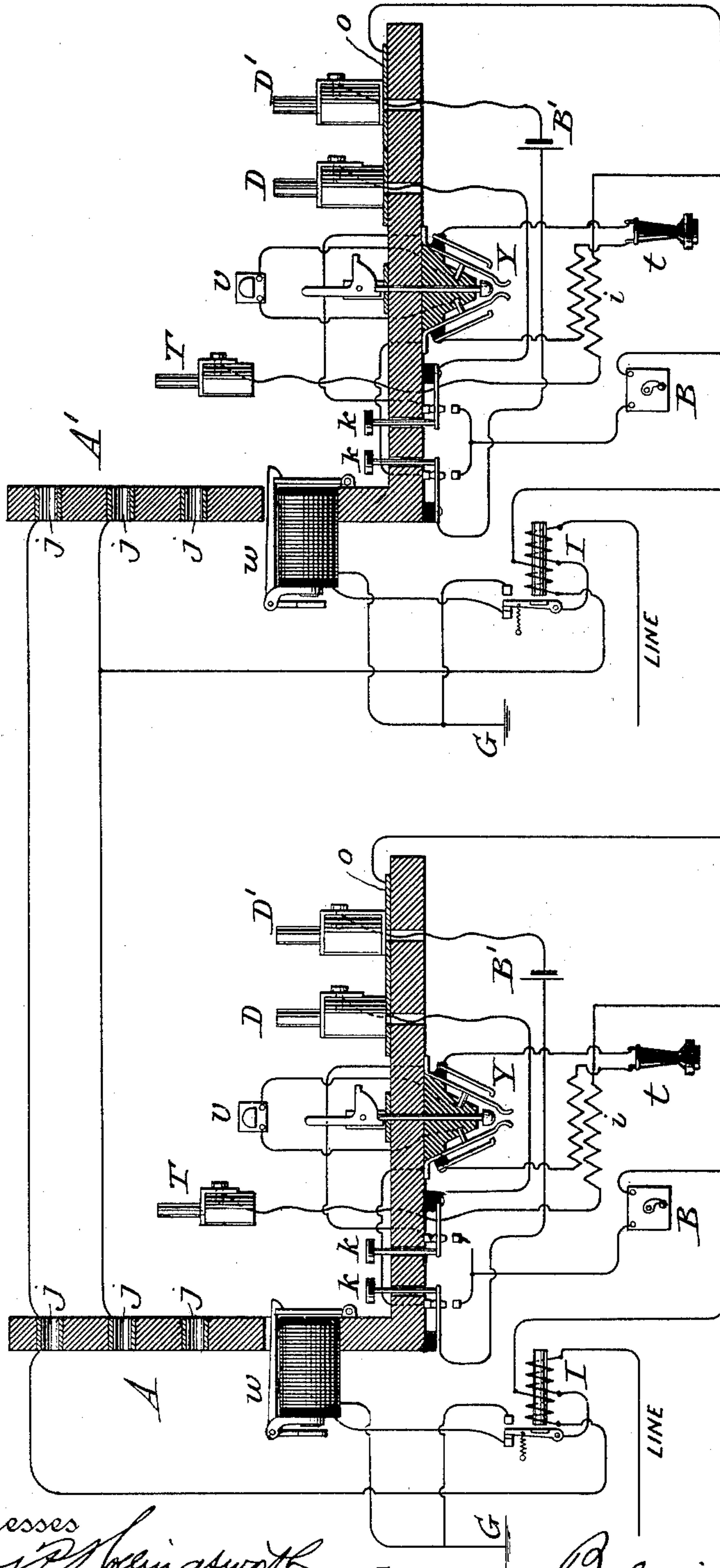


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,412.

Patented Oct. 26, 1897.



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UNITED STATES PATENT OFFICE.

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MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,412, dated October 26, 1897.

Application filed September 8, 1891. Serial No. 405,094. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Multiple Switchboards for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.
10 My invention relates especially to a ground-circuit telephone-exchange system in which induction-coil translators or converters, one for each line at the central office, are employed to translate the telephone-currents
15 from one circuit or line to another circuit or line.

It consists of a system for calling, switching, testing, and clearing-out signals for such an exchange which I shall describe and claim
20 in detail.

The accompanying drawing, illustrating my invention, represents sectional views of two switchboards with the central-office switches and apparatus for two lines of the exchange
25 and the connecting and answering apparatus at each board for answering calls, connecting the translators of the two lines, testing to see whether the lines are in use, and receiving clearing-out signals for a connection which
30 may be made.

A A' are two switchboards. Other boards may be added and used as required for the size of the exchange. Each board has a metal socket or switch contact-piece for each line.
35 These sockets or contact-pieces are marked *jj* and are each adapted to receive the switch-plugs at the board and thereby form contact with the contact-piece of the plug and also to have the plug contact-pieces applied to
40 them for testing, as will hereinafter be described.

I I are two induction-coil translators or converters, one for each line, with relay-armatures and attachments such as will be de-
45 scribed.

ww are two annunciators, one for each line.

At each board there is a pair of plugs, (marked D D',) a test-battery for the pair of
50 plugs, (marked B',) a clearing-out annunciator for the pair of plugs, (marked *v*,) two calling-keys for the pair of plugs, (marked *k k*,) an

operator's telephone, (marked *t*,) a looping-in switch for the pair of plugs, (marked Y,) and a calling-generator, (marked B.)

The switch Y has two levers and two pairs
55 of contact-bolts on which the levers may alternately be placed.

The plugs are adapted to be inserted into the switch-holes of the terminals *jj* at their board and form connection with the termi-
60 nals. The keys *k k* have each a lever normally in contact with a point and another point against which the lever comes into contact when it is pressed away from the first-mentioned point.
65

One of the plugs is connected by a flexible conductor to one of the key-levers, and the other plug is similarly connected to the other key-lever.

The two points against which the levers
70 normally press are connected to the two levers of the switch of the pair of plugs.

The bolts of one pair of the contact-bolts with which the levers of the switch Y may be placed in contact are connected together
75 through the operator's telephone, and the other pair are connected together through the clearing-out annunciator of the pair of plugs. The test-battery of the pair of plugs is con-
80 nected in circuit with one of the cords.

The contact-piece connected to plug D' of the plugs D D' extends, as shown, to the bottom of the handle and rests normally on the metal strip *o*.

The induction-coil translators I I have each
85 an armature placed so as to be attracted and moved by the core of the translator when a battery-current of suitable character passes through one of its coils and a contact-point against which the armature normally closes
90 and from which it is separated when the armature is thus moved and another contact-point from which the armature is normally separated and with which it is closed when the armature is moved.
95

Each of the ground-circuit lines passes through one coil of its translator and thence to the armature. The first-mentioned contact-point of the translator of the line is grounded through the line-annunciator, and
100 the other contact-point of the translator is grounded, but not through the annunciator.

One side of the other coil of the translator of the line is connected to all the metal sockets $j j$ of the line, and the other side of said coil is connected by a wire or metallic-circuit connection with the same side of all the other coils of the exchange which are connected to metal sockets $j j$. As the circuits of these coils are local to the exchange, they may be called the "local" coils of the translators.

One side of the generator is connected to each of the lower of the normally open contacts of the calling-keys $k k$, and the other side of the generator is connected by metallic connection with said metallic-circuit connection mentioned above. The metal plates o , with which the contact-pieces of the plugs D' normally connect, are also metallica-ly connected with said metallic-circuit connection.

The subscriber's-station apparatus may be of the usual form used for ground-circuit lines.

The operation of the system is as follows: When a subscriber desires a connection, he operates his generator while his telephone is on the switch. A signal-current passes from his ground connection through the line to ground at the central office, through the normally closed pair of contact-points of the translator and the line-annunciator, and operates the annunciator. When the operator to whom the annunciator is assigned observes the indication, she places one of her plugs D in the metal socket j of the line, and the levers of the switch Y being in position, so that her telephone is in circuit with the plug, her telephone is in a closed circuit with the local coil of the translator of the line and the battery B' which belongs to the plug. This circuit is, say, from the metal socket j through the local coil of the translator to said metallic-circuit connection of the exchange to the mate D' of the plug, through its contact with plate o , and thence through the operator's telephone and the test-battery B' to the plug D , which is inserted in the metal socket. The operator then by conversation finds out what line is wanted, and she tests the line, as will hereinafter be indicated, and if she finds it to test "free" or not in use she places the plug D' of the pair of plugs in the metal socket of that line. The local coils of the translators of the two lines are thereby included in a closed metallic circuit which is local to the central office and contains the test-battery B' . The operator then presses on the key k , which is connected to the plug D' , and the calling-generator is included in a local circuit with the local coil of the translator of the line wanted, and an induced current will be generated in that line and will ring its signal-receiving bell at the subscriber's station. The operator then moves the lever of the switch Y so that the clearing-out annunciator is in circuit with the pair of plugs.

The test-batteries $B' B'$ should be of such strength that when one of them is included, as above described, in a closed circuit with a

local translator-coil, it will cause the armature of the translator to be attracted, so as to open its pair of normally closed contacts and close the pair of normally open contacts. The ground connection of the line at the central office through the annunciator is thereby opened as soon as connection is made with one of its metal sockets $j j$, and the line is grounded, but not through the annunciator, by the closing of the armature with the normally open contact.

The batteries and clearing-out annunciators should be so related as that the annunciators will not be operated by the batteries when connected as described. For this purpose they may be made less sensitive than the relay part of the line-translator.

To send a clearing-out signal, either subscriber operates his generator and a current passes over his circuit and an induced current is thereby generated in the circuit which contains his local coil and operates the clearing-out annunciator which is in circuit with the local coil. The test-battery which is also in circuit will reinforce the clearing-out current generated by the subscriber, so as to insure that the clearing-out signal shall be indicated when either subscriber sends a clearing-out current over his line, which is translated at the central office into the circuit which contains the clearing-out annunciator. The use of the battery to thus reinforce the clearing-out-signal current is of importance in that it allows of the use of such forms of translators as are best adapted to telephone-currents and without special consideration of their being best adapted to translate signaling-currents and of causing the clearing-out annunciator to be operated in the secondary circuit.

It is well known that translators of the constructions which are best adapted to translate the feeble rapidly-alternating currents of telephonic transmission are not those best adapted to translate the stronger and less rapidly alternating currents generated by the subscribers' generators—that is, a form of translator which best translates the telephone-currents into the secondary circuit will produce in the same circuit an unduly weak secondary current from the subscriber's calling-generator for clearing-out purposes, and thus would make the operation of the clearing-out annunciator uncertain and unreliable were the most suitable translators used for telephone-currents. With the use of the battery as described to reinforce the clearing-out current reliability in the clearing-out operation would only be obtained by the use of such constructions of translators as would not give the best results for the telephone-currents. By my organization, however, with the battery employed, as described, to reinforce the clearing-out current such forms of translators may be employed as are best adapted to translate the feeble rapidly-alternating currents of telephony, and at the same time reliability in

the operation of the clearing-out signals may be obtained.

As the ground connection of the line through the line-annunciator is open when the clearing-out signal is sent, the subscriber sends the signal without operating the line-annunciator.

The test system is as follows: Each operator has a test-plug *T* and an induction-coil *i*. One coil of the induction-coil is in circuit with his telephone. The test-plug is connected to a flexible conductor, by which it may be carried into contact with any metal socket *j* at its board and is connected through the other coil of the induction-coil with the heretofore-mentioned metallic-circuit connection of the exchange.

When the operator tests a line, she places her test-plug on its metal socket. If the line is not in use, no complete circuit is established which contains a battery and one coil of the induction-coil, and her telephone will not respond. If, however, any metal socket of the line has a switch-plug in it, as above described, a complete circuit is established which includes the coil and a battery, and the telephone will respond, indicating that the line is in use. This circuit may be traced thus: from the test-plug to the metal socket in which is a switch-plug, thence to the mate of the plug through the battery *B'*, thence to the metallic circuit of the exchange, and thence through the coil of the induction-coil *i* to the test-plug.

It will be observed that in this system the ground connection of each line through its annunciator is opened when the line is switched for conversation, and the line is grounded through a circuit connection which does not include the annunciator; also, that the line has the translator-coil in circuit with it whether it is grounded through the annunciator or not. From this organization it results that an operator sends a calling-signal to any line without operating the line-annunciator, and any subscriber sends the clearing-out signal without operating his line-annunciator, whereas if the annunciator remained in circuit during conversation it would produce a retardation effect on the telephone-currents, and when signals were sent by the operator on making connection or clearing-out signals sent by the subscriber after completing a conversation the line-annunciator would also indicate a call, and since in multiple-switchboard systems the annunciator of a line is frequently at another board than that where the connection is made great confusion would occur in the operation of the exchange.

Other ways than that described may be employed to remove the annunciator from the line-circuit when the line is switched for conversation—as, for instance, the annunciator may be shunted or short-circuited by suitable relay-contacts when the line is switched

and thereby practically removed from the circuit.

I claim as my invention—

1. In a telephone-exchange system, a switch-board, telephone-lines, each permanently grounded at the outer end and normally grounded at the central office through its annunciator, and translators at the central office for said lines, one for each line, one coil of which is in the circuit of the line, in combination with a normally open ground connection for each line which does not include the line-annunciator, a connection between one side of the other coil of the line-translator and the same side of the same coil of each of the other translators, and switch apparatus to connect the other side of said coil of the line-translator with the same side of the same coil of any other translator and close said normally open ground connection of the line as long as its translator-coil is thus connected.

2. In a telephone-exchange system, telephone-lines, each permanently grounded at its outer end, a ground connection with which it is normally closed, a line-annunciator in such ground connection, and translators at the central office, one for each line, one coil of which is in the circuit of the line, in combination with a second ground connection for each line which does not include the line-annunciator and is normally open to the line, a connection between one side of the other coil of the line-translator and the same side of the same coil of each of the other translators, and switch apparatus to connect the other side of said coil of the line-translator with the same side of the same coil of any other translator and as long as the translator is thus connected open the first-mentioned and close the second-mentioned ground connection of the line.

3. In a telephone-exchange system, two telephone-lines, each permanently grounded at their outer ends and grounded at the central office while and as long as switched for conversation between subscribers, and translators at the central office for said lines, one translator for each line, one coil of which is in the circuit of the line between such grounds of the line, the other coils of the translators being connected into a complete circuit for conversation, in combination with a clearing-out annunciator and a battery in said complete circuit of the two coils, and calling apparatus at each subscriber's station to send a clearing-out current through his line, said battery being made of too little strength to cause the clearing-out annunciator to be operated when they are in said complete circuit of the two coils but reinforcing the clearing-out current sent by either subscriber to insure the operation of the annunciator.

4. In a telephone-exchange system, two telephone-lines, each permanently grounded at its outer end and grounded at the central office while and as long as switched for conver-

sation between subscribers, and translators at the central office for said lines, one for each line, one coil of which is in the circuit of the line, the other two coils being temporarily
 5 connected together into a complete circuit for conversation, in combination with a clearing-out annunciator and a battery, said annunciator and battery being in a circuit with each of said last-mentioned coils, and calling apparatus at each subscriber's station to send
 10 a clearing-out current through his line, said battery being made of too little strength to cause the clearing-out annunciator to be operated when they are in said complete circuit
 15 of the two coils but reinforcing the clearing-out current sent by either subscriber to insure the operation of the annunciator.

5. In a telephone-exchange system, two telephone-lines, each permanently grounded
 20 at its outer end and normally grounded at the central office through a line-annunciator, and translators at the central office for said lines, one for each line, one coil of which is in the circuit of its line, the other coils of the line-
 25 translators being temporarily connected together into a complete circuit for conversation, and said lines being grounded at the central office while, and as long as switched for conversation between subscribers, their
 30 coils are thus connected by circuit connections which do not include the line-annunciators, in combination with a clearing-out annunciator in said complete circuit of the two coils, and calling apparatus at each sub-
 35 scriber's station to send a calling-current through his line.

6. In a telephone-exchange system, telephone-lines, each permanently grounded at its outer end, and translators at the central
 40 office for said lines, one for each line, one coil of which is in the circuit of the line, each translator having two pairs of contacts operated by an armature, one pair being normally closed and the other pair normally open, one
 45 contact of each pair being connected with the line, the other contact of the normally closed pair being grounded through the line-annunciator, and the other contact of the normally open pair being grounded but not
 50 through the line-annunciator, in combination with switching apparatus to connect together into a circuit any two of the other coils of the translators for conversation between subscribers, and a battery in any circuit thus
 55 established, said battery as long as two coils are thus connected acting on the translator-cores through the coils with which it is in circuit to move the armature of each of the two translators to open the normally closed
 60 and close the normally open pairs of contacts.

7. In a telephone-exchange system, telephone-lines each permanently grounded at its outer end, and translators at the central office for said lines, one translator for each
 65 line, one coil of which is in the circuit of the line, each translator having a normally open pair of contacts operated by an armature of

the translator, one contact being connected to the line and the other to the ground, in combination with switching apparatus to connect together into a circuit any two of the
 70 other coils of the translators, and battery in circuit with each coil as long as thus connected, said battery acting on the translator-coils with which it is in circuit to move the
 75 armature of each of the two translators to close its said pair of contacts.

8. In a telephone-exchange system, two telephone-lines permanently grounded at their outer ends and each normally grounded
 80 at the central office through its line-annunciator, and translators at the central office for said lines, one for each line, one coil of which is in the circuit of the line, the other two coils being temporarily connected into a
 85 circuit for conversation between the two subscribers, and the two lines being then or as long as the coils are thus connected grounded at the central office and not through the line-annunciators.
 90

9. In a telephone-exchange system, subscribers' telephone-lines, calling-annunciators, one for each line, each normally in a circuit with its line, switches on a switchboard, one for each subscriber's talking-circuit and
 95 having each a contact-piece, electromagnetic devices other than said line-annunciators, one for each line, each operated when a current is established through it, and thereby controlling the line-annunciator that it will not
 100 then be operated and made to indicate a call by a current sent over the line, pairs of switch-plugs, each plug having a contact-piece adapted to form connection with said contact-piece
 105 of the switch of a subscriber's talking-circuit when the plug is placed in said switch to switch said talking-circuit for conversation, said contact-pieces of the pair of plugs being connected together by a flexible switch-conductor, said contact-piece of a line being connected
 110 to one side of its electromagnetic device, and the other sides of the electromagnetic devices being connected together, and a battery in the circuit between said contact-pieces of each pair of plugs, thus establishing
 115 current through said electromagnetic devices of two lines and then or while the lines are switched controlling their calling-annunciators so that they shall not then be operated by currents sent over the lines from either
 120 subscriber's station.

10. In a telephone-exchange system, multiple switchboards, subscribers' telephone-lines, annunciators, one for each line, each normally in a circuit with its line, switches,
 125 one on each board for the talking-circuit of each subscriber and having each a contact-piece, electromagnetic devices, one for each line, each actuated when a current is established through it to so control the line-annunciator that it will not then be operated by a
 130 current sent over the line, pairs of switch-plugs at each board, each plug having a contact-piece adapted to form connection at its

board with said contact-pieces of the switches
of the subscribers' talking-circuits when the
plug is placed in either of said switches to
switch a talking-circuit for conversation, said
5 contact-pieces of each pair of plugs being con-
nected together by a flexible switch-conduc-
tor, said contact-pieces of a line being con-
nected to one side of its electromagnetic de-
vice, and the other sides of the electromag-

netic devices being connected together, and 10
a battery in the circuit between said contact-
pieces of each pair of plugs.

In testimony whereof I have hereunto sub-
scribed my name.

MILO G. KELLOGG.

Witnesses:

CALVIN DE WOLF,
R. B. BELL.