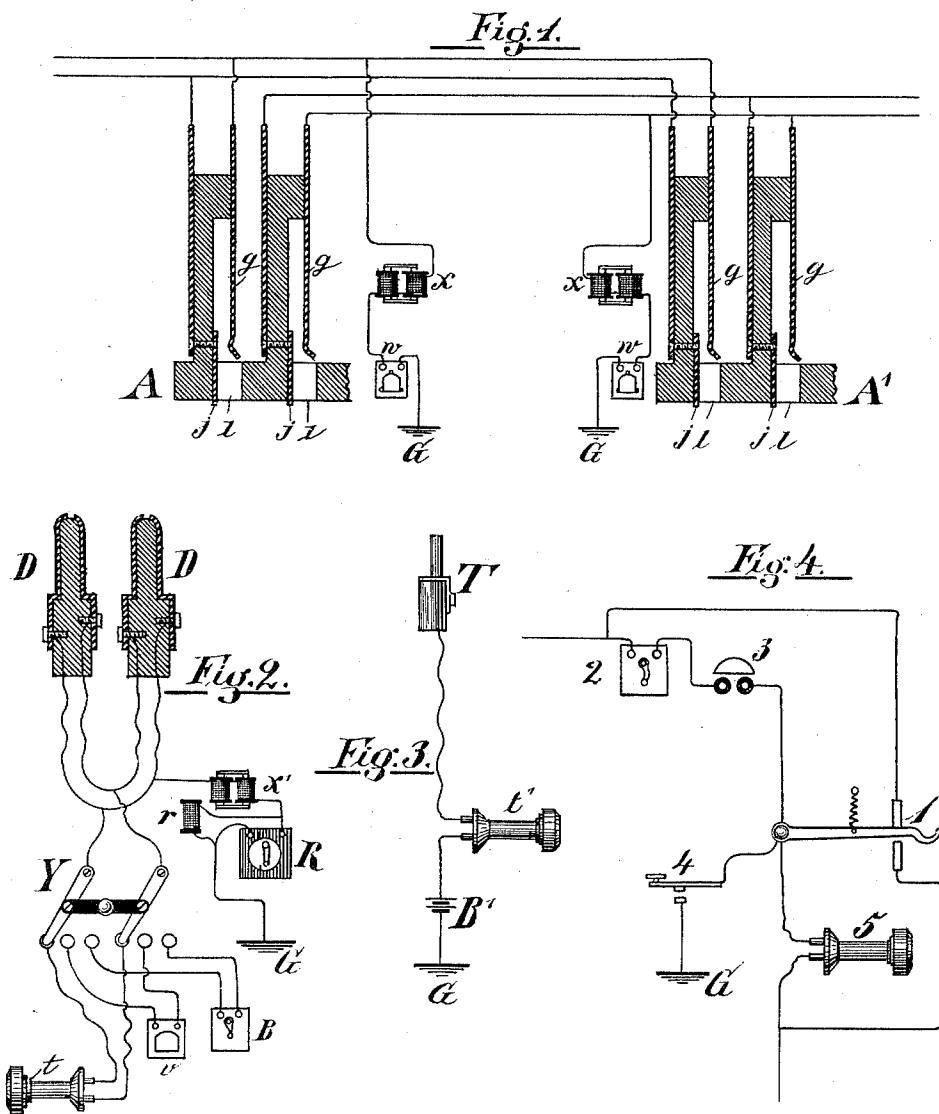


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,414.

Patented Oct. 26, 1897.



Witnesses:

Harry H. Starnett
M. J. Kelly

Inventor:

M. G. Kellogg
By his Attorneys
Baldwin, Davidson & Wright

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. 592,414, dated October 26, 1897.

Application filed November 30, 1891. Serial No. 413,604. (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 Geneva, in the Republic of Switzerland, have invented certain new and useful Improvements in Metallic Switchboards for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates especially to a metallic-circuit exchange system in which each line is permanently grounded at the central office through its annunciator; and it consists of a system of calling, testing, switching, and clearing out for such an exchange which I shall describe and claim in detail.

In the accompanying drawings, illustrating my invention, Figure 1 is a diagram with sections of two switchboards to which the same lines are connected, with two lines connected to the same and their central-office apparatus. Fig. 2 shows an operator's cord system adapted to be used at any board. Fig. 3 shows an operator's test system adapted to be used at any board. Fig. 4 shows a subscriber's-station apparatus for each line.

In Fig. 1, A A' are sectional views of sections of the two switchboards. Each board has a switch for each line. Each switch has two contact-pieces insulated from each other (except by the circuit connection) and a switch-hole adapted to receive the loop-switch plugs at its board. The contact-pieces of the switch are so placed and arranged that when a loop-plug (shown in Fig. 2 and marked D D) is inserted into the switch-hole the two contact-pieces of the plug form connection with the two contact-pieces of the switch, respectively. In the drawings one of the contact-pieces of the switches is marked *g g*, and the other contact-piece is placed along the switch-hole and they are marked *j j*. The holes are marked *l l*. The contact-pieces are mounted on rubber strips of the shape substantially as shown, through the fronts of which are the switch-holes *l l*.

Other forms of switches may be used which have two contact-pieces insulated from each

other and adapted to receive loop-switch plugs and form connection between their contact-pieces and the contact-pieces of the plug.

W W are line-annunciators, and *x x* retardation-coils—one annunciator and one retardation-coil for each line.

One side or branch of each metallic-circuit line is connected to one contact-piece of each of the switches of the line—say contact-pieces *g g*—and the other side or branch of the line is connected to the other contact-pieces of the switches—say *j j*. One side or branch of each line is permanently grounded at the central office through the annunciator and retardation-coil of its line. The connections shown in Fig. 1 are substantially as described above.

In Fig. 2, D D are a pair of loop-switch plugs, each plug adapted to be inserted into each switch at its board, and when inserted to form connection between its contact-pieces and the contact-pieces of the switches, respectively. The two contact-pieces of one plug are connected with the two contact-pieces of the other plug, respectively, by two flexible switch conductors. *t* is the operator's telephone; B, a calling-generator; *v*, a clearing-out annunciator; Y, a looping-in switch, and *x'* a retardation-coil; R, a rheotome, and *r* a resistance-coil.

Each pair of plugs has one looping-in switch, one clearing-out annunciator, and one retardation-coil. One calling-generator and one rheotome will answer for the exchange.

The connections are substantially as shown.

By means of the looping-in switch the operator may bridge across the two flexible conductors of a pair of plugs with either her telephone or the calling-generator or with the clearing-out annunciator of the pair of plugs. One of the flexible conductors of the pair of plugs is grounded through their retardation-coil and the test-rheotome R and resistance-coil *r* in derived or parallel circuit. The rheotome may be of any usual form of mechanical or electrical rheotome by which the circuit in which it is placed is alternately made or broken. It is preferable that the breaks of the rheotome are of such interval as to give some certain musical tone which the operator will always distinguish in her

test receiving instrument on testing a line which is already switched for use. A telephone is preferable for the test receiving instrument, as it will readily respond to the vibrations of the rheotome.

Only one pair of plugs, with their special apparatus, is shown. Other pairs may be added to the operator's cord system, substantially as shown and in a way which will be apparent to those skilled in the art.

In the operator's test system shown in Fig. 3, T is the test-plug, B' a test-battery, and *t*' the test receiving instrument. The test-plug is connected to a flexible conductor and is adapted to be brought for testing into connection with one contact-piece—say *j*—of each switch at its board. It is grounded through its test receiving instrument and the test-battery. Each operator has a cord system and a test system suitably arranged at her board.

In the subscriber's station apparatus shown in Fig. 4, 1 is the telephone-switch; 2, the calling-generator; 3, the signal-receiving bell. 4 is a calling-key, and 5 the subscriber's telephone. These parts may be the usual form of subscriber's station apparatus. The line is on closed circuit at the subscriber's station. The contact-points of the key 4 are normally open to each other. One of them is connected with the ground and the other is connected with the line circuit, with the generator between such connection and the ground connection of the line at the central office. The circuits are substantially as shown and may be in other ways by which the signal-bell and calling-generator are in circuit with the line when the telephone is on the switch and the telephone is in the circuit while it is off the switch.

The operation of the system is as follows: When a subscriber wishes a connection, he presses on his key 4, and while doing so operates his generator. A calling-current goes from the ground he establishes through one branch of his line to its ground connection at the central office and operates his line-annunciator. The operator then places one of her switch-plugs in the switch of the line, and the switch Y being in position, so that her telephone bridges the circuit between the two plug-contacts, finds out by conversation what line is wanted. She then tests the line wanted, as will hereinafter be indicated, and if it tests "free" or "unswitched" she places the other plug of the pair in the switch of that line and moves the lever of the switch Y, so that the calling-generator bridges the circuit and a split current goes to both lines and will ring the bell of the subscriber wanted. The operator then moves the lever of the switch Y, so that the circuit of the two lines is bridged by the clearing-out annunciator. The lines are then connected together in metallic circuit for conversation.

To send a clearing-out signal, either subscriber places his telephone on its switch and operates his generator without pressing on

the key 4. A clearing-out signal then goes through the circuit of his line and operates the clearing-out annunciator.

Preferably there should be no automatic shunt on the calling-generators and the resistance of the generators and bells should be sufficiently high, so that when a clearing-out current is sent by one subscriber there will not so large a portion of the current go through the other line as to prevent the clearing-out annunciator from being operated. The subscriber should not press on his key while sending a clearing-out signal, as part of the current would then go to the ground through the line-annunciators and might operate them.

The switches Y Y may be left normally in such a position that the operator's telephone bridges across the circuit of each pair of flexible conductors. The operator in that case can connect her telephone with any line by the mere act of placing one of her switch-plugs into the switch of the line.

The operation of the test system is as follows: When a line is switched for conversation, it is grounded through the rheotome and resistance-coil in derived or parallel circuit. If when the line is in that condition a test-plug is connected to it at any board by being applied to one of its switch contact-pieces at that board, say piece *j*, there is a complete circuit established from the ground through the test-battery and test receiving instrument to the line at the point where it is tested and from the line at the place where it is switched to the ground through the rheotome and resistance-coil in derived circuit, and the operator will hear in the test receiving instrument the vibrations of the rheotome and thereby know that the line is switched for use. If the line is not switched for use, no such circuit will be established on testing, and the operator, not distinguishing the vibrations of the rheotome, will know that the line is not switched.

The utility of the resistance-coil *r* is that the test-circuit of a line to ground is not dead opened and closed by the operation of the rheotome, which might on testing a line which is in use occasion too loud a sound in the operator's test receiving instrument. With the use of the resistance-coil, connected as shown and described, the effect of the rheotome is to alternately short-circuit the coil. With the coil of suitable resistance to correspond to the test receiving instrument, battery, and circuits, the required test indication may be secured without any injurious effect. The resistance-coil may be dispensed with and still the defined indication due to the rheotome be obtained.

It is not necessary to the operation of the test system that the lines be connected through the rheotome to the ground while switched for use. They may be connected by a metallic conductor through the rheotome to the test receiving instruments. It is also true that

practically the same result may be obtained if the test-battery is placed in the circuit to ground through the rheotome.

Instead of the annunciator W and retardation-coil x for each line an annunciator may be employed which has high resistance and high retardation to telephone-currents.

I claim as my invention—

1. In a telephone-exchange system, a metallic-circuit line normally open to the ground at the subscriber's station, a circuit connection at the central office for said line, permanently connected to the line at one end and to the ground at the other end, and the line-annunciator in said circuit connection in combination with a key at the subscriber's station in a normally open ground connection with contact-points to close said connection at will, and a calling-generator at the subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, substantially as set forth.

2. In a telephone-exchange system, metallic-circuit lines, each normally open to the ground at its subscriber's station, circuit connections at the central office one for each line, each permanently connected to the ground and permanently connected to its line, and annunciators, one for each line, each in said circuit connection of its line in combination with a key at each subscriber's station in a normally open ground connection with contact-points to close said connection at will, a calling-generator at each subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, switching apparatus at the central office to connect any two of said lines in a metallic circuit which does not include the annunciators of the lines, and a clearing-out annunciator in circuit with any line thus connected in metallic circuit, substantially as set forth.

3. In a telephone-exchange system, metallic-circuit lines, each normally open to the ground at its subscriber's station, and annunciators, one for each line, through which one side of the line is permanently grounded at the central office, in combination with a key at each subscriber's station in a normally open ground connection with contact-points to close said connection at will, a calling-generator at each subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, switching apparatus at the central office to connect any two of said lines in a metallic circuit which does not include the annunciator of the lines, and a clearing-out annunciator in a bridge to the circuit of any two lines thus connected in metallic circuit, substantially as set forth.

4. In a telephone-exchange system, a metallic-circuit line normally open to the ground at the subscriber's station, and a line-annun-

ciator and retardation-coil through which one side of the line is permanently grounded at the central office, in combination with a key at the subscriber's station in a normally open ground connection with contact-points to close said connection at will, and a calling-generator at the subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, substantially as set forth.

5. In a telephone-exchange system, metallic-circuit lines, each normally open to the ground at its subscriber's station, and annunciators and retardation-coils, one of each for each line through which one side of the line is permanently grounded at the central office, in combination with a key at each subscriber's station in a normally open ground connection with contact-points to close said connection at will, a calling-generator at each subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, switching apparatus at the central office to connect any two of said lines in a metallic circuit which does not include the annunciators of the lines, and a clearing-out annunciator in circuit with any line thus connected in metallic circuit, substantially as set forth.

6. In a telephone-exchange system, metallic-circuit lines, each normally open to the ground at its subscriber's station, and annunciators and retardation-coils, one of each for each line, through which one side of the line is permanently grounded at the central office, in combination with a key at each subscriber's station in a normally open ground connection with contact-points to close said connection at will, a calling-generator at each subscriber's station in the circuit of the line between said normally open ground connection and the permanent ground connection at the central office, switching apparatus at the central office to connect any two of said lines in a metallic circuit which does not include the annunciators of the lines, and a clearing-out annunciator in a bridge to the circuit of any two lines thus connected in metallic circuit, substantially as set forth.

7. In a telephone-exchange system, two metallic-circuit lines connected together in metallic circuit, and circuit connections at the central office, one for each line, each permanently connected to the ground and permanently connected to its line, and annunciators, one for each line, each in said circuit connection of its line, in combination with a clearing-out annunciator in a bridge connection to said circuit, and a calling-generator in the circuit of each line at its subscriber's station, substantially as set forth.

8. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one

side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a rheotome and resistance-coil in derived circuit branched from a looped-cord circuit connecting any two lines together and through which the metallic circuit thus established is grounded, test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

9. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a rheotome branched from a looped-cord circuit connecting any two lines together and through which the metallic circuit thus established is grounded, test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

10. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a retardation-coil and a rheotome and resistance-coil in derived circuit branched from a looped-cord circuit connecting any two lines together and through which the metallic circuit thus established is grounded, test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

11. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit

which does not include the annunciators of the line, a retardation-coil and a rheotome branched from a looped-cord circuit connecting any two lines together and through which the metallic circuit thus established is grounded, test receiving instruments, one at each board, each grounded on one side and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

12. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a rheotome and resistance-coil in derived circuit in a circuit connection branched from a looped-cord circuit connecting any two lines together and to one side of which the metallic circuit thus established is thereby connected, test receiving instruments one at each board, each connected on one side to the other side of said circuit connection and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument substantially as set forth.

13. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a rheotome in a circuit connection branched from a looped-cord circuit connecting any two lines together and to one side of which the metallic circuit thus established is thereby connected, test receiving instruments, one at each board, each connected, on one side to the other side of said circuit connection and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

14. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board, and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators

of the line, a retardation-coil and a rheotome and resistance-coil in derived circuit in a circuit connection branched from a looped-cord circuit connecting any two lines together and to one side of which the metallic circuit thus established is thereby connected, test receiving instruments one at each board, each connected on one side to the other side of said circuit connection and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

15 15. In a telephone-exchange system, multiple switchboards, metallic-circuit lines, each line connected to each board and annunciators, one for each line, through which one side of the line is permanently grounded, in combination with switching apparatus at each board whereby any two of the lines may be included for conversation in a metallic circuit which does not include the annunciators of the line, a retardation-coil and a rheotome in a circuit connection branched from a looped-cord circuit connecting any two lines together and to one side of which the metallic circuit thus established is thereby connected, test receiving instruments, one at each board, each connected on one side to the other side of said circuit connection and connected on its other side to a plug adapted to be brought for testing into connection with each line, and a battery in any test-circuit thus established which contains the rheotome and test receiving instrument, substantially as set forth.

16. In a telephone-exchange system, two metallic-circuit lines, a switchboard at the central office to which they are connected, and means at the switchboard for switching them together for conversation, in combination with an annunciator for each line at the central office, each annunciator being grounded on one side and permanently connected on its other side to its line, a clearing-out annunciator in circuit with both lines while they are left thus switched for conversation, means at each subscriber's station to at will ground his line, and a calling-generator at each subscriber's station in the circuit of the line between the ground connection through the annunciator at the central office and the ground

which may be established at the subscriber's station, whereby either subscriber may at will operate his line-annunciator or when his line is switched the clearing-out annunciator.

17. In a telephone-exchange system, two metallic-circuit lines, a switchboard at the central office to which they are connected, and means at the switchboard for switching them together for conversation, in combination with an annunciator for each line at the central office, each annunciator being grounded on one side and permanently connected on its other side to its line, a clearing-out annunciator in a bridge or cross-connecting circuit to their combined circuit while they are left thus switched for conversation, means at each subscriber's station to at will ground his line, and a calling-generator at each subscriber's station in the circuit of the line between the ground connection through the annunciator at the central office and the ground which may be established at the subscriber's station, whereby either subscriber may at will operate his line-annunciator or when his line is switched the clearing-out annunciator.

18. In a telephone-exchange system, two metallic-circuit lines, a switchboard at the central office to which they are connected, and means at the switchboard for switching them together for conversation, in combination with an annunciator in a circuit of high resistance and retardation, for each line at the central office, each annunciator being grounded on one side and permanently connected on its other side to its line, a clearing-out annunciator in circuit with both lines while they are left thus switched for conversation, means at each subscriber's station to at will ground his line, and a calling-generator at each subscriber's station in the circuit of the line between the ground connection through the annunciator at the central office and the ground which may be established at the subscriber's station, whereby either subscriber may at will operate his line-annunciator or when his line is switched the clearing-out annunciator.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

ANNA P. KELLOGG,
JAMES G. KELLOGG.