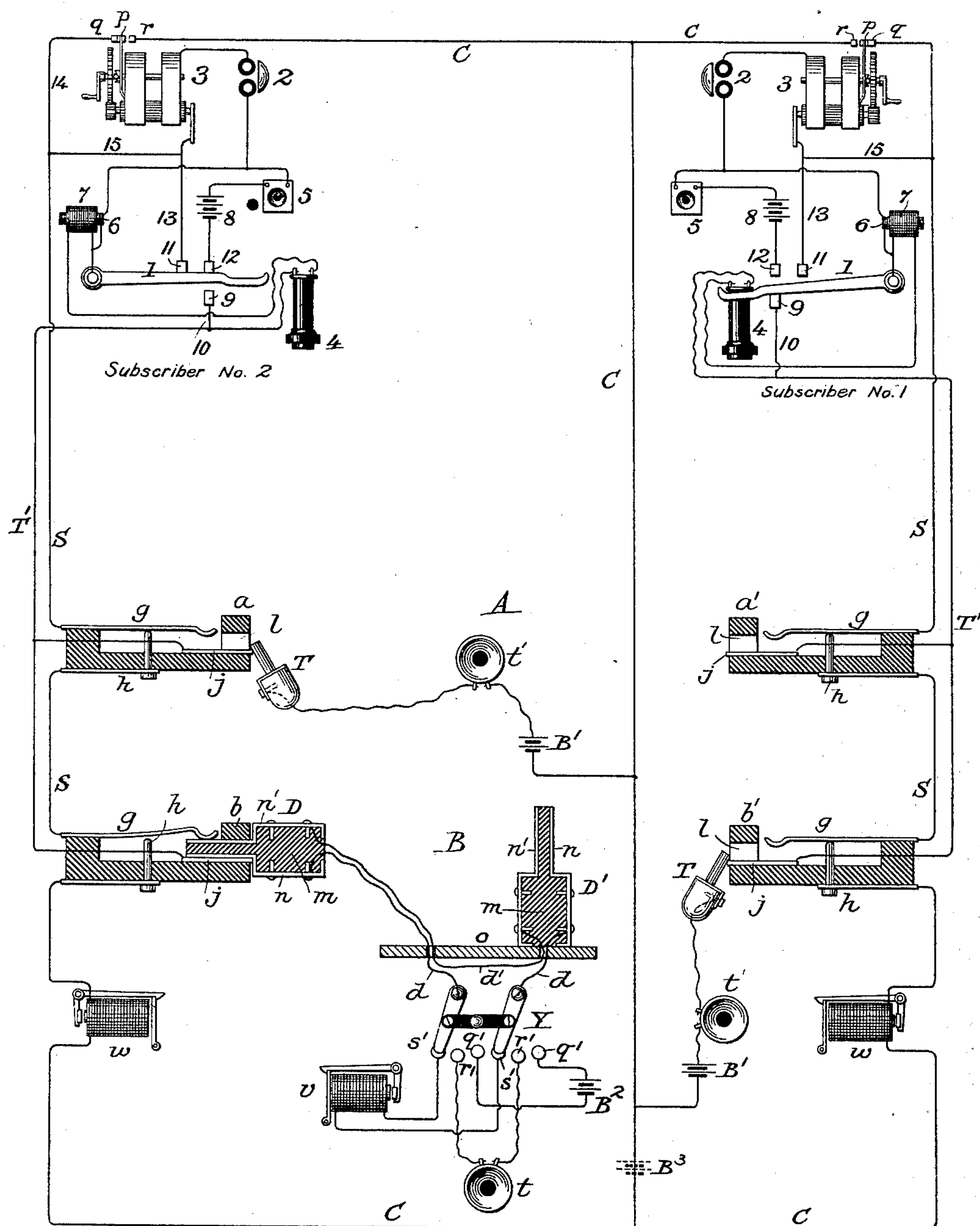


(No Model.)

M. G. KELLOGG.  
MULTIPLE SWITCHBOARD.

No. 592,339

Patented Oct. 26, 1897.



Witnesses,

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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. 592,339, dated October 26, 1897.

Application filed December 20, 1889. Serial No. 334,357. (No model.)

*To all whom it may concern:*

Be it known that I, MILO G. KELLOGG, of Chicago, Illinois, temporarily residing at Stuttgart, in the Empire of Germany, 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 to a telephone-exchange system in which the subscribers' lines are metallic-circuit lines; and it consists in a system of calling, switching, and testing such lines which I shall describe and claim.

I place as many switchboards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines. On each board I place for each line a spring-jack or similar switch having two contact-pieces which are normally in contact and a third contact-piece normally insulated from the rest, (except by the circuit connections,) said switch being adapted to receive a switch-plug, and when a plug is inserted to disconnect the contact-pieces of the switch which are normally in contact and connect one of them with one contact-piece of the plug, while the other contact-piece of the plug is connected with said third contact-piece of the switch. The third contact-pieces of the switches mentioned above are so placed and arranged that the operator may at will apply a test-plug or similar device to them.

In the drawing the figure represents the apparatus and circuits embodying one form of my invention.

Two metallic circuits are shown connected to two boards A and B of a multiple-switchboard exchange. Each of the metallic circuits may be traced from the test-contacts *j* in the spring-jacks *b a* and *b' a'* over the line conductor *T'* to the subscriber's station, thence to the telephone 4 and secondary coil 7 of the induction-coil to the switch-lever 1, short-circuited by the conductor 10 and contact 9 normally or when the telephone is not switched for use, thence through the primary coil 6, bells 2, to the generator-frame 3, thence through the armature of the generator by way

of conductor 15 to the line conductor *S*, through normally closed contacts *g h*, annunciator *w*, common wire *C*, thence back to the subscriber's station to contacts *r*, adapted to be connected to the generator-contact *p*, while calling by the usual automatic device. When the telephone 4 is removed from its hook 1, the bells 2 and generator 3 are short-circuited by the conductor 13 and contact 11. At the same time the transmitter-circuit is closed from the switch-lever 1 through the primary coil 6, transmitter 5, battery 8, and contact 12. The short circuit 14 and the normally closed contacts *p q* switch the armature from the circuit except when the generator is actuated for a call, when these contacts are opened for calling by the automatic device already referred to.

Each spring-jack *a b a' b'* is provided with a switch-hole *l* and is provided with normally closed contacts *g h*, disconnected by a switch-plug *D* or *D'* when inserted therein, and a test-contact *j*, placed, as shown, so that a test-plug *T* can be applied to it for testing.

When a subscriber's call-generator is actuated, the following call-circuit is established: generator-contact *p*, the armature of said generator, the conductor 15, line conductor *S*, annunciator *w*, and common return-conductor *C*, to the contact *r*, connected to the generator-contact *p* while calling.

At each board is located an operator's test outfit comprising a test-plug *T*, a test receiving instrument *t'*—a telephone, for example—and a test-battery *B'*, all connected to the common wire *C*. Instead of a separate battery *B'* for each outfit there may be a single test-battery *B'*. (Shown in broken lines.) When a test-plug *T* is applied to a test-contact *j* for testing, a test-circuit is established from the test-contact *j* over the two line conductors *T'* and *S*, including the subscriber's outfit and the normally closed contacts *g h*, thence through the annunciator *w*, common wire *C*, to the test outfit. This circuit is shown over line No. 1.

At board A the operator's outfit is shown testing line No. 2. As the contacts *g h* of spring-jack *b* at board B are opened by the switch-plug *D* no test-circuit is established. When a circuit is closed, the current from



the test-battery causes a click in the telephone, indicating that the line is free. When, however, no test-circuit is established, the test receiving instrument will remain silent.

5 This indicates that the line is busy.

At board B is shown an operator's switching outfit comprising two switch-plugs D and D'. Each plug is composed of insulating material *m*, upon which are mounted two contacts  
10 *n* and *n'*, adapted to be connected to two jack-contacts *j* and *g* when inserted in a jack and adapted to be cross-connected by the conducting base-plate *o* when in their normal position.

The two contacts *n'* of the two switch-plugs  
15 are connected together by a flexible conductor *d'*. The two contacts *n* are connected together by a flexible conductor *d*, in the circuit of which is a looping-in switch Y, adapted to be placed upon pairs of contacts *q' q'*,  
20 *r' r'*, or *s' s'*, and thereby loop into the circuit a call-generator B<sup>2</sup>, an operator's telephone set *t*, or a clearing-out annunciator *v*. When one plug is inserted in a spring-jack, as shown at board B, the circuit of the operator's ap-  
25 paratus is completed through the cross-connected contacts of the other plug.

The operation of the system is as follows: When a subscriber desires to call, he turns the crank of his generator, thereby removing  
30 the shunt and connecting the line with the common wire, so that the armature-coil is between this connection and the line-annunciator. A complete circuit being thus established, in which is the armature-coil and the  
35 annunciator, the latter indicates a call. The operator then places one of a pair of plugs into the switch of the line indicated, and by conversation finds out what line is wanted. She then tests the line wanted by placing the  
40 test-plug on the contact-piece *j* of its switch. If the line is not switched for use, a complete circuit will be established, in which is the operator's test receiving instrument and battery, and the test receiving instrument will  
45 respond. If, on the other hand, the line is switched for use by a plug being in one of its switches, the circuit, as above described, will be open and the instrument will not respond. The operator can therefore deter-  
50 mine on testing whether or not a line is in use.

When the test indicates that the line is not in use, the operator will place the other plug of the pair in the switch of the called line. The two lines are thus connected together in  
55 metallic circuit, and their normal connection with the common wire is removed. The operator may now by moving the levers of the looping-in switch connect her calling-generator into the circuit. Again, she may by mov-  
60 ing the levers of the switch connect a clearing-out annunciator into the circuit. Again, she may by moving the levers of the switch loop her telephone into the circuit and listen to determine whether the subscribers are  
65 through conversation.

By this system of calling, switching, and testing the test receiving instruments are not

grounded, but are open to the ground at the central office, and an accidental ground on a line tested between the subscriber's station  
70 and the line-annunciator would not give on testing a false signal that the line was free when it was switched at the central office, as would be liable to be the case were the test  
75 receiving instrument connected with the ground. It is well known that such accidental grounds are liable to occur, and it is apparent that in the system described above such a ground would not affect the testing or  
80 other operation of the system.

Normally the looping-in switch Y rests upon the annunciator-contacts *s' s'*. If placed upon other contacts while the switching system is not in use—the telephone or generator  
85 contacts, for example—those elements would be short-circuited and rendered useless for the other plug sets.

The annunciators *w* are distributed among the various boards to equalize the work of the  
90 various operators.

What I claim, and desire Letters Patent for, is—

1. In a multiple-switchboard exchange, a three-conductor system comprising a telephone-circuit, ungrounded call and test cir-  
95 cuits associated therewith, each extending from the subscriber's station to the central office, one conductor and one only common to both circuits.
2. In a multiple-switchboard exchange, un-  
100 grounded telephone, call and test circuits, each extending from the subscriber's station to the central office, a conductor common to each of said circuits, a second conductor com-  
105 mon to said telephone and test circuits, and a third conductor forming a part of said call-circuit, each conductor electrically continuous from the subscriber's station to the central office.
3. In a multiple-switchboard exchange, un-  
110 grounded telephone, call and test circuits, each extending from the subscriber's station to the central office, a conductor common to each of said circuits, a second conductor com-  
115 mon to said telephone and test circuits, and a third conductor forming a part of said call-circuit, each conductor electrically continuous from the subscriber's station to the central office, said circuits being normally open  
120 but closed while performing their several functions.
4. In a multiple-switchboard exchange, a telephone-line, ungrounded call and test cir-  
125 cuits associated therewith, three conductors each extending from the subscriber's station to the central office, a single conductor common to both including a call device and normally closed contacts open while the telephone-line is switched for use, a call-generator in said call-circuit, and a test-battery in  
130 said test-circuit at the central station.
5. In a multiple-switchboard exchange, ungrounded telephone, call and test circuits, three conductors each extending from the



subscriber's station to the central office, a conductor common to said call and test circuits, a second conductor common to said test and telephone circuits, a third conductor forming part of said call-circuit, and a test battery and instrument in said test-circuit at the central station.

6. In a multiple-switchboard exchange, ungrounded telephone, call and test circuits, three conductors each extending from the subscriber's station to the central office, normally open but closed while performing their several functions, a conductor common to said call and test circuits, a second conductor common to said test and telephone circuits, a third conductor forming part of said call-circuit, and a test battery and instrument in said test-circuit at the central station.

7. In a multiple-switchboard exchange, in the order named, test-contacts, an ungrounded metallic circuit closed at the subscriber's station, normally closed switchboard-contacts opened while in use, a call-annunciator, an ungrounded conductor, an extension to the subscriber's station including normally open contacts closed through a call-generator while calling; in combination with a test outfit including a test-battery connected on one side to said ungrounded conductor and on the other side adapted to be connected to a test-contact for testing.

8. In a multiple-switchboard exchange, in the order named, test-contacts, one at each board, a line-conductor, an ungrounded subscriber's outfit including a call-generator, a

return line conductor, normally closed jack-contacts, a pair at each board opened while the line is switched, for use, an annunciator and two connections, one to an ungrounded common conductor adapted to be connected to a subscriber's call-generator while calling; the other to an operator's test outfit including a test-battery, adapted to be connected to a test-contact for testing.

9. In a multiple-switchboard exchange, two metallic circuits, each connected in the order named from test-contacts, one at each board, a line conductor, ungrounded subscriber's outfit including a call-generator, a return line conductor, normally closed jack-contacts, a pair at each board opened while the line is switched for use, an annunciator, and two connections one to an ungrounded common conductor adapted to be connected to a subscriber's call-generator while calling; the other to an operator's test outfit including a test-battery, adapted to be connected to a test-contact for testing in combination with loop-plugs with cord connections adapted to be inserted in jacks of said two lines and disconnect a pair of normally closed contacts in said jacks, and connect said lines together for conversation.

In witness whereof I hereunto subscribe my name this 29th day of November, 1889.

MILO G. KELLOGG.

Witnesses:

EMIL ABENHEIM,  
MARGARETHA RIEHL.