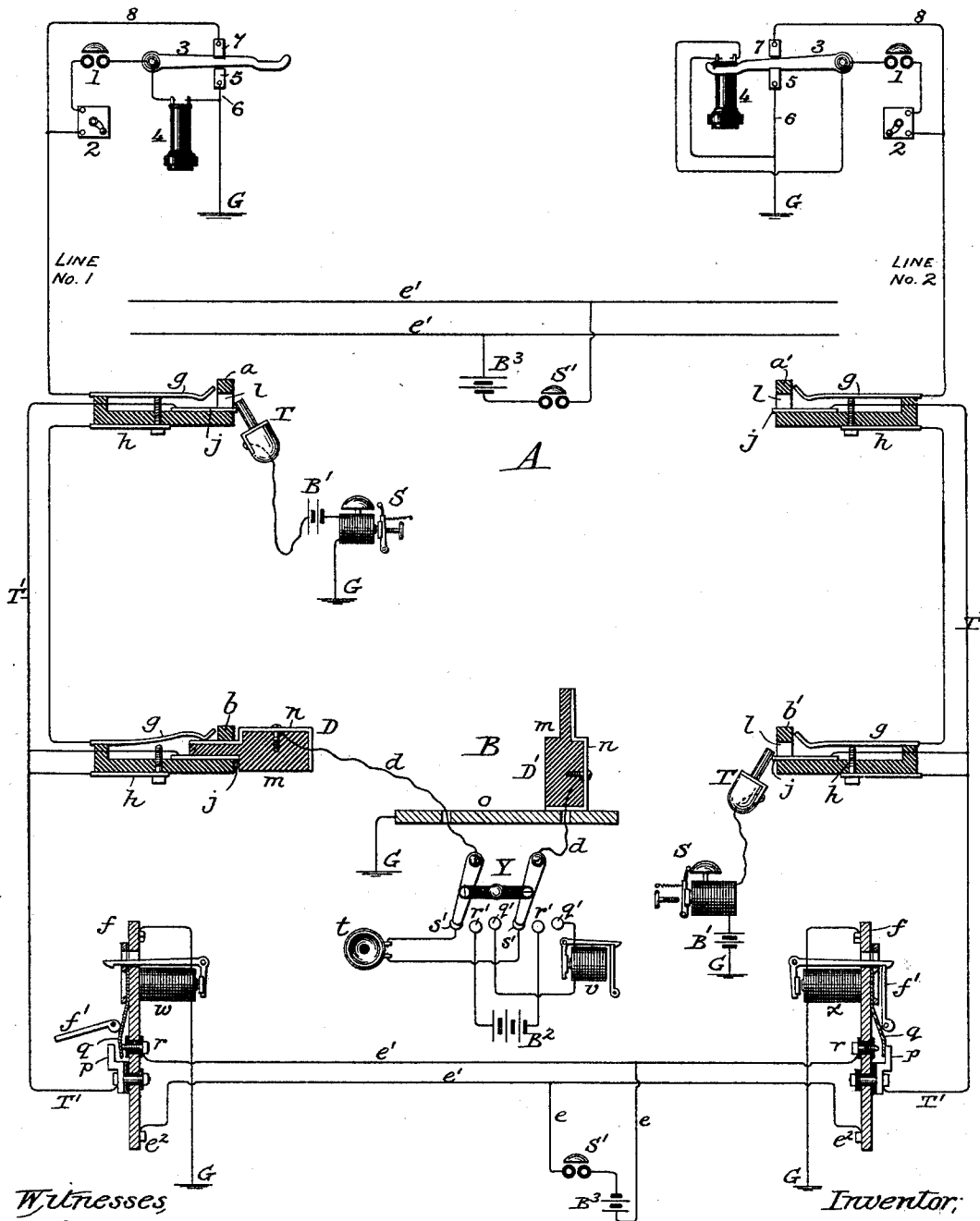


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,333.

Patented Oct. 26, 1897.



Witnesses

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MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,333, dated October 26, 1897.

Application filed December 12, 1889. Serial No. 333,536. (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 accompanying drawing, illustrating my invention, the figure shows the apparatus and the circuit connections preferably used therewith.

There are as many boards in the exchange as the number of lines renders necessary, and the line-annunciators are distributed among the operators in such a way as to equalize their work. On each board is a switch for each line. Each switch is preferably in the form of a spring-jack having three contacts, two of which are normally in contact, but disconnected by the insertion of a switch-plug, and the third insulated from the other two, except for the circuit connections, and so placed as to be conveniently touched by a test plug or device for the purpose of testing. The connections of a subscriber's line may be traced from ground G at the subscriber's station in parallel through two branches, one containing the telephone 4, the other a short circuit 6, terminating in a contact 5 normally, or when the telephone is not switched for use in connection with the switch-lever 3, thence in multiple through two other branches, one containing the call-generator 2 and the bells 1, and the other being a short circuit 8 around the calling set, terminating in a contact 7, connected with the switch-lever only while the telephone is switched for use, as shown in line No. 1, thence over the line conductor to the pairs of contacts *g h* in the spring-jacks *a* and *b* or *a'* and *b'*, as the case may be, at boards A and B, thence

through test-contacts *j* at each board connected together by the test-wire T', contacts *p q*, annunciator *w* or *x*, as the case may be, to ground at G.

The annunciators *w* and *x* are each mounted upon a conducting-plate *f*, upon which is mounted a spring-contact *q*, in electrical connection therewith, so bent as to normally make connection with the contact *p*, mounted upon, but insulated from, the plate *f*. The normal connections are shown in line No. 2. When the annunciator drops its flap *f*, the cam-shaped base of the flap forces the spring *q* away from the contact *p* and thus disconnects the test-wire T' from the office ground.

Upon the plate *f*, but insulated therefrom, is mounted an additional contact *r*, so placed that when the spring *q* leaves the contact *p* it comes into connection with the contact *r*, so that when the annunciator-flap falls it closes the circuit through the signal-bell S' and battery B³, connected by multiple connections *e* and *e'* to the plate *o* and the contact *r*, respectively, so that the flap of an annunciator when it falls performs two functions—it opens the line connection to ground and it closes a signal bell circuit. This bell-circuit may be open during the day and closed for use at night, or it may be used at all times. There may be one bell for the exchange, but I prefer to arrange a different bell on each board, common to the groups of lines at that board, so that a night operator is easily directed to the proper board when a call is made.

In my application, Serial No. 333,343, filed December 11, 1889, I have described and claimed a system in which there is a distinctive night-signal upon a night-table common to the lines of each board. In this case the board-signal is located at the board itself.

Heretofore operators at night have been compelled to hunt over all the annunciators of the exchange to find the line that has sent in a call. In my system the operator is at once directed to the board that has called by the bell ringing at that board.

At each board is a test outfit comprising a battery B' and test receiving instrument S, grounded on one side, and on the other connected to a test plug or device T, adapted to

be connected to a test-contact j of a line for testing. The test-battery and test receiving instrument and the two grounded branches or ends of the line-circuit and the apparatus in said circuit are so adjusted to each other that the test receiving instrument will sound when on testing neither the line is switched at a switchboard nor the annunciator-contacts are open, but not otherwise. To accomplish this result, the line-annunciator is given such a resistance that when the test outfit is in circuit with it and not in circuit with the subscriber's outfit in multiple the test outfit will fail to respond, and the line will indicate "busy." The subscriber's outfit is given such a resistance that when it is in circuit with the test outfit alone, and the office ground G has been cut off by the calling-annunciator, the test outfit will fail to respond.

The resistance in the subscriber's outfit lies preferably in the calling and the telephone sets, and the resistance of either set is sufficient to prevent a response from the test outfit when the annunciator-contacts $p q$ are open, but not enough to prevent a response when those contacts are closed. The resistance of the annunciator branch may be in the coil itself or in a separate resistance, or in both, in the manner well-known to electrical engineers.

The joint resistance of the annunciator branch of the test-circuit to the office ground and the subscriber's branch of the test-circuit to the subscriber's ground should be sufficiently low to permit the test receiving instrument to respond.

The resistance of the operator's telephone t is preferably high, so that when in an additional branch to ground through the operator's cord connection from a line-contact g , as shown at board B, a test outfit (shown at board A, for example) will not respond.

At board B the test outfit is shown connected to the test-contact j of the spring-jack b' . It is thus connected in a test-circuit traced from the grounded test outfit in the order named through test-contact j of spring-jack b' , test-wire T' , two branches in multiple, one comprising the normally closed contacts $p q$, annunciator x , grounded at g , the other comprising the normally closed contacts $h g$, the line conductor, and the grounded subscriber's outfit. The test receiving instrument S is shown responding to this test-circuit.

At board A the operator's test outfit is shown connected to the test-contact j of jack a for the purpose of testing the condition of line No. 1. The test-wire T' is disconnected from the line conductor at jack b at board B, where the contacts $g h$ are disconnected from each other by the insertion of the switch-plug D . The test-wire T' is also disconnected from the office ground, as shown, by the opening of the annunciator-contacts $p q$, so that the test receiving instrument S at board A is silent, as shown. Thus the line indicates

"busy." The same indication would have been given if the contacts $g h$ were not open, or if the contacts $p q$ were closed and the contacts $g h$ were open.

At board B is shown an operator's switching outfit adapted to connect together two lines for conversation. The apparatus may be variously arranged, but I prefer the arrangement shown, in which two switch-plugs D and D' , having contacts n mounted upon insulating material m , are connected through a flexible cord-circuit d , in which is a looping-in switch Y , adapted to be placed upon pairs of contacts $q' q'', r' r'', s' s''$, and thereby loop into the circuit of the switch-plugs the operator's telephone set t , the battery or alternating call-generator B^2 , or the clearing-out annunciator v . The contacts n of the plugs are so arranged that they make connection normally with a conducting base-plate o , grounded at G . Thus when one plug is inserted into a line-jack the circuit of the operator's outfit is completed through the contact n of the other plug and the grounded base-plate o , upon which it rests. When two lines are connected together for conversation, the contacts g of the spring-jacks of those lines are connected together through the operator's outfit, and the clearing-out annunciator v is left in the circuit for the purpose of clearing out.

The adjustment of the test system with various resistances and test outfits depends upon the degree of resistance, the size of the battery, the strength of the retractile spring of the test receiving instrument, and the power and number of coils of the magnet of the test receiving instrument. For instance, the resistance of the lines may be about two hundred and fifty ohms each and the resistance of the annunciator-magnets may be about two hundred and fifty ohms each. When under such conditions the test-plug T is applied to a contact-piece j of a line, and neither the line is switched at any board nor the annunciator indicates a call, the battery finds ground both through the switch contact-points to the subscriber's station and through the annunciator contact-points and the annunciator-magnets, and the resistance from the plug to such ground will be about one hundred and twenty-five ohms. With an ordinary bell of, say, one hundred ohms and eight or ten cells of battery and a suitable retractile spring the bell may be adjusted so as to ring when closed through such a circuit of, say, one hundred and twenty-five ohms resistance, but not to ring when the resistance of the circuit through which it is closed is increased to, say, two hundred and fifty ohms. When, the test being made as above, the line is switched at any board, (the annunciator not indicating a call,) the circuit to the subscriber's ground will be open and the resistance will be that to the office ground, which is, say, two hundred and fifty ohms, and the bell will not ring. When again the test is made

and the annunciator indicates a call, (the line not being switched at any board,) the circuit to the office ground will be open and the resistance will be that to the subscriber's ground, which is, say, two hundred and fifty ohms, and the bell will not ring. When again the test is applied and both the line is switched and the annunciator indicates a call, no circuit is established, and the bell will not ring. The operator can therefore know when the bell rings that neither the line is switched nor the annunciator indicates a call, and when it does not ring the bell either the line is switched or the annunciator indicates a call, or both. The night-bell S' may be a single or continuous stroke bell. If continuous, it may be a vibrating bell operated by any suitable current, or it may be a polarized bell operated by a current of alternating polarity, or under proper conditions by an intermittent current of one polarity. The particular character of the bell is immaterial, as long as it is sufficient to attract the attention of an operator to the board at which it is located. It is obvious that an annunciator might be substituted for the call, and the noise caused by the dropping of the flap be utilized for attracting the attention of the operator. The Law or any other system of calling may be substituted for that shown, so arranged as to perform the same functions.

In ordinary systems the subscriber's generator, when actuated for a call, is apt to cause induction on neighboring lines and thus interfere with conversation on those lines. My system obviates this difficulty, for the calling-annunciator opens the office-ground connection of the line when it indicates a call, and the subscriber's generator is left on open circuit. The subscriber is also informed that his call is indicated by his bell, which stops ringing when the line-circuit is thus opened.

Although the system has been described as a grounded system, it is evident that a metallic conductor might be substituted therefor, or the circuits may be metallic, and the individual return-conductors of all the circuits be joined together and connected to the apparatus, shown as grounded, or some lines may be metallic and some grounded, and the metallic returns of the metallic circuits connected to ground at the central office.

Various other modifications may be made without departing from my invention.

The switch Y of the connecting apparatus should normally rest upon the pair of contact-points s' s'. The connection in multiple of the operator's telephone set and the calling-generator B² to the other sets of connecting apparatus is well understood by telephone-engineers.

At board A is shown the night-call S' and battery B³, operated by the annunciators located at that board. These annunciators are not shown.

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

1. In a multiple-switchboard exchange, a test-circuit comprising three parallel branches, one temporarily closed branch containing a test receiving instrument, and each of the other two branches normally closed through contacts opened by switchboard apparatus when in use, said test receiving instrument giving one indication while the two branches are closed, and giving a second indication while they are open, and a test-battery in said test-circuit.

2. In a multiple-switchboard exchange, a test-circuit comprising three parallel branches, one temporarily closed branch containing a test receiving instrument and battery, and each of the other two branches normally closed but opened by switchboard apparatus while in use, resistances in each of said other two branches, said test receiving instrument and battery being so adjusted to each other and to said resistances as to give one indication while the two branches are closed, and a different indication while either or both of said branches are open.

3. In a multiple-switchboard exchange, in the order named, a grounded subscriber's circuit, normally closed switchboard-contacts open while the line is switched for use, test-contacts, call-contacts, normally closed but open during a call, and a ground connection; in combination with a grounded test outfit adapted to be connected to a test-contact and give one indication while said switchboard and call contacts are closed, and a different indication while said contacts are open.

4. In a multiple-switchboard exchange, in the order named, a grounded subscriber's outfit containing a resistance, normally closed switchboard-contacts open while the line is switched for use, test-contacts, and a call-circuit and resistance grounded through normally closed contacts open during a call; in combination with a grounded test outfit adapted to be connected to a test-contact for testing so adjusted to said resistances as to give one indication while said contacts are closed and a different indication while either the call-contacts or the switchboard-contacts or both are open.

5. In a multiple-switchboard exchange, in the order named, a grounded subscriber's line containing a resistance, pairs of normally closed switchboard-contacts, one pair at each board opened while the line is switched for use, test-contacts, one at each board, an annunciator-circuit containing a resistance, normally closed contacts open during a call, and a ground connection; in combination with grounded test receiving instruments, one at each board, adapted to be connected to a test-contact for testing, and test-batteries, said batteries and test receiving instruments being so adjusted to said resistances as to respond while on testing, neither the switchboard nor the annunciator contacts are open, but not otherwise.

6. In a multiple-switchboard exchange, in

the order named, a grounded subscriber's line containing a resistance, pairs of normally closed switchboard-contacts, one pair at each board opened while the line is switched for
5 use, test-contacts, one at each board, an annunciator-circuit containing a resistance and normally closed contacts open during a call, and a ground connection; in combination with
10 grounded test receiving instruments, one at each board, adapted to be connected to a test-contact for testing, and test-batteries, said

batteries and test receiving instruments being so adjusted to said resistances as to respond while on testing, neither the switchboard nor the annunciator contacts are open, 15 but not otherwise, and a switch-plug adapted to open a pair of said switchboard-contacts.

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Witnesses:

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