

(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.

TEST CIRCUIT FOR MULTIPLE SWITCHBOARD SYSTEMS.

No. 484,867.

Patented Oct. 25, 1892.

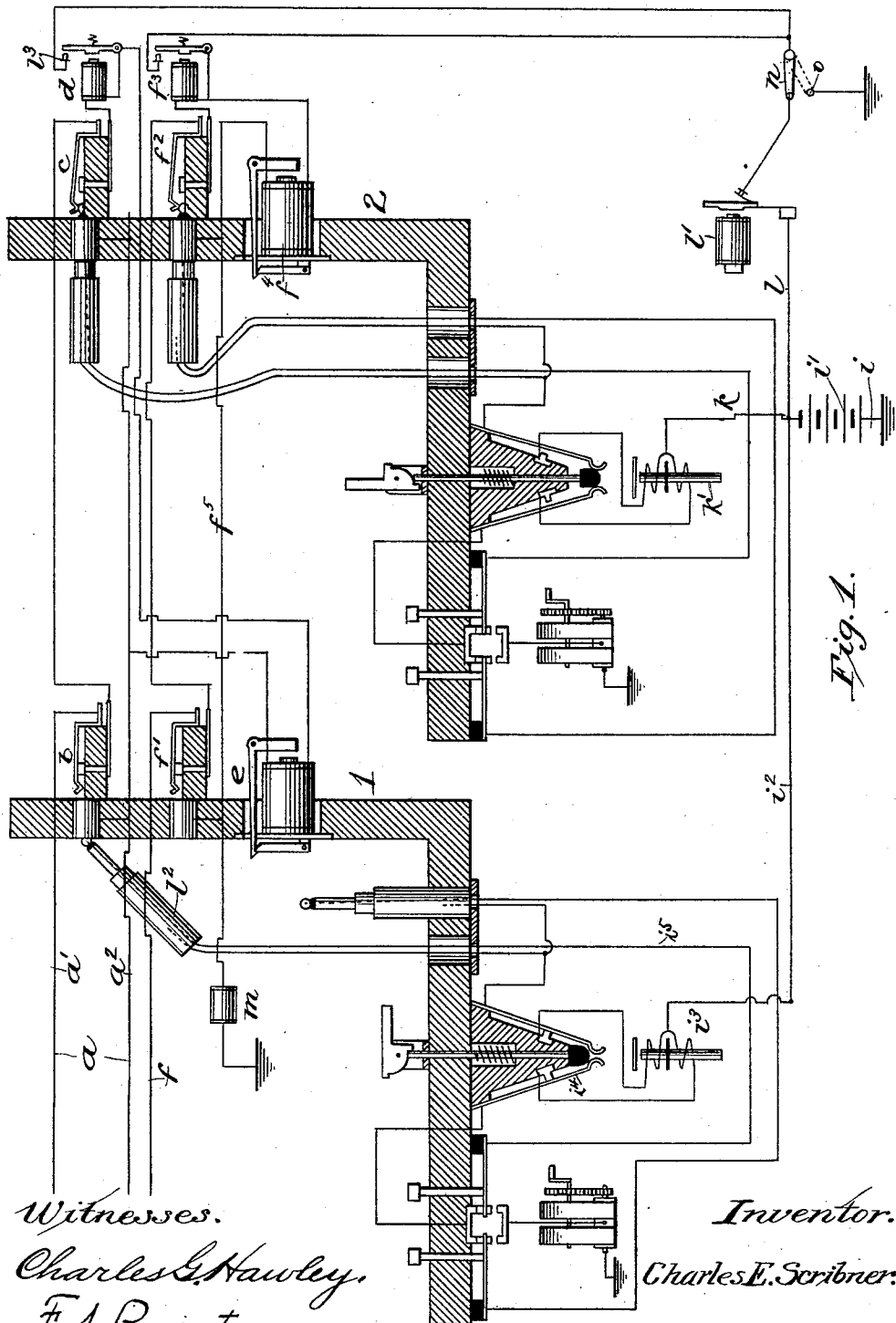


Fig. 1.

Witnesses.

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T. A. Boynton

Inventor.

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(No Model.)

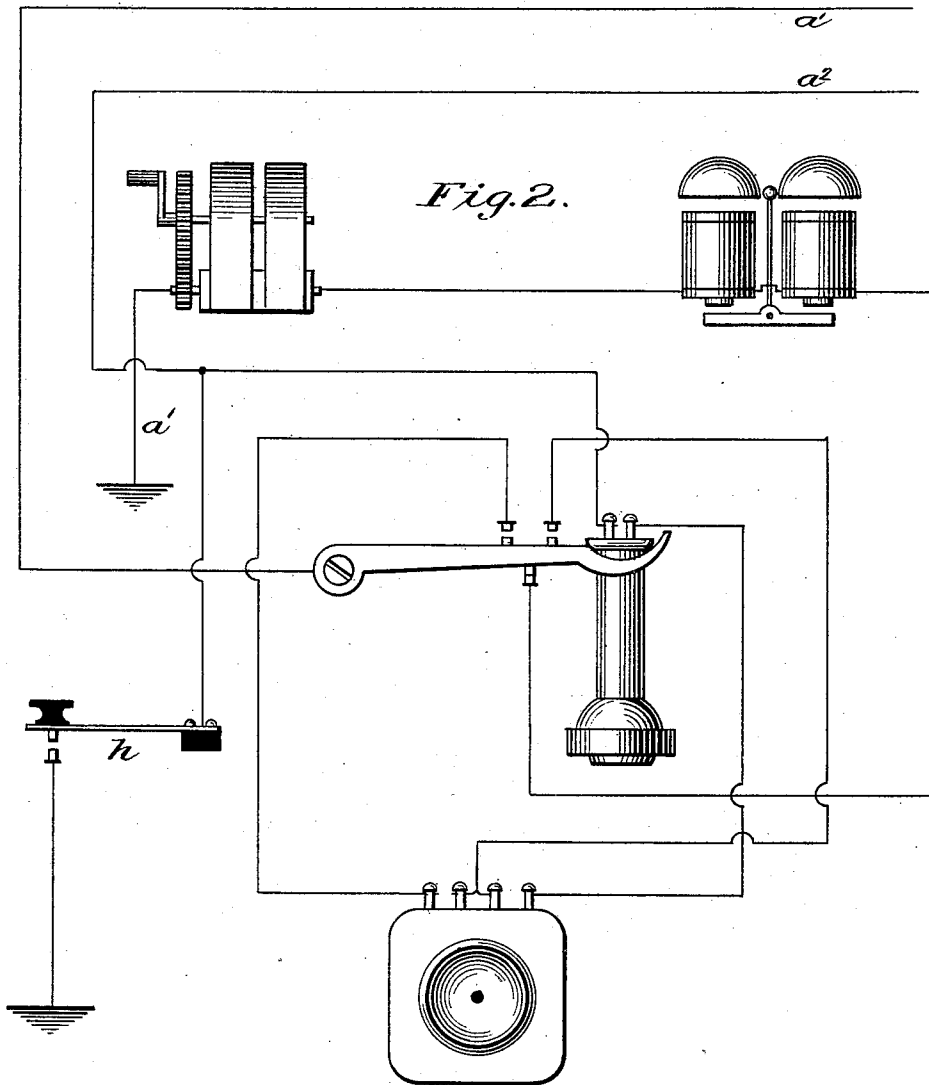
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Fig. 3.

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UNITED STATES PATENT OFFICE.

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TEST-CIRCUIT FOR MULTIPLE-SWITCHBOARD SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 484,867, dated October 25, 1892.

Application filed March 1, 1890. Serial No. 342,275. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Test-Circuits for Multiple-Switchboard Systems, (Case No. 220,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

A testing or indicating device consisting in a buzzer placed in the line between the contact of the last switch of the line and the test-piece thereof in connection with means at the different boards for connecting a test-battery and telephone with the test-piece of the line have been heretofore employed, as is shown in my applications, Serial No. 222,698, filed December 27, 1886, for test-circuits for multiple switchboards, and Serial No. 222,706, filed December 27, 1886, for multiple-switchboard-testing apparatus. In case the test-battery thus applied should find circuit the buzzer would respond and the sound thus caused in the operator's telephone would indicate that the line was not open at any of its spring-jack switches—that is, that no connection had been made with the line. It has been found objectionable to have a circuit-interrupter placed thus directly in the line; and the object of my invention is to avoid the necessity of such impairment or possible impairment of the circuit as results from any device therein which intermittently opens and closes the same between the contact of the last switch and the test-piece thereof—in other words, in the portion of the line which is cut off when connection is made with the line at any spring-jack switch by inserting a plug in any spring-jack of the line.

My invention consists, first, in an electro-magnetic responsive device included in the circuit of a telephone-line at a point of the circuit which will be disconnected in the event of the line being connected for use in connection with a circuit-closing device controlled by said responsive device to close a circuit with the circuit of the telephone-line in which the responsive device is included and a telephone and test-battery in connection with the

connecting-cords to actuate the electro-magnetic responsive device.

My invention consists, second, in the introduction of an electro-magnet into the circuit of a telephone-line at a point between the last switch of the multiple-switchboard system and the test-rings of the switches, the armature of the electro-magnet controlling contact-points, the contact-points being included in a branch circuit from the telephone-line to ground or to a buzzer and battery.

My invention consists, third, in providing an electro-magnetic circuit-controller in the cut-off portion of the line in connection with a branch, including a buzzer connected with the test-battery and so arranged that when any line is tested this branch circuit will be closed. This vibrator or buzzer being in an independent branch from the test-battery, it is evident that the integrity of the circuit cannot be impaired by the action of the buzzer or by any imperfection in the contacts thereof.

My invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a diagram illustrative of two telephone-lines connected with two multiple switchboards in connection with testing apparatus at the different boards embodying my invention. Fig. 2 is a diagram of the outfit of a metallic circuit at the subscriber's station. Fig. 3 is a detailed sectional view of the loop-plug.

Referring now to Figs. 1 and 2, the telephone-line *a* extends from the subscriber's station, as shown, in two branches or limbs *a'* *a''*, the branch or limb *a'* passing through the switches *b c* on the different boards, through the coil of the electro-magnet *d*, and thence through the annunciator *e*, and thence to limb *a''*, which connects with the test-pieces of the switches *b c*, and thence by limb *a''* back to the subscriber's station. The circuit of line *f* is the same at the central office, extending through the switches *f' f''*, through the electro-magnet *f''*, thence through the individual annunciator *f''*, and thence to the test portion *f''* of the line, which, instead of returning to the subscriber's station, passes through resistance to ground. The individual annunciators *e* and *f''* of the different lines should be polar-

ized, and the generators at the subscribers' stations may be adapted to send alternating currents or intermittent current in the proper direction to operate the annunciator.

5 The apparatus at the subscriber's station (shown in Fig. 2) consists of an ordinary automatic telephone-switch, a telephone and transmitter, the generator and bell, and a grounding-key *h*, which on being depressed
10 loops the generator and bell into the circuit of line *a* to operate the individual annunciator *e*. An ordinary subscriber's outfit will be used in connection with each single-circuit line *f*. Such an outfit, being well known, requires no
15 illustration or special description. Usual looping-in or listening keys and loop plugs and cords are provided at the different switch-boards; also, usual calling-keys for sending signaling-current from the central office over
20 any of the telephone-lines. Each operator has a ground branch connecting with her telephone, a battery or a source of electricity being included in or connected with such ground branch, such battery serving as the test-bat-
25 tery and being preferably common to several operators.

A special feature of my invention consists in a branch connection from the test-battery through a constantly-operated circuit-breaker
30 to the contact-points of the circuit-controllers, as *d f*³, of the different telephone-lines. Thus we have the ground branch *i*, containing the battery *i'*, this battery being preferably common to several subscribers' outfits.
35 Thus this battery *i'* is connected by branch *i*² with operator's telephone *i*³ at board 1 and by branch *k* with the center of the coil of the operator's telephone *k'* at board 2. Now connected with the same pole of this battery we
40 have also the branch *l*, which includes the constantly-operated circuit-interrupter *l'*. Any instrument which will constantly interrupt the circuit *l* may be used. This branch
45 *l* is extended to the different contacts of the armatures of the electro-magnetic devices *d f*³ of the different telephone-lines or as many thereof as may be convenient. The individual annunciators *e f*⁴ of the different lines are polarized and so placed in the circuit that
50 they will not respond or be operated by any current that may be closed through them from the test-battery.

The battery *i'* is the test-battery included in the ground branch *i*, connected by branches
55 *k* and *i*² through a portion of the coil of the different operators' telephones *i*³ *k'*. When the tip of a plug, as plug *l*², is applied to the test-piece of a line, the battery *i* will be connected to the tip of said plug, when the tele-
60 phone, as telephone *i*³, is connected in the circuit. Now if the line tested is in use at some other board the line will be open at the contact-switch where the connecting-plug is inserted at such other board, and hence the
65 circuit of test-battery *i'* will not be completed to ground at the subscriber's station on account of such opening in the circuit at

the board where the connecting-plug is inserted in the switch. Therefore the circuit-
70 controller will not be operated to connect the branch leading to ground at the central office to the telephone-line. If, however, the line tested is not in use, the test-battery will find
75 circuit from the tip of the plug to the test-piece of the line to which it is applied, and thence over the portion of the line containing the individual annunciator thereof, through
80 the coil of the circuit-controller, and thence through the portion of the line containing the contact-springs of the spring-jack switches, and thence to ground at the subscriber's station, thus sending current through the circuit-
85 controller to excite the same, and the armature of the circuit-controller, being attracted, will close the branch to ground at the central office to the telephone-line tested. Suppose, for example, the plug at board 2 is removed from the switch *c*, in which case line
90 *a* will be free. In such case the circuit from test-battery *i* would be over branch *i*², through the lower half of the coil of telephone *i*³ to the
95 spring *i*⁴ of the loop-switch, and thence to the strand *i*⁵ of the loop-plug *l*², and thence to the tip of the plug. From the tip of the plug the circuit would continue to the test-piece of the
100 switch *b*, and thence through the coil of individual annunciator *e* of line *a*, and thence through the coil of the circuit-controller *d*, and thence through the contact and spring of switch *c*, and thence over the limb *a'* to ground
105 at the subscriber's station, as shown in Fig. 2. The individual annunciator *e*, being polarized, will not respond to the current of the test-battery thus directed through it. The electro-magnet of the circuit-controller *d* will, however, be excited and attract its armature
110 to close the same upon contact *l*³, and thus the branch leading from said contact *l*³ to ground at the central office will be closed. This branch from contact *l*³ will be interrupted, so as to cause an intermittent action
115 or fluctuation of the strength of the current passing through the operator's telephone *i*³. Thus if the line is not in use the operator, listening at her telephone *i*³ and hearing the sound caused by such fluctuation in current, will know that the line tested is free.

As shown in Fig. 1, the two telephone-lines
120 *f* and *a* are looped together for conversation at the second board. When thus connected, both lines will test busy at all the other boards—as, for example, at board 1. Thus
125 when plug *l*² is applied to the test-piece of switch *b*, as shown, the battery *i'* will find circuit to the tip of said plug *l*², but not through the coil of the test-circuit closer *d* of
130 line *a*, and hence the branch connection *l*³ will not be closed by the action of battery *i'* upon the electro-magnet of circuit-controller *d*, and the circuit-interrupter *l'* will produce no effect in the operator's telephone *i*³ at board 1. If, however, the plug is removed from the switch *c* at board 2, then when the tip of plug *l*² is applied, as shown, to the test-

piece of switch *b* the battery *i'* will find circuit through the electro-magnet *d* to close said contact *l*³ of branch *l*, which contains the circuit-interrupter *l'*, and the interruptions caused by the instrument *l'* will be heard in the operator's telephone *i*³ at board 1. The circuit of the battery when thus closed may be traced from battery *i'* by branch *i*² through half of the winding of telephone *i*³, through a contact and spring of the loop-switch, and thence to the strand of the cord of plug *l*², connected with the tip thereof, and thence to limb *a*² of the metallic circuit. This limb *a*², it will be observed, is normally open at the subscriber's station, and hence the circuit will be completed through individual annunciator *e*, and thence through the coil of electro-magnet *d*, and thence over limb *a'* to the ground of said limb *a'* at the subscriber's station. The annunciator *e* being polarized will not respond. The electro-magnet *d* will, however, attract its armature, and hence the contact *l*³ will be closed. A new circuit will thus be formed from test-battery *i'* over limb *l* through the circuit-interrupter to the telephone-line *a*. This derived or additional circuit from the battery will intermittently shunt a portion of the current of the battery from the telephone, and thus the operator listening at the telephone will know that the branch circuit has been closed, and hence that the line is free. In case she does not hear the interruptions, she knows that the circuit-controller *d* has not been operated and that the line is in use.

It will be understood that the resistance *m*, included in the line *f*, will be sufficiently high—say two hundred and fifty ohms or more—to divert sufficient test-current through the circuit-controller *f*³ to cause the same to respond.

Thus far I have made no reference to a modification of my device, which consists in dispensing with the common branch *l* and the special circuit-interrupter *l'* and connecting the contacts of the circuit-controllers *d* *f*³ directly to ground. This may be accomplished by throwing the switch *n* over to ground-contact *o*, as indicated by the dotted lines. In this position of the switch the branch *l* and the circuit-interrupter *l'* will have no function. The circuit-controllers *d* *f*³ will, however, it is evident, be set in vibration when battery is closed through them, as will be the case if the lines are free when the test is made. This vibration, it is evident, will be caused by the armature-lever of the circuit-controller grounding the test-battery direct, thus intermittently diverting it from the coil of the controller, the armature thus vibrating on its front contact-point, as *l*³, and thus creating a buzz in the operator's telephone to indicate that the line is free, the absence of the buzz indicating that the line is busy.

Having thus described my invention, I

claim as new and desire to secure by Letters Patent—

1. Telephone-lines extending from ground at the subscribers' stations thereon to multiple switchboards at the central office, each line including a circuit-controller after passing through its switches on the switchboards, an operator's telephone connected with a test-battery at each board, and means for connecting the circuit, including said telephone and battery, with the test-piece of any of the telephone-lines and branch circuits, one for each telephone-line, and adapted to be intermittently interrupted by the influence of the circuit-controller, substantially as and for the purpose specified.

2. A telephone-line extending from ground at the subscriber's station through the springs and contacts of switches on different multiple switchboards and through a circuit-controller and thence to the test-rings of said switches, a telephone connected with a ground branch at each of the switchboards, with means for closing said ground branch to the test-ring of any of the switches of its board, in combination with a branch circuit from the same battery through a circuit-interrupter to contacts of the different circuit-controllers, whereby when the ground branch, including the battery and telephone, is closed to the test-ring of the switch of a line at any board the operator by listening at the telephone may determine whether the line tested is in use.

3. The test-battery in a ground branch connected with several operators' telephones and to connecting-plugs, in combination with a branch *l* from said battery containing a circuit-interrupter, said branch after passing through said circuit-interrupter being extended to circuit-controllers of the different telephone-lines, and the said telephone-lines normally provided with ground connections at the subscribers' stations thereon, whereby the different lines may be tested, substantially as and for the purpose specified.

4. In a telephone-exchange system, lines connecting with different switches upon multiple switchboards, each line including a circuit-controller between the switch at the last board and the test-ring of the switch, a ground connection from each circuit-controller, adapted to be closed with the telephone-line by the circuit-controller, a test-battery included in the circuit with the operator's telephone, and a test-plug whereby the circuit-controller may be operated to close the ground branch when the test-plug is applied to a test-ring to indicate whether a line is in use.

In witness whereof I hereunto subscribe my name this 7th day of February, A. D. 1890.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,

GEORGE P. BARTON.