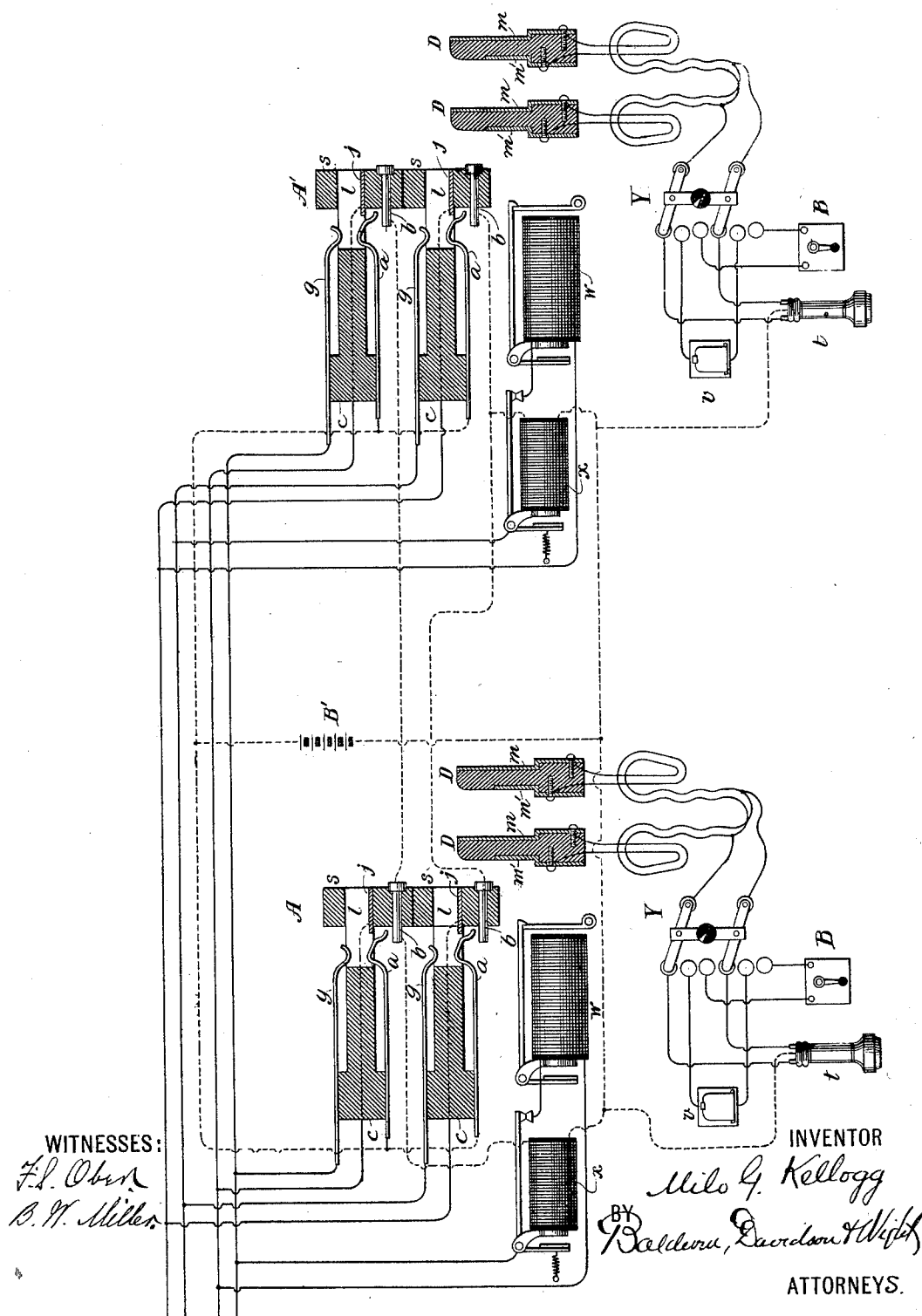


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,417.

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. 592,417, dated October 26, 1897.

Application filed June 19, 1893. Serial No. 478,099. (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 drawing, forming a part of this specification.

My invention relates especially to a telephone-exchange system in which the lines are metallic-circuit lines.

My invention consists in a system of calling, answering calls, switching, testing, and clearing-out signals which I shall describe and claim in detail.

The accompanying drawing, illustrating my invention, is a diagram of the central-office apparatus and connections.

In the drawing two multiple switchboards (marked A A') are shown. As many other switchboards may be used as is necessary for the size and character of the exchange. Each board has a switch or line-terminal for each line of the exchange. The switches are marked *s s*. Each switch is adapted to receive the loop-switch plugs marked D D and has two contact-pieces *g j*, with which, respectively, the two contact-pieces *m m'* of the plug form contact when the plug is inserted. Each switch has also two contacts *a b*, which are insulated from the rest of the switch parts and are normally (or when a plug is not in the switch) not in contact with each other.

l l are the switch-holes, into which the switch-plugs D D may be placed for switching the lines together.

c c are the rubber pieces, suitably shaped, on which the metal parts of the switches are respectively mounted.

g j may be called the "main-line" contacts of the switch, because they are connected with the circuit of the main line, and *a b* may be called the "local" contacts of the switch, because they are used in a circuit which is local to the central office of the exchange.

The switch-plugs D D have each two contacts *m m'*. When a plug is inserted into a switch, its contact-piece *m* forms connection with the contact-piece *g* of the switch and its

contact-piece *m'* forms connection with the contact-piece *j* of the switch, while the insulated piece of the plug forces the contact-piece *a* of the switch into contact with the contact-piece *b* of the switch, but *a* and *b* are not in electric connection with the contact-pieces *g j* of the switch. The switches and the plugs are so shaped and constructed as to produce the switching operations above described. They may, however, be shaped and constructed in other ways, so as to produce substantially the same switching operations.

In the construction and arrangement shown there are two contact-pieces of the switch with which the two contact-pieces of the plug respectively form connection when the plug is inserted and two other contact-pieces of the switch which are insulated from said first-mentioned contact-pieces and are normally unconnected with each other, (except through the circuit connections,) but are brought into electrical connection when a plug is inserted into the switch.

Each line has an annunciator (marked *w*) and a relay, (marked *x*.)

Each relay may be of any suitable construction, with a pair of contact-points which are normally, or when no current is passing through the relay-magnet, closed, but are opened when the magnet is energized by being included in closed circuit with a battery of suitable character. The relay and annunciator of each line may be conveniently mounted in juxtaposition—as, for instance, on the same frame or support—with the relay in the rear of the annunciator, the drop of the latter being of course at the front of the switchboard.

The two contact-pieces *g j* of each line-switch are the main-line contacts of the switch. One side of each metallic-circuit line is connected to one of these contact-pieces, say *j*, of each switch of the line, and the other side of the line is connected to the other contact-pieces of the line, say *g*. The two sides of the line are connected together at the central office through the annunciator of the line and the normally closed pair of contacts of the relay of the line.

The line-annunciators are distributed

among the various boards and at boards where the calls of the lines are to be answered.

Each operator has as many pairs of plugs D D as she may need for her work.

5 The two contact-pieces $m m$ of the plugs are connected together by a flexible conductor and the two contact-pieces $m' m'$ of the plugs are connected together by another flexible conductor.

10 Y is a looping-in switch having two levers and three pairs of contact-bolts against which the two levers may alternately be placed in contact. There is one switch Y for each pair of plugs. The two levers are connected to 15 the two flexible conductors, respectively, of the pair of plugs. The two bolts of one pair are connected together through the operator's telephone, (marked t .) The two bolts of another pair are connected together through 20 the clearing-out annunciator of the pair of plugs. The two bolts of the third pair are connected together through the operator's calling-generator.

v is a clearing-out annunciator, of which 25 there is one of each for each pair of plugs.

B' is a test and relay battery, and B is a calling-generator, of which there may be one or more of each for the exchange.

One of the local contacts of each switch, 30 say a , is connected with all of the contacts of the same kind, say a , of all the other switches of the exchange. One side of the relay and test battery B' is connected to the circuit connection which connects together all of these 35 contact-pieces $a a$ of the switches of the exchange. One side of each relay is connected to the other side of this relay and test battery B', and the other side of each relay is connected to all the contact-pieces $b b$ of the 40 switches of the line to which the relay belongs.

Each operator's telephone should preferably have two coils, and the connection between the two coils is connected by a circuit-wire 45 to the circuit connection which connects the last-mentioned side of the battery B' with the relays. A retardation-coil may be placed in this circuit-wire.

For clearness of illustration the main lines 50 and their circuit connections are indicated by solid lines and the local connections of the relay and local contacts system of the exchange are represented by broken lines.

One of the local contacts, say b , of each 55 switch is conveniently placed so that one of the contacts of each switch-plug, say m , may be applied to it for testing.

The subscriber's-station apparatus may be of the ordinary construction used in telephone 60 exchanges and is in the metallic circuit of the line.

The line-annunciators $w w$ may be of the ordinary construction of non-polarized telephone-annunciators. The clearing-out 65 annunciators $v v$ may also be non-polarized and should preferably be of high resistance and retardation to telephone-currents.

Each operator's plug and cord apparatus should be conveniently mounted and arranged for her work. 70

The operation of the system is as follows:

A subscriber on operating his calling-generator to send in a call sends a current through his metallic circuit and through his line-annunciator, which is then in a bridge between 75 the two sides of his metallic-circuit line. The line-annunciator will therefore be operated and will indicate a call. The operator on observing the indication places one of her switch-plugs D into the switch of the line. 80

By so doing she automatically closes the pair of contacts $a b$ of the switch. This brings the relay x of the line into closed circuit with the battery B', and the relay being thereby energized its contact-points are opened 85 and the bridge between the two sides of the line which contains the line-annunciator is opened and remains open as long as the plug remains in the switch. As soon as the operator places the plug in the switch she places 90 the levers of the switch Y which belong to the plug in the position where her telephone bridges across between the two contact-pieces of the plug. The operator's telephone is

therefore in closed circuit with the subscriber's metallic-circuit line, and she by conversation finds out what connection the subscriber wishes. This closed circuit is established by the connection of the two contacts 95 $m m'$ of the plug (to which, respectively, the

two sides of the operator's telephone are connected) with the two contacts g and j , respectively, of the switch, which, as stated before, are connected to the two sides of the line. 100

When the operator finds out what line is wanted, she tests the line wanted, as will hereinafter be indicated, and if she finds it "free" or unswitched she places the other 105 plug D of the pair of plugs in the switch of the line wanted. By so doing the contacts a

b of that switch are also closed, and the relay of that line, being thereby brought into closed circuit with the battery B', is energized, and the bridge-circuit of that line through the line-annunciator is also opened by the opening 115 of the pair of contacts of the relay of the line. The operator then moves the levers of the switch Y so that the calling-generator B is bridged across between the two conductors of the pair of plugs. Calling-current there-

fore goes in split or derived circuit through the metallic circuit of both lines and will ring the bell of the subscriber wanted. The operator then places the lever of the switch Y so that the clearing-out annunciator v of 125 the pair of plugs is bridged across between the two conductors of the pair of plugs. The two lines are then connected together into metallic circuit for conversation with the clearing-out annunciator bridged across their 130 combined circuit. When the subscribers are through conversation, either of them may operate his calling-generator and send a current which will pass through the clearing-out

annunciator and operate it. As the line-annunciators are out of circuit with the calling-generator, when the clearing-out signal is sent (the circuit through the annunciators being opened by the pairs of contacts of the line-relays) no current will pass through the line-annunciators. For the same reason no current will pass through the line-annunciators when the operator sends the calling-current to line, as before indicated. The line-annunciator of the two lines will therefore not be operated either when the operator sends a calling-signal or either subscriber sends the clearing-out signal.

When the operator receives the clearing-out signal, she removes the plugs from the switches of the two lines. The closed contacts between *a* and *b* of the two switches are thereby automatically opened and the armatures of the relays of the two lines will take their normal positions, closing the bridges which contain their respective annunciators. The lines are thereby automatically in condition to receive calls from the subscribers.

The test system is as follows: When an operator desires to test any line, she places the contact *m* of one of her switch-plugs into contact with the contact-piece *b* of the line-switch, the switch *Y* of the plug having its levers in connection with her telephone. If the line is switched for conversation at any board, a complete circuit is thereby established which contains her telephone and the battery *B'*, and the telephone will respond or click, indicating that the line is switched for use. This complete circuit may be traced as follows: from the contact-piece *m* of the plug through the cord conductor and switch-lever, through one coil of her telephone, thence through the battery *B'*, thence to the contact *a* at the switch where the line is switched, thence to contact *b* of that switch, and thence to the contact *b*, to which the contact-piece *m* is applied for testing. If the line is not switched at any board, no such complete circuit will be established on testing and the telephone will not sound. The operator can therefore determine on testing whether or not a line is switched for use.

When a plug is applied for testing, as above described, and the line tested is switched for conversation, the operator's telephone (which is then her test receiving instrument) is shunted by the relay of the line tested. This will not, however, divert so much of the battery-current from the telephone that the test-signal will not be audible and distinct.

The drawing and the description heretofore made are for metallic-circuit lines only. The system is, however, adapted to ground-circuit lines or to a mixed system of metallic and ground circuit lines. To adapt it for such a system, the circuits and operation will be exactly as heretofore described, except that the ground-circuit lines are connected to one of the contacts, say *g*, of each of their line-switches, and the circuit connection

which connects the other contacts *j* of these switches is connected to ground.

I claim—

1. In a telephone-exchange system, metallic-circuit lines, multiple switchboards, switches, one switch on each board for each line, each switch having two contact-pieces to which respectively the two sides of its line are connected, pairs of loop-switch plugs at each board to connect any two lines into a metallic circuit for conversation each of said loop-plugs being adapted to be in any of said switches at its board and having two contact-pieces which when the plug is inserted into any one of said switches form connection with the two contact-pieces of said switches respectively, the two contacts of the two loop-plugs of each pair being connected together respectively by two flexible switch-conductors and a clearing-out annunciator with its magnet bridged across between the two sides of said metallic circuit, in combination with a bridge-circuit for each line between its two sides or branches, an annunciator for each line located at a board and with its magnet located in said bridge-circuit of the line between the two sides or branches of the line, and electromagnetic apparatus for each line automatically operated by the switching of the line for conversation to open said bridge-circuit of the line, substantially as set forth.

2. In a telephone-exchange system, metallic-circuit lines, a switchboard, a switch on said board for each line, each switch having two contact-pieces to which respectively the two sides of its line are connected, pairs of loop-switch plugs to connect any two lines into a metallic circuit for conversation by joining the contact-pieces respectively of their switches, each of said loop-plugs being adapted to be in any of said switches at its board and having two contact-pieces which when the plug is inserted into any one of said switches form connection with the two contact-pieces of said switches respectively, the two contacts of the two loop-plugs of each pair being connected together respectively by two flexible switch-conductors and a clearing-out annunciator with its magnet bridged across between the two sides of said metallic circuit, in combination with a bridge-circuit for each line between its two sides or branches, an annunciator for each line with its magnet located in said bridge-circuit of the line between the two sides or branches of the line, and electromagnetic apparatus for each line automatically operated by the switching of the line for conversation to open said bridge-circuit of the line.

3. In a telephone-exchange system, telephone-lines, a switchboard, a switch for each line on said board, each switch having two contact-pieces to one of which the direct conductor and to the other of which the return circuit or conductor of the line are connected, pairs of loop-switch plugs to connect any two lines into a complete circuit for conversation,

each of said loop-plugs being adapted to be in any of said switches at its board and having two contact-pieces which when the plug is inserted into any one of said switches form
 5 connection with the two contact-pieces of said switches respectively, the two contacts of the two loop-plugs of each pair being connected together respectively by two flexible switch-conductors and a clearing-out annunciator
 10 with its magnet bridged across between the direct conductor and the return circuit or conductor of said complete circuit, in combination with a bridge or cross-connection circuit for each line between its direct conductor and return circuit or conductor, an annunciator for each line with its magnet located
 15 in said bridge-circuit of the line between the two sides or branches of the line, and electromagnetic apparatus for each line automatically operated by the switching of the line for
 20 conversation to open said bridge-circuit of the line.

4. In a telephone-exchange system, metallic - circuit lines, multiple switchboards,
 25 switches, one switch on each board for each line, each switch having two contact-pieces to which respectively the two sides of its line are connected, pairs of loop-switch plugs at each board to connect any two lines into a metallic circuit for conversation by joining the
 30 contact-pieces respectively of their switches,

each of said loop-plugs being adapted to be in any of said switches at its board and having two contact-pieces which when the plug is inserted into any one of said switches form
 35 connection with the two contact-pieces of said switches respectively, the two contacts of the two loop-plugs of each pair being connected together respectively by two flexible switch-conductors, and a clearing-out annunciator
 40 with its magnet bridged across the two sides of said metallic circuit, in combination with a bridge circuit or connection for each line between its two sides or branches, an annunciator for each line located at a switchboard
 45 and with its magnet located in said bridge-circuit of its line between the two sides or branches of the line, an electromagnet-relay for each line with a pair of contacts normally, or when the relay-magnet is not energized,
 50 closed to each other, said pair of contacts of the relay being also in said bridge-circuit of its line, battery, and means to automatically close the magnet of the relay of a line with battery when and as long as the line is switched
 55 for conversation.

In testimony whereof I have hereunto subscribed my name.

MILO G. KELLOGG.

Witnesses:

E. S. WALKER,
 CALVIN DE WOLF.