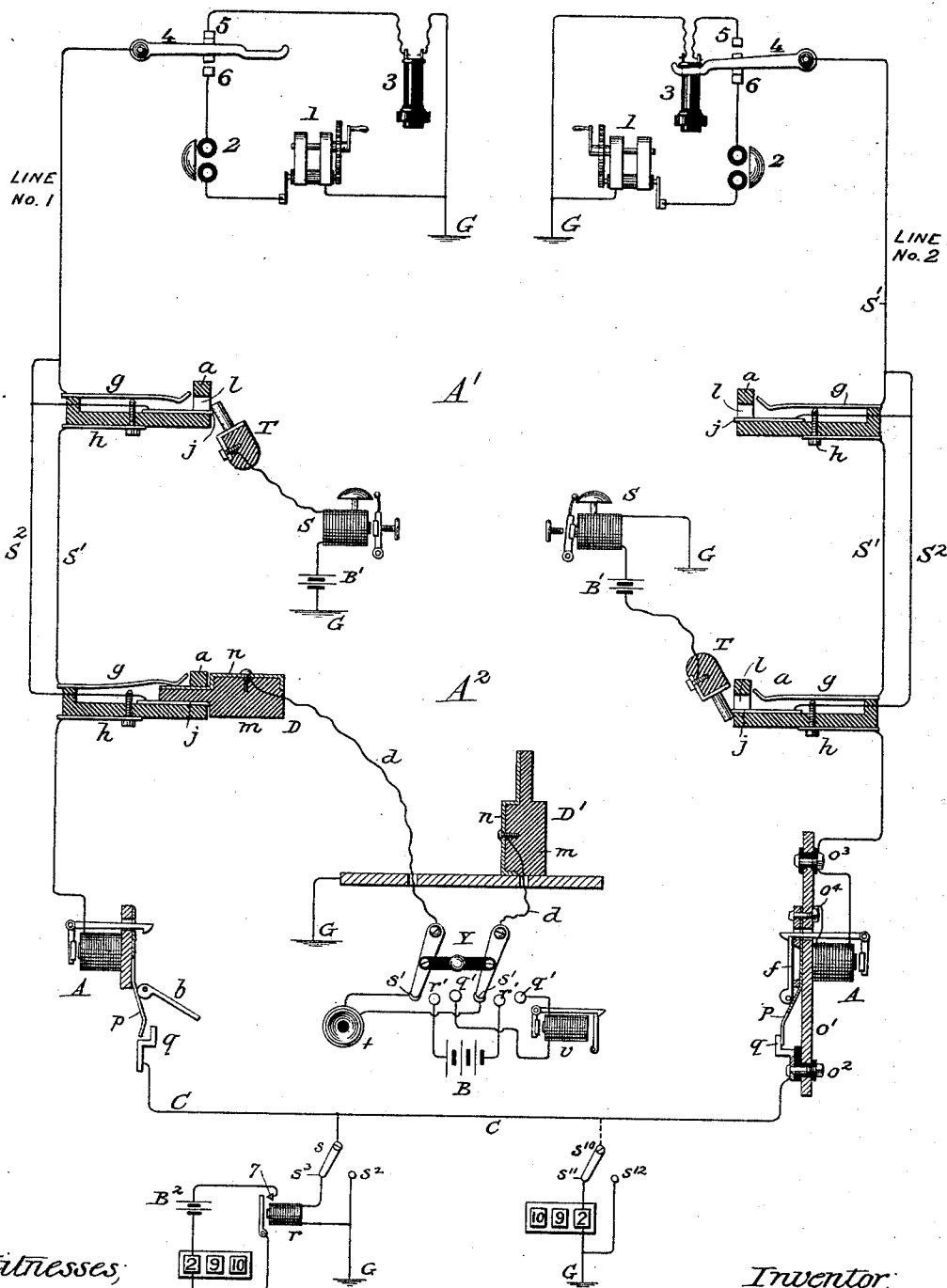


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,330.

Patented Oct. 26, 1897.



Witnesses:

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MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,330, dated October 26, 1897.

Application filed December 11, 1889. Serial No. 333,343. (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 lines which are normally grounded at the central office.

It consists, first, of an improved system of subscribers calling on such lines; secondly, to an improved system of testing such lines, and, thirdly, to an improved night-signal at the central office.

In the drawing accompanying this specification, showing my invention, the figure illustrates the apparatus and circuits in which I prefer to embody my invention.

The subscribers' lines in the exchange are divided among the different boards of the exchange as in the usual manner, as many boards being employed as the size of the exchange requires. On each board is a spring-jack or similar switch for each line. Each switch has a spring-contact normally bearing upon an insulated contact-anvil and a third contact-piece insulated from the rest except by the circuit connections. A subscriber's line is traced through these spring-jacks as follows: from ground at G through two branches in parallel, one branch including a call-generator 1, bells 2, and terminating in a contact 6, normally or when the telephone is not switched for use, in connection with the lever 4, the other branch including the operator's telephone set 3 and terminating in a contact 5, in connection with the lever 4 while the telephone is switched for use, thence over the subscriber's line conductor S', through the test-contacts *j* in the jack-switch at each board, thence through the pairs of normally closed contacts *g h*, the annunciator A, the normally closed pair of contacts *p q*, opened while the annunciator indicates a call, to the common conductor C, grounding-switch *s*, which is grounded directly or through the

relay *r*, according to whether the switch rests upon the contact *s*² or *s*¹.

The construction of the line-annunciator A is shown more in detail in line No. 2. The line conductor S', after passing through the spring-jacks, is connected to the bolt *o*³ and thence through the coil of the annunciator to the spring *p*, mounted upon the metal frame *o*¹. The spring *p* normally bears against the contact *q*, which is mounted upon the frame *o*¹ by means of the bolt *o*², both of which are insulated from said frame. To this bolt *o*² is connected the common grounding-wire C. During the daytime, or while the exchange is active, this grounding-wire has its circuit closed through the circuit of switch *s* and contact *s*² to ground at G.

At each board is an operator's test outfit, comprising a plug T, a test receiving instrument S, a test-battery B', all of which are grounded at G. The order of these elements is immaterial as long as the battery and test receiving instrument are between the test-plug and ground. One of the outfits is provided at each board.

At board A² is shown one of the switching sets, there being as many switching sets at each board as there are connections to be established at the time of greatest activity. A switching set comprises two plugs D D', connected together by a flexible cord conductor *d*, in the circuit of which there is a looping-in switch Y, which introduces a telephone *t*, a call generator or battery B, or a clearing-out annunciator *v*, according to whether the switch Y rests upon the contacts *s*¹ *s*², *r*¹ *r*², or *q*¹ *q*². The switch Y normally rests upon the annunciator-contacts *q*¹ *q*². The annunciator *v* is individual to each set, but the call-generator B and operator's telephone set *t* are used in common with a number of switching sets in the manner well known to electrical engineers.

The plugs are composed of a body of insulating material *m*, upon which are mounted contacts *n* so arranged as to make contact with the metallic grounded plate *o*, upon which the plugs normally rest, and to be in connection with either of the contacts *g* or *j* when inserted into the hole *l* of a spring-jack *a*.

When both plugs are inserted in spring-jacks, their circuit is completed over two line-wires connected to the jacks. When one plug only is inserted in a jack, the circuit of the other plug is completed to ground at G through the metallic supporting-plate *o*.

The strength of the test-batteries is so adjusted to the resistance of the subscriber's apparatus or his line conductor, or both, that when in its circuit and in circuit with it alone the test receiving instruments will not respond. If, however, the pairs of contacts *gh* of the jacks and the pairs of contacts *p q* of the line-annunciator are closed, two branches to ground are provided for the test-batteries, the joint resistance of which permit the test receiving instrument to respond. This circuit may be traced as follows: from ground at G, test receiving instrument S at board 2, battery B', test-plug T, test-contact *j*, test-conductor S², thence in parallel over two grounded wires or branches, one branch being traced over the line-circuit S' to ground at the subscriber's station, the other branch being traced over the conductor S', through the pairs of contacts *gh* in the jacks at the several boards, through the line-annunciator A, the pair of contacts *p q*, controlled by said annunciator, common grounded wire C, thence to ground at G by way of either the contacts *s'* or *s*². The joint resistance of these two branches of the test-circuit permits the test-battery to cause the test receiving instrument to respond and thereby indicate that the line is "free."

At board A' is shown a test outfit testing a "busy" line. The office ground was first cut off by the opening of the contacts *p q*, caused by the falling flap of the annunciator. This alone prevents the test receiving instrument from responding. The operator at board 2 inserts her switch-plug D into jack *a*, as shown, thereby lifting the spring-contact *g* from its anvil *h*, opening the office ground at a second point. The opening of this pair of contacts alone prevents the response of the test outfit.

It will be noticed that the line conductor S' is connected temporarily to the office ground as follows: spring-contact *g*, plug-contact *n*, cord conductor *d*, including the operator's telephone set *t*, contact *n* of the plug D', and grounded plate *o*. The resistance of the telephone set *t* is so great that the test receiving instrument does not respond. When the switch-plug D' is inserted into the jack *a* of another line—line No. 2, for example—the subscriber's line is substituted for the office ground, and the resistance of it being sufficient to prevent the test receiving instrument from responding a test of two connected lines indicates that they are "busy." To facilitate these adjustments, the resistance to ground through the subscriber's station may be high and the office ground through the annunciator may be comparatively low. The existence of the annunciator branch to ground

is an established test-circuit, and this branch alone will permit the line to test "free." All of the other grounds of the system have such high resistance as to prevent a "free" test.

The switch *s* rests during the active hours of the exchange upon the contacts *s*². At night the switch is placed upon the contact *s'*, so that the common wire C is grounded through the relay *r*. When a subscriber sends in a call, a current energizes the relay *r* and closes the pair of contacts 7, permitting the battery B² to act upon an indicator 2, indicating to the night operator that a call has been sent in at board 2. There is one of these relays *r* individual to each board of the exchange, or, in other words, there is a different common wire C, a different switch *s*, and a different relay *r* for each board. The indicators 2 9 10, &c., are grouped at a night station or table, where they may be overlooked by the night operator. The noise of the falling flap alone may be sufficient to attract the operator's attention, or a signal in addition of the ordinary kind may be given in the usual way. The switch *s*¹⁰, connected to the common wire C by broken lines, controls a modification by which a direct ground or a grounded night-indicator 2 may be introduced into the circuit, according to whether the switch rests upon the contact *s*¹² or *s*¹¹.

This system of testing differs from other systems in that the line tests "busy" whether it is switched or whether its annunciator indicates a call, and it is applicable in its general features to all systems of testing in which the test is made directly to the circuit of the line, whether the line is switched or not, and in which the test indicates whether or not the connection of the line is broken to the office ground.

The relays *r* should preferably be of comparatively small resistance and of a construction which will cause them to operate when the usual calling-current is sent through them. The current of a subscriber's generator being a comparatively strong one and generally one rapidly intermittent frequently causes induction on neighboring wires, which impedes telephone conversation on them as long as the subscriber may think it necessary or find it convenient to operate his generator in making a call. In this system the circuit is open as soon as a call is indicated, so that further operation of the generator will not cause prolonged induction on neighboring wires. At the same time the subscriber's own signal-bell will stop ringing as soon as his annunciator at the central office indicates a call, and he thereby knows that his call has been indicated.

In telephone-exchanges signal-bells are not generally necessary in the exchange-office during the daytime to call the attention of the operator that a call is indicated, as there is an operator stationed at each board to watch the annunciator indications and answer the

calls, and the operation of the annunciators themselves generally make a sound which is heard for a short distance. At night, however, one operator is frequently sufficient to attend to the calls on many boards; but it is impossible for her to watch closely all the drops at the various boards to see when a call is indicated. To remedy this trouble, I place relays or annunciators, as described, in the common circuit of each board or group of lines, and I group the annunciators, one operated by each relay, at a night-table, where the operator may remain to watch the indications while she is not at the switchboards answering calls. The annunciators at the night board indicate the board or group of lines from which the call comes, and on going to the board she sees what particular line has made the call.

I am aware that heretofore it has been proposed to divide the lines of an exchange into groups and place a telephone in a wire common to the group; but in such systems the telephone is placed where the operator is located to make the connections for the group of lines. Signal-bells or annunciators have also been employed in the same way in a wire common to a group of lines. It has also been proposed to provide all the individual annunciators of an exchange with contacts to close the circuit of a signal-bell common to all of them when an annunciator is operated by a calling subscriber. The operator is thus informed that a call has been made some where in the exchange, but he must search all the groups or boards to ascertain the annunciator of the line indicating the call.

In my system the annunciators common to the respective groups of lines are located at a table where the night operator of an exchange is to remain, and the line-annunciator of each line is located at the switchboard where its calls are to be answered. Thus the group annunciator or indicating device indicates to the night operator the group of lines in which a call has been sent in, and on going to the switchboard of the group he readily finds the individual annunciator of the line that has called.

In my system I have an individual annunciator in each line and also one for each group of lines, and each subscriber has a generator for operating both annunciators, and when a subscriber operates his generator to call both annunciators are operated, one indicating to the operator the group and the other the particular line of the group.

I claim as my invention and desire to secure by Letters Patent—

1. In a multiple-switchboard exchange, a test-circuit, normally closed contacts in said test-circuit, and a call device opening said contacts while indicating a call.

2. In a multiple-switchboard exchange, a test-circuit, normally closed contacts in said

test-circuit, an annunciator in said test-circuit opening said contacts while indicating a call.

3. In a multiple-switchboard exchange, three parallel circuits, one containing normally closed contacts, the second containing the subscriber's line, and a third normally open and closed for testing, containing a test receiving instrument and battery so adjusted to each other and to the two other parallel circuits as to give one indication while the normally closed contacts are closed, and another indication while they are open; in combination with a call device opening contacts while indicating a call.

4. In a multiple-switchboard exchange, a test-circuit, comprising a test outfit, connected on one side to ground and on the other side to a line conductor grounded at both ends; in combination with a circuit-breaker in one grounded end, said test outfit being adjusted to give one indication while the circuit-breaker is closed, and another indication while the circuit-breaker is open, and an annunciator opening said circuit-breaker.

5. In a multiple-switchboard exchange, a telephone-line comprising in the order named, a subscriber's grounded line, test-contacts, one at each board and an office grounded connection containing normally closed contacts; in combination with a grounded test outfit at each board adapted to be connected to a test-contact for testing, so adjusted to the resistance of two grounded ends as to respond while the said contacts are closed but to fail to respond when they are open, and an annunciator opening said contacts while indicating a call.

6. In a multiple-switchboard exchange, a grounded telephone-line comprising in the order named, a subscriber's line, test-contacts, one at each board, normally closed jack-contacts, a pair at each board, and a ground connection containing normally closed annunciator-contacts; in combination with a test outfit at each board adapted to be connected to a test-contact for testing, so adjusted to the resistances of the grounded ends of the telephone-line as to respond when the annunciator-contacts and the jack-contacts are closed, but to fail to respond when any of the said contacts are opened, an annunciator opening said annunciator-contacts while indicating a call, and a switch-plug adapted to open a pair of jack-contacts while the line is switched for use.

7. In a telephone-exchange system, two or more groups of lines, an indicating device or annunciator for each group common to all the lines of that group, such indicating devices for all the groups being arranged together at the central office, an individual annunciator for each line located at the board where its calls are to be answered, and a generator or source of electricity at each subscriber's sta-

tion for causing the operation of the individual annunciator of the line and the indicating device of the group to which the line belongs.

8. In a telephone-exchange system, two or
5 more groups of lines, an indicating device or
annunciator for each group common to all the
lines of that group, such indicating devices
for all the groups being arranged together at
the central office, an individual annunciator
10 for each line located at the board where its
calls are to be answered, a generator or source
of electricity at each subscriber's station for
causing the operation of the individual an-
nunciator of the line and the indicating de-
15 vice of the group to which the line belongs,
and a switch for disconnecting each group of
lines from its common indicating device.

9. In a telephone-exchange system, groups

of lines each line passing through its switch-
board system and an individual annunciator 20
and the lines of a group then uniting into a
common wire or circuit for said group, in com-
bination with a relay in the common wire or
circuit and an indicator or annunciator con-
trolled by said relay to indicate when a call 25
has been made on any line of its group, the
individual annunciator of each line being lo-
cated at a board of the exchange where its
calls are to be answered, and the indicators
of the different groups of lines being arranged 30
together at the central office, substantially as
set forth.

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Witnesses:

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