

(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,423.

Patented Oct. 26, 1897.

Fig. 1.

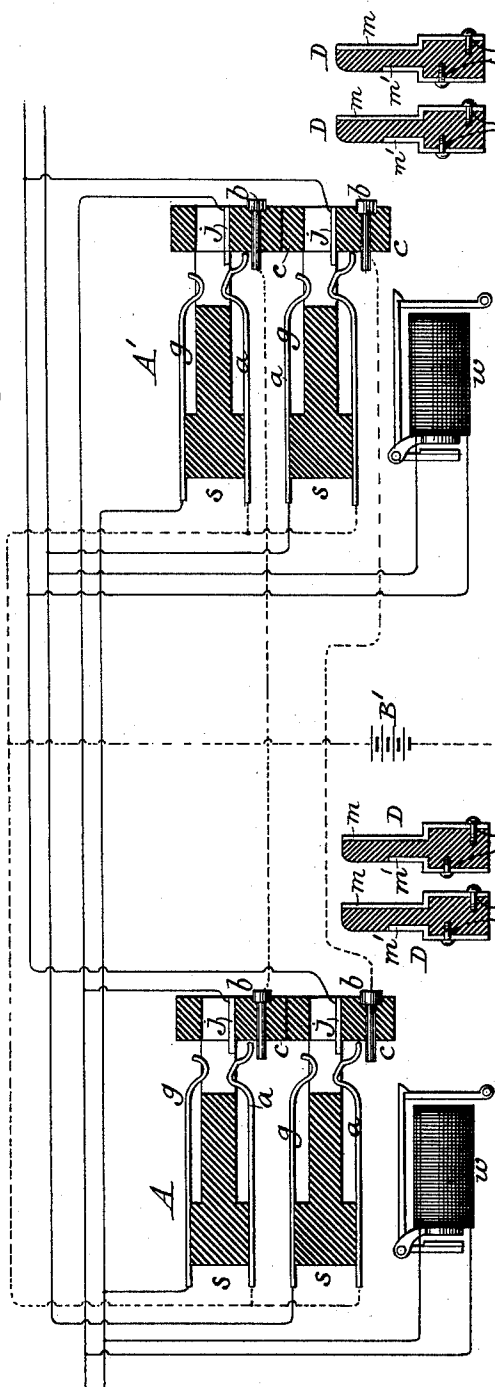
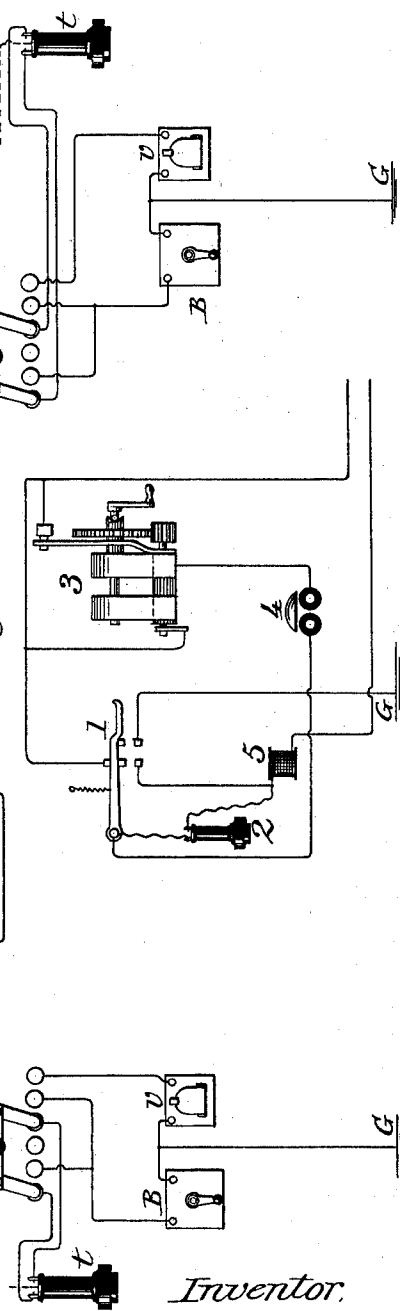


Fig. 2.



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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF SAME PLACE.

MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,423, dated October 26, 1897.

Application filed February 25, 1895. Serial No. 539,620. (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 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 especially to a metallic-circuit telephone-exchange system.

It consists in a system of calling, switching, and clearing-out signals which I shall describe and claim in detail and in which the two sides of the lines are permanently bridged or cross-connected by their respective line-annunciators and one side of the circuit of two lines connected for conversation is left grounded through a clearing-out annunciator.

In the accompanying drawings, Figure 1 illustrates the central-office apparatus, and Fig. 2 the subscriber's-station apparatus, of my invention.

In Fig. 1, A and A' are two multiple switchboards, to each of which all the lines of the exchange are connected.

As many boards or sections may be used as are necessary for the exchange in which the system is used.

Each switchboard or section has a switch for each line of the exchange. These switches are marked *s s*. Each switch has two contact-pieces, (marked *g j*), with which, respectively, the two contact-pieces of a loop-switch plug are connected when a plug is placed into the switch for switching. These loop switch plugs are marked *D D* in the drawings. Each switch has also two other contact-pieces, (marked *a b*), which are insulated from the other contact-pieces and are normally out of contact with each other, but when a switch-plug is inserted into a switch it presses the contact-piece *a* into contact with *b*. When the plug is withdrawn, the contact between *a* and *b* is automatically broken.

One of the last-mentioned contact-pieces, as *b*, is at or extends to or near the front of the switch, so that an operator's test contact-piece may be readily connected to it for testing.

l l are the switch-holes adapted to receive the plugs, and *c c* are the rubber pieces on which the metal parts are mounted.

The two contacts *g j* of each switch are connected to the main-line circuit, as will hereinafter be described, and may therefore be called the "main-line" contacts of the switch. The two contacts *a b* of each switch are connected in a local system for testing, as will hereinafter be described, and may therefore be called the "local" contacts of the switch.

The loop-switch plugs *D D* are of the shape substantially as shown, and each plug has two contacts, (marked *m m'*.) When a plug is placed into a switch, its contact *m* forms connection with the contact *g* of the switch, and its contact *m'* forms connection with the contact *j* of the switch, while the rubber insulation of the plug presses the piece *a* of the switch into contact with the piece *b*. The two latter pieces *a b* are, however, always insulated from the pieces *g j*.

The switches and plugs may be of the shape and construction substantially as shown. They may, however, be greatly changed in shape and construction and yet have substantially the same switch parts, operating in the same manner, as heretofore described.

w w are the line-annunciators, of which there is one for each line. These annunciators are distributed among the several boards or sections of the exchange and each is placed at the section where its subscriber's calls are to be answered.

Each operator has as many pairs of loop-switch plugs *D D* as she may need in order to properly attend to the lines which are allotted to her.

Y Y are switches, one for each pair of plugs. Each switch *Y* has two switch-levers and two pairs of contact-bolts, on which, respectively, the two levers may be alternately placed. It has also another or fifth contact-bolt, on which one of the levers may be placed. The switch-levers are adapted to occupy three positions at the will of the operator, in one of which they are in contact with one pair of said bolts, in another of which they are in contact with the other pair of said bolts, and in the third position of which one of them is in contact with said fifth bolt.

tt are the operators' telephones, of which there is one for each operator.

B B are calling-generators, of which there may be one for each operator, or one generator may answer for several or all of the operators.

vv are clearing-out annunciators, of which there is one for each pair of plugs.

B' is a test-battery connected into the local test-circuit, as will hereinafter be described.

The two contact-pieces *mm* of a pair of plugs are connected together by a flexible conductor, and the two contact-pieces *m'm'* are connected together by another flexible conductor. The two flexible conductors of a pair of plugs are connected to the two levers of the switch *Y* of the pair of plugs. The flexible conductors are long enough so that a switch-plug may be placed in any switch of the section at which it is located. The bolts of one pair of contact-bolts of each switch *Y* are connected together through the operator's telephone. The bolts of the other pair are connected together by a circuit connection, from the center of which is a connection to one side of the calling-generator *B*. The other side of the generator is connected with ground. The last or fifth contact-bolt of each switch *Y* is connected to one side of the clearing-out annunciator *v* of the pair of plugs and the other side of the annunciator *v* is connected to ground.

One side or branch of each metallic-circuit line is connected to one of the main-line contacts, say *g*, of each switch of the line, and the other side or branch is connected to the other main-line contact, say *j*, of each switch of the line.

The two sides or branches of each line are bridged or connected together at the central office through the line-annunciator *w* of the line.

All the contacts *aa* of all the switches of the exchange are connected together by a circuit connection. One side of the battery *B'* is connected to this circuit connection.

All the contacts *bb* of the switches of a line are connected together.

The operator's telephone has two coils. From the circuit-wire which connects these coils a connection is run to the other side of said battery *B'*.

The circuit connections, both main-line and local, are shown substantially as above described. For convenience of illustration the main-line circuit and connections are represented by solid lines and the local circuits and connections are represented by broken lines.

In the subscriber's-station apparatus shown in Fig. 2, 1 is the telephone-switch; 2, the subscriber's telephone; 3, the subscriber's calling-generator; 4, his signal-receiving bell, and 5 a resistance-coil of the resistance which will hereinafter be described.

The calling-generator has the usual automatic device by which its armature is auto-

matically short-circuited while it is not being operated. It should preferably be an alternate-current generator.

The switch 1 has a lever and three insulated contact-pieces, with two of which the lever is in contact when the telephone is on the switch, and with the third of which the lever is in contact when the telephone is off the switch. One of the first-mentioned contacts is connected with the ground.

Both sides of the line are connected to the switch-lever. In one side are the calling-generator and the signal-receiving bell and in the other side are the subscriber's telephone and the resistance-coil 5. The circuits to the switch-contacts are substantially as shown and such that when the telephone is on the switch the telephone is short-circuited, and when the telephone is off from the switch the calling-generator and signal-receiving bell are short-circuited.

The resistance of one side of the line from the switch-lever to the connection with one side of the line-annunciator should normally, or when the subscriber's telephone is not off from the switch, be substantially the same as the resistance of the other side of the line from the switch-lever to the other side of the line-annunciator. This may be obtained by making the resistance of the coil 5 of the right amount to produce this equality of resistance. Of course the lines themselves may be constructed so as to obtain this equality of resistance.

All the annunciators should be constructed so as to offer high retardation to alternating currents, and the line-annunciators should, for the purpose hereinafter indicated, be of much higher resistance than the clearing-out annunciators.

The operation of the system is as follows: When a subscriber operates his calling-generator, he sends a signal over his metallic circuit which operates his line-annunciator. The operator who receives the indication then places one of her switch-plugs *D* into the switch of the line and places the levers of the switch *Y* to which the plug belongs in the position in which the two sides of her telephone are connected to the two levers of the switch. Her telephone is then in complete or closed metallic circuit with the line, and she will receive verbally the order of the subscriber. This complete circuit exists because the two contacts of the plugs (which are connected to the two levers of the switch *Y*) are by their contact with the two contacts *gj* of the switch connected to the two sides, respectively, of the line. When the operator finds out what line is wanted, she tests that line, as will hereinafter be indicated, and if she finds that it is not in use she places the mate of the plug first used in the switch of the line wanted. She then moves the levers of the switch *Y* so that they are in contact with the other pair of bolts, (which are grounded through the generator *B*.) Cur-

rent from the operator's generator will then pass from ground at the central office through the two sides or branches of the metallic circuit of the line wanted in split or derived circuit to the ground at the subscriber's station. As the two branches of the line are of the same resistance, as much current will pass through one branch as the other. The current which passes through the signal-receiving bell of the subscriber wanted will be sufficient to ring his bell. The operator then moves the switch-levers of the switch Y so that one of the levers is on said fifth contact-bolt, connected to ground through the clearing-out annunciator of the pair of plugs. The two lines are thus connected together into a complete metallic circuit for conversation, and one side of the circuit is grounded through the clearing-out annunciator. When the lines are thus connected, their combined circuit is bridged or cross-connected through the annunciators of both lines. As these annunciators offer high retardation to telephone and other alternating currents, substantially, none of the telephone-current generated during the conversation will pass through them.

When the call is sent by the operator, the subscriber's line-annunciator will not be operated for the following reason: The resistances from the generator to each side of the line-annunciator are the same, as are also the resistances from each side of the annunciator through the two sides or branches of the line to the subscriber's ground. None of the calling-current will therefore pass through the line-annunciator. These resistances should be equal with sufficient approximation so that enough current will not pass through the line-annunciator to operate it.

The clearing-out system is as follows: Each subscriber's apparatus is connected into his circuit so that his calling-generator is in the circuit between his ground and the ground connection through a clearing-out annunciator when the line is switched for conversation. The clearing-out signal is sent after the subscriber has placed his telephone on the switch. The current generated will therefore divide into four parts, passing through four branch or derived circuits. One of these circuits is from the subscriber's ground through his generator and one branch of the line to the clearing-out annunciator, and thence to ground. Two other circuits through which part of the current passes are through his metallic-circuit line to the central office, and thence in split-circuit through the two line-annunciators. The fourth circuit is by way of the subscriber's station of the other line. If, when the clearing-out signal is sent, the telephone of the other subscriber is not yet placed on its switch, the circuit is through the metallic-circuit line of the other subscriber. If, however, both subscribers have their telephones on their switches, it is from the ground at one station through one side

of the combined circuit to ground at the other station. The resistance of the line-annunciators should be much higher than that of the clearing-out annunciators. A very small amount of the current will therefore pass through the line-annunciators as compared with that which passes through the clearing-out annunciators. The line-annunciators may, moreover, be of such construction and adjustment as not to be operated by the same strength of current passing through them as will operate the clearing-out annunciators, and in the latter case there will not be the necessity of as great a difference of resistance between the line-annunciators and the clearing-out annunciators as would otherwise be necessary to make the system operative.

The subscribers' calling-generators should be of such power and adjustment to the other apparatus and circuits and the other apparatus and circuits should be so adjusted to each other as to resistance and sensitiveness of operation and to the calling-generator that when a call is sent from any station and the line is not switched for conversation the line-annunciator will invariably be operated; but when two lines are connected together, as above described, and their circuit is grounded through a clearing-out annunciator the operation of the calling-generator of either subscriber will invariably operate the clearing-out annunciator and invariably fail to operate either line-annunciator.

The test system is as follows: Each operator can place any contact-piece *m* of any of her switch-plugs into contact for testing with any contact-piece *b* of any switch located at her board. When she has thus placed a plug into contact with the piece *b* of any line (her telephone being then in connection with the plug) and the line is switched at any board for conversation, a complete circuit is established which contains the battery *B'* and one coil of her telephone and the telephone will sound or click, indicating that the line is switched for use. This complete circuit may be traced as follows: From the switch-plug used in testing through one coil of the operator's telephone, thence through the battery *B'* to the circuit connection which connects together all the contacts *a a* of all the switches of the exchange, thence to the contact *a* of the switch at which the line tested is switched, thence to the contact *b* of that switch, and thence to the contact *b* to which the plug is applied for testing. If the line is not switched at any board, no such complete circuit is established on testing, and the operator will get no click or sound in her telephone. She can therefore determine by testing whether or not the line is in use.

It is evident that the subscriber's signal-receiving bell might also be placed in the ground connection at his station. In that case all the calling-current which the operator sends over his line would pass through his bell. For the purpose heretofore indi-

cated the resistances of the two branches of the line should in this case also be made substantially alike. Certain features of my invention are also applicable to systems in which the line-annunciators are prevented from being operated when either the operator calls or a clearing-out signal is sent by other instrumentalities than those heretofore indicated. My invention in these respects is broad enough to include these variations.

The system herein claimed is limited to a system in which the two sides of the lines are permanently bridged or cross-connected by their respective line-annunciators and one side of the circuit of two lines connected for conversation is left grounded through a clearing-out annunciator, as I have other applications pending on other systems in which broader claims are pending, and it is not my intention in prosecuting this application to waive or abandon anything claimed in such other applications.

I claim—

1. In a telephone-exchange system, metallic-circuit lines each normally or while not switched for use ungrounded at the central office, multiple switchboards, switches, one switch for each line on each board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its lines are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals at that board, in combination with line-annunciators, one of each line located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation; a calling-generator at each subscriber's station located in the closed metallic circuit with both sides of its line whenever the generator is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station while the subscriber sends a clearing-out signal with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected.

2. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, multiple switchboards, switches, one switch for each line, on each board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by con-

necting together their respective contact pieces or terminals at that board, in combination with line-annunciators, one for each line, located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, said line-annunciator being of a resistance relatively high to the clearing-out annunciator, a calling-generator at each subscriber's station located in the closed metallic circuit with both sides of its line whenever the generator is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station while the subscriber sends a clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected.

3. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, multiple switchboards, switches, one switch for each line on each board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals at that board, in combination with line-annunciators one for each line located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, said line-annunciator being of a resistance relatively high to the clearing-out annunciator, a calling-generator at each subscriber's station located in the closed metallic circuit with both sides of its line whenever the generator is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station, while the subscriber sends a clearing-out signal with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected, said annunciators and generators being of such construction and such relation to each other and to the circuits that when a generator is operated while its line is not switched its line-annunciator is operated and when a generator is operated, while its line is switched the line-annuncia-

tors are not operated, but the clearing-out annunciator through which the circuit of the two united lines is grounded is operated.

4. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, multiple switchboards, switches, one switch for each line on each board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals at that board in combination with line-annunciators, one for each line located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation; a calling-generator at each subscriber's station located in the closed metallic circuit with both sides of its line whenever the generator is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station, while the subscriber sends a clearing-out signal, with the ground connection on such side of the generator, that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected; said annunciators and generators being of such construction that when a generator is operated while its line is not switched, the line-annunciator is operated, and when a generator is operated while its line is switched the line-annunciators are not operated, but the clearing-out annunciator through which the circuit of the two united lines is grounded is operated.

5. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, a switchboard, switches, one switch for each line on said board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals, in combination with line-annunciators one for each line permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each subscriber's station located in the closed metallic circuit with the two sides of its line whenever the generator is operated to send any signal (whether pri-

mary or clearing-out) and means at each subscriber's station for grounding his closed metallic circuit while he sends a clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected.

6. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, a switchboard, switches, one switch for each line on said board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals, in combination with line-annunciators, one for each line permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, said line-annunciators being of a resistance relatively high to the clearing-out annunciators; a calling-generator at each subscriber's station located in the closed metallic circuit with the two sides of its line whenever the generator is operated to send any signal (whether primary or clearing-out) and means at each subscriber's station for grounding his closed metallic circuit while he sends a clearing-out signal, with the ground connection on such side of the generator, that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected, said annunciators and generators being of such construction and such relation to each other and to the circuits, that when a generator is operated while its line is not switched its line-annunciator is operated, and when a generator is operated while its line is switched the line-annunciators are not operated, but the clearing-out annunciator through which the circuit of the united lines is grounded is operated.

7. In a telephone-exchange system, metallic-circuit lines, each normally or while not switched for use ungrounded at the central office, a switchboard, switches, one switch for each line on said board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals, in combination with line-annunciators, one for each line, permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and

connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each subscriber's station
 5 located in the closed metallic circuit with the two sides of its line whenever the generator is operated to send any signal (whether primary or clearing-out) and means at each subscriber's station for grounding his closed
 10 metallic circuit while he sends a clearing-out signal with the ground connection on such side of the generator, that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or
 15 branch of the line to which the clearing-out annunciator is directly connected; said annunciators and generators being of such construction that when a generator is operated while its line is not switched the line-annun-
 20 ciator is operated and when a generator is operated while its line is switched, the line-annunciators are not operated but the clearing-out annunciator through which the circuit of the two united lines is grounded is
 25 operated.

8. In a telephone-exchange system, metallic-circuit lines, multiple switchboards, switches, one switch for each line on each
 30 board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by connecting together their res-
 35 pective contact pieces or terminals at that board, in combination with line-annunciators, one of each line located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-out
 40 annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each subscriber's station in
 45 the closed metallic circuit of its line whenever it is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station while the subscriber
 50 sends a clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which
 55 the clearing-out annunciator is directly connected.

9. In a telephone-exchange system, metallic-circuit lines, multiple switchboards, switches, one switch for each line on each
 60 board, each switch having two contact pieces or terminals to which respectively the two sides or branches of its line are connected, and means at each board to connect together any two lines into a metallic circuit for conversation by connecting together their res-
 65 pective contact pieces or terminals at that board, in combination with line-annunciators,

one for each line located at a switchboard and permanently bridged across between the two sides or branches of its line, a clearing-
 70 out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each subscriber's station in the
 75 closed metallic circuit of its line whenever it is operated to send any signal (either primary or clearing-out) and means for grounding each closed metallic circuit at the subscriber's station while the subscriber sends a
 80 clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which
 85 the clearing-out annunciator is directly connected; said annunciators and generators being of such construction that when a generator is operated while its line is not switched the line-annunciator is operated and when a
 90 generator is operated while its line is switched the line-annunciators are not operated but the clearing-out annunciator through which the circuit of the two united lines is grounded is operated.

10. In a telephone-exchange system, metallic-circuit lines, a switchboard, switches, one switch for each line on said board, each switch having two contact pieces or terminals to which respectively the two sides or branches
 100 of its line are connected and means to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals, in combination with line-annunciators one for each line permanently bridged
 105 across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each sub-
 110 scriber's station in the closed metallic circuit of its line whenever it is operated to send any signal (whether primary or clearing-out) and means at each subscriber's station for grounding his closed metallic circuit while he sends
 115 a clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which
 120 the clearing-out annunciator is directly connected.

11. In a telephone-exchange system, metallic-circuit lines, a switchboard, switches, one switch for each line on said board, each switch having two contact pieces or terminals to which respectively the two sides or branches
 125 of its line are connected and means to connect together any two lines into a metallic circuit for conversation by connecting together their respective contact pieces or terminals, in combination with line-annunciators one for each
 130

line permanently bridged across between the two sides or branches of its line, a clearing-out annunciator grounded on one side and connected on its other side to one side of a metallic circuit established by connecting any two lines together for conversation, a calling-generator at each subscriber's station in the closed metallic circuit of its line whenever it is operated to send any signal (whether primary or clearing-out) and means at each subscriber's station for grounding his closed metallic circuit while he sends a clearing-out signal, with the ground connection on such side of the generator that the generator and the clearing-out annunciator are in a closed ground-circuit which comprises that side or branch of the line to which the clearing-out annunciator is directly connected, said annunciators and generators being of such construction that when a generator is operated while its line is not switched the line-annunciator is operated and when a generator is operated while its line is switched the line-an-

nunciators are not operated but the clearing-out annunciator through which the circuit of the two united lines is grounded is operated. 25

12. In a telephone-exchange system, two metallic-circuit lines and two line-annunciators, one for each line, through which the line is permanently closed at the central office, said lines being temporarily switched together for conversation into a single metallic circuit, in combination with a clearing-out annunciator in a circuit connection from said metallic circuit to ground, and a calling-generator at each subscriber's station in circuit with said line-annunciators and clearing-out annunciator when operated to send a clearing-out signal, substantially as set forth. 30 35

In testimony whereof I have hereunto subscribed my name. 40

MILO G. KELLOGG.

Witnesses:

A. M. McLACHLEN,
LLOYD B. WIGHT.