

(No Model.)

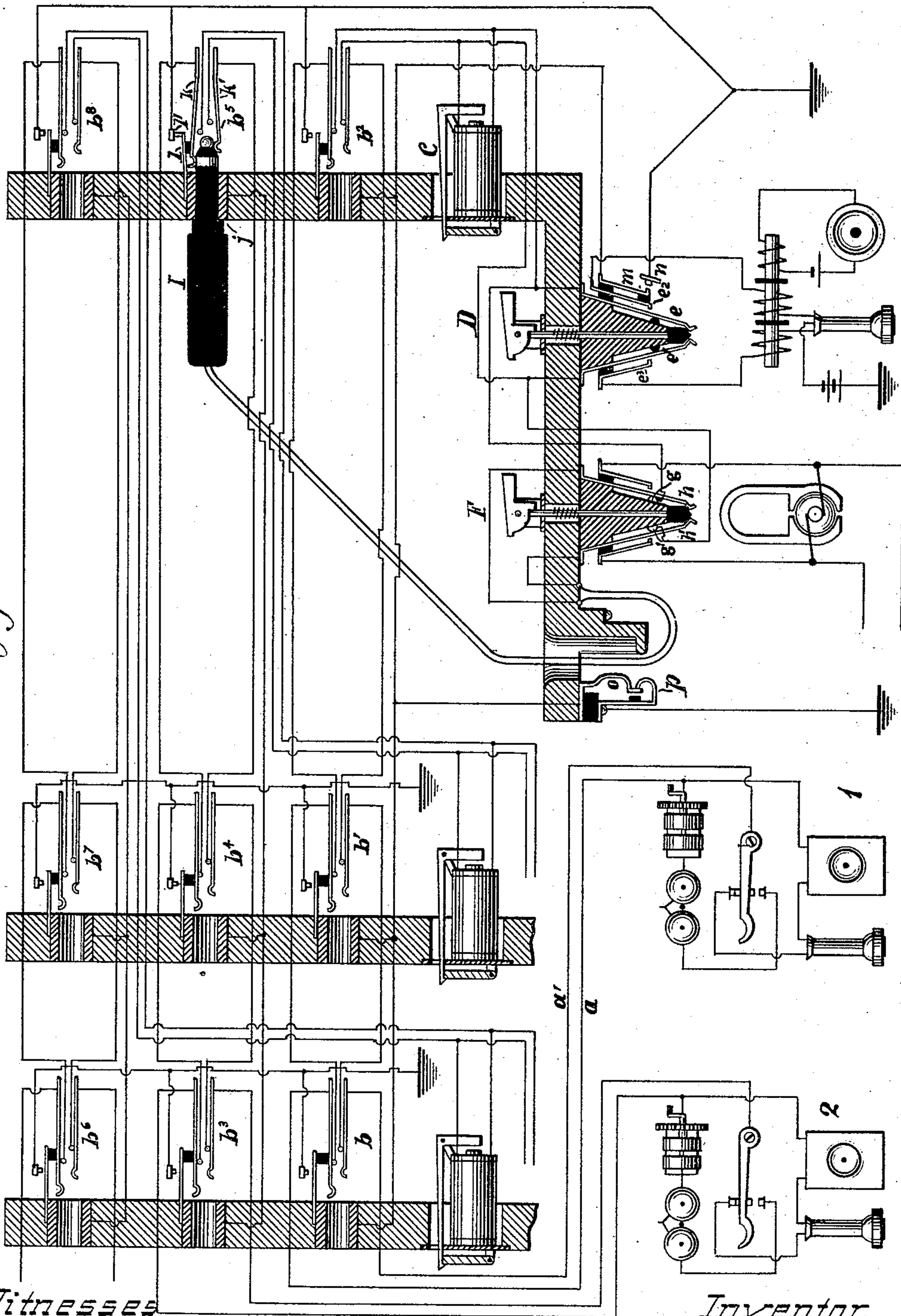
O. A. BELL.

TEST CIRCUIT FOR MULTIPLE SWITCHBOARDS.

No. 488,053.

Patented Dec. 13, 1892.

Fig. 1.



Witnesses

Charles G. Hawley
F. A. Boynton.

Fig. 2.



Inventor.

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UNITED STATES PATENT OFFICE.

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TEST-CIRCUIT FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 488,053, dated December 13, 1892.

Application filed March 12, 1891. Serial No. 384,734. (No model.)

To all whom it may concern:

Be it known that I, ORO A. BELL, a citizen
of the United States, residing at Brooklyn, in
the county of Kings and State of New York,
5 have invented a certain new and useful Im-
provement in Test-Circuits for Multiple
Switchboards, (Case No. 1,) of which the fol-
lowing is a full, clear, concise, and exact de-
scription, reference being had to the accom-
10 panying drawings, forming a part of this
specification.

My invention relates to multiple-switch-
board systems for telephone-exchanges; and
its object is to provide means whereby a line
15 which is in use may be made to test "busy,"
which means, however, shall not have any
electrical connection with the telephone-line
itself.

In an application, Serial No. 379,948, filed
20 February 3, 1891, I have described a system
in which this object is attained in connection
with the type of multiple switchboard known
as the "two-cord system;" but herein I will
describe a method of accomplishing the same
25 general result in connection with the "single-
cord system."

My invention herein may be applied indif-
ferently to metallic and grounded circuits.

My invention consists in improved appara-
30 tus and circuits for grounding the test-rings
of the line of a calling subscriber, and pro-
vides, first, in connection with the listening-
key of a line, contacts adapted to be closed
by the operation of connecting the telephone
35 to the line and when so closed to complete a
ground connection to the series of electrically-
connected test-rings of that line, so that the
operator in answering a call at one board
makes the line of the calling subscriber test
40 "busy" at all other boards from the moment
she closes her telephone to the line by oper-
ating the said key; second, in connection with
the terminal plug of a line, contacts normally
held open by the presence of the plug in its
45 socket, but adapted to close a ground con-
nection to the series of electrically-connected
test-rings when the plug is withdrawn from
its socket, whereby the line of the calling
subscriber is put in condition to test "busy"
50 as long as its terminal plug remains out of its
socket.

My invention will be more clearly under-
stood by reference to the accompanying draw-
ings, in which—

Figure 1 is a diagram of three telephone- 55
lines connected with three switchboards, with
the operator's outfit at the last board. Fig. 2
is a longitudinal sectional view of the plug.

The circuits connecting these several stations
with the exchange are shown as metallic. The 60
lines a and a' from station 1, for example,
may be traced through the line-springs and
contacts of spring-jacks $b b' b^2$ on the first,
second, and third sections of switchboard, re-
spectively, to the annunciator c , which is 65
bridged across between the two lines, thence
to the listening-key D , where the lines are
connected to the springs $e e'$, respectively, of
the listening-key, thence to the ringing-key F ,
through contacts $g g'$ and springs $h h'$, through 70
the strands of a cord, and terminating in
the sleeve and tip, respectively, of a plug I .
The circuit from station 2 may be traced
similarly through its line-jacks $b^3 b^4 b^5$ at the
first, second, and third boards, respectively, 75
thence returning to its annunciator at the
second board. The circuit from another sta-
tion 3, which is not shown, also extends
through its spring-jacks $b^6 b^7 b^8$ at the first,
second, and third boards, respectively, and 80
returns to its annunciator at the first board.
The keyboard connections of the circuits at
their respective terminal boards from stations
2 and 3 are not shown, but are similar to those
of lines $a a'$ at the third board. 85

I will now describe briefly the novel fea-
tures of my invention.

The spring-jacks, as b^2 , at the various
boards are provided with test-rings j , insu-
lated from the line-springs $k k'$ and their con- 90
tacts and furnished with normally-open con-
tacts $l l'$, which are adapted to be closed by
the action of thrusting a plug into the jack.

The individual annunciators, as c , and the
ringing-keys, as F , are of a type well known 95
in the art.

The general construction of the listening-
key, as D , is also well known; but in addition
to the usual springs $e e'$ and their respective
contacts $e^2 e^3$, which are constructed to be 100
closed together by the operation of throwing
the cam into its vertical position, my inven-

tion provides a spring m , insulated from but mechanically in contact with the contact-spring e^2 and so adjusted that when the spring e is forced into contact with its contact-spring e^2 the spring m shall be forced against its contact n and shall thus close a ground connection to the test-rings, as before described

The terminal plug I is constructed with a central core i , ending in a spherical tip i' . Around this core is an insulating-sleeve i^2 , and outside this sleeve a tube i^3 , expanded at i^4 for a small part of its length to the diameter of the stem or shank of the plug, the expansion forming the contact for one of the line-springs. The remainder of the stem and the body of the plug have an insulating-covering i^5 .

In connection with the socket in which the terminal plug I rests when not in use my invention provides a spring o , the curved portion of which bears against the base of the plug I when the latter is present and is held open from its contact p . When, however, the plug is withdrawn, the spring o closes upon its contact p .

The operation of the switching system shown and of my invention in connection therewith may now be traced. Suppose that the operator at the third board sees the annunciator-shutter c fall. She throws the cam of her listening-key D into its vertical position, which, as described, loops her telephone into the circuit of station 1 and also closes the spring m against its contact, which completes an earth connection to the test-ring of the line-jacks of station 1. To this latter connection, however, I shall revert in considering the operation of testing.

Having received the order from the calling subscriber 1, say, for a connection with subscriber 2, the operator proceeds to test to determine whether the line required is or is not busy. This she does by presenting the tip of the terminal plug I to the test-ring of switch b^5 at her board. If now the line of the subscriber called be busy, she will perceive the characteristic sound in her telephone. Thus if the operator at the second board, at which the line from station 2 terminates, has her telephone connected to that line then the spring m of her listening-key is closed upon its contact and has closed a ground connection to the series of test-rings of the switches of line 2, as before described in connection with the operation of listening on the calling-line. Hence the battery of the testing operator, which is included in a connection from earth to the middle of her telephone-coil, finds circuit through one-half of her telephone-coil, through the contacts $e' e^3$ of one side of her listening-key, through the spring h' and contact g' of her ringing-key F, through one strand of the cord to the tip of the plug I, thence to test-ring of the tested line and to ground, as described. Again, if the second operator has completed the con-

nection desired by subscriber 2 and thrown her listening-key into its normal condition still the terminal plug of line from station 2 is out of its socket, and hence the spring o is closed upon its contact and completes another ground connection to the test-rings of the switches of line 2, so that the current of an operator testing as before would find circuit as before to the test-ring of the tested line, thence through spring o and contact p to earth. Suppose, however, that another subscriber has obtained a connection with 2. Then the terminal plug and listening-key of the latter line would not be in use; but in making the connection to the line of subscriber 2 the connecting operator would have thrust the terminal plug of the calling subscriber into some one of the line-jacks of line 2, closing the contacts $l l'$ and completing a third ground connection to the test-rings of line 2, as described. This condition is shown at the third board, where the terminal plug I of line from station 1 is shown thrust into the line-jack b^5 of line from station 2. The battery of an operator testing would now find circuit from the tip of her testing-plug through the series of test-rings to that one at which the jack was in use, thence through contacts $l l'$ to ground. If the line from station 2 be not busy, then the testing operator will hear no sound in her telephone, since the test-rings are nowhere connected to ground. Having found that line not busy, the operator at the third board thrusts the terminal plug of line from station 1 into the line-jack b^5 of line from station 2, raises the lever of her ringing-key F, thus disconnecting the terminal plug of line from station 1 from that line and connecting it to a calling-generator, from which the calling-current passes over the lines to station 2 and operates the call-bell provided there. The ringing-key having been returned to its normal position, the calling and answering subscribers are now in communication. Circuit may be traced from station 1 over line a , through the upper line-springs and contacts of its line-jacks, past the listening-key, through the contact and spring on the right side of ringing-key, through one strand of the connecting-cord and the tubular portion or sleeve of the terminal plug I to the upper line-spring of jack of line from station 2, thence through the upper line-springs and contacts of the line-jacks of that line at the preceding boards and over one of the lines to station 2, thence returning over the other line, through the lower line-springs and contacts of the spring-jacks, through the tip of terminal plug I of line from station 1, through the corresponding strand of the cord, through the spring and contact on the left side of ringing-key, past the listening-key, through the lower contacts and springs of the line-jacks and over line a' to the starting-point. Having thus traced the communicating and the testing circuits, it will be seen that when a line is in use it is provided with a busy-test circuit which has

no electrical connection with the talking-circuit, and hence the injurious effects of the common system of putting a ground connection on one side of the line are avoided.

5 I do not wish to claim, broadly, a test system independent of the talking-circuits, nor the construction of the spring-jack provided with contacts adapted to close a test-piece to ground when a connection is made to the jack, since
10 these have been described and claimed in Letters Patent No. 308,315, granted Milo G. Kellogg November 8, 1884; but

I claim as new and desire to secure by Letters Patent—

15 1. The combination of a spring-jack having line-springs connected to the two sides of a telephone-line, and a test-ring insulated from the line-springs with a plug having an inner conducting-core adapted to come into
20 contact with one of the line-springs, a sleeve of insulating material surrounding the core, except at that portion which comes into contact with the line-spring, and a metallic tube surrounding the insulated core and terminating
25 near the tip of the plug in an enlarged portion adapted to make contact with the other line-spring and having an insulating-covering surrounding it for such portion of its length as to prevent its coming in contact with the test-
30 ring of the jack, in the manner and for the purpose specified.

2. In a listening-key for telephone-exchange systems, the combination of normally-open contacts adapted when closed to connect
35 the operator's telephone to a subscriber's line, means for closing the contacts, a test-ring and ground connection therefrom, and contacts in said ground connection closed by the act of connecting the operator's telephone to
40 line, substantially as specified.

3. The combination, with telephone-lines extending from the subscriber's station through the line-springs and contacts, of

spring-jack switches provided with test-rings insulated from the line-springs, respectively, 45 thereof, the test-rings of the spring-jack switches of each line being electrically connected together, of a listening-key provided with contacts, which contacts are closed to complete a ground connection to the test- 50 rings when the listening-key is operated, to connect the telephone of the operator to a line, substantially as specified.

4. The combination, with two telephone-lines, each provided with switches on two or 55 more switchboards, and one of said lines being provided with a flexible cord and plug adapted to be inserted in the spring-jack switch of the other line to loop the two lines together, of a listening-key provided with contacts, 60 one of which is connected to earth and the other to the series of test-rings of the lines, and a socket adapted to receive the plug when not in use, said socket being provided with normally-open contacts, said contacts being 65 adapted to close together upon the removal of the plug from the socket and to connect the test-rings of the switches to earth, substantially as specified.

5. The combination, with a spring-jack having 70 two line-springs and a test-ring insulated from said line-springs, of a connecting-plug having a central core furnished with a tip making contact with one of said line-springs, a conducting-sleeve insulated from the core and 75 making contact with the other of said line-springs, and a sleeve insulating the said conducting-sleeve from the test-ring, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe 80 my name this 27th day of February, A. D. 1891.

ORO A. BELL.

Witnesses:

FRANK PIERSON,
JOHN O. PARSONS.