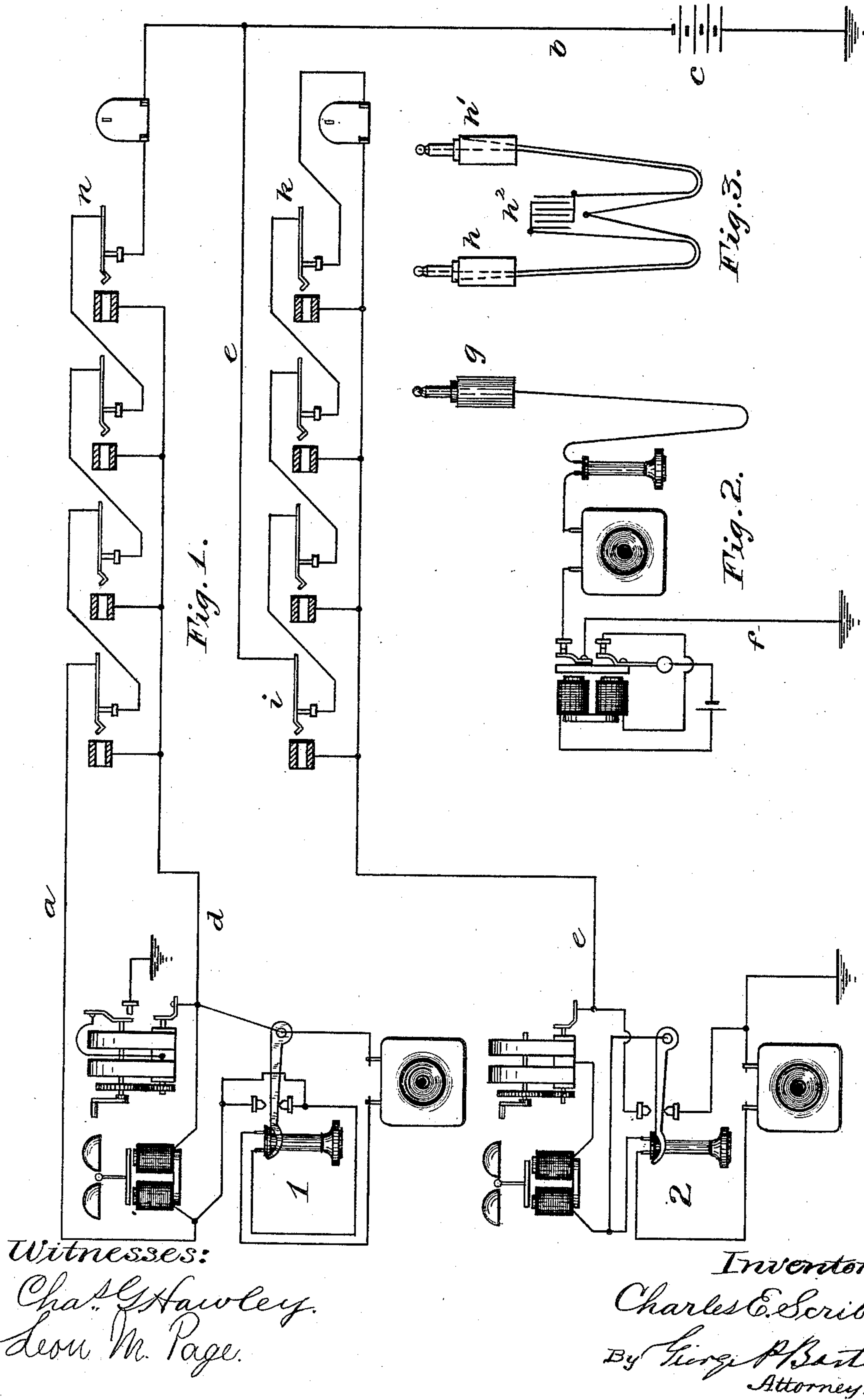


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TEST CIRCUIT FOR MULTIPLE SWITCH BOARDS.

No. 427,623.

Patented May 13, 1890.



(No Model.)

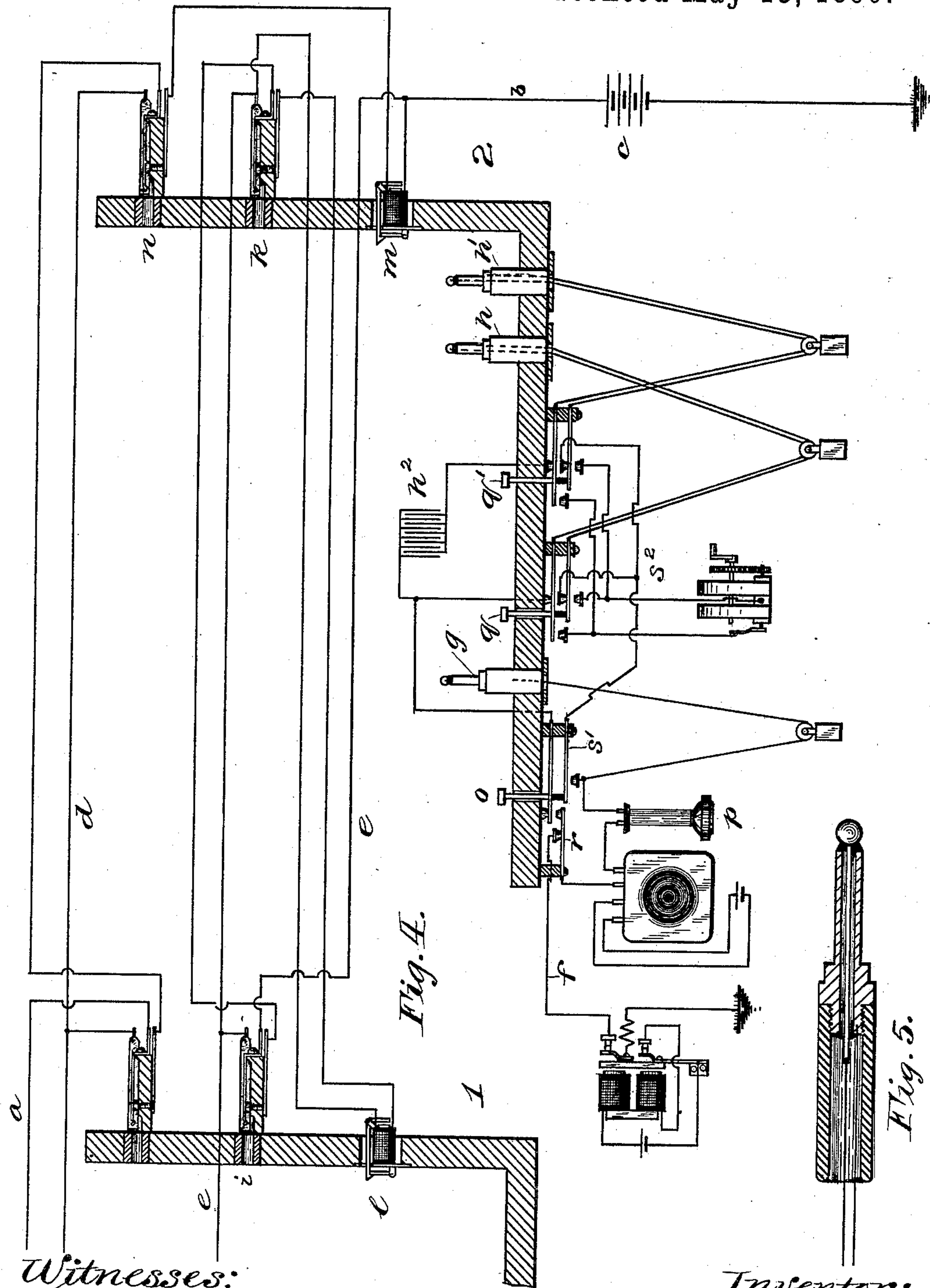
2 Sheets—Sheet 2.

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TEST CIRCUIT FOR MULTIPLE SWITCH BOARDS.

No. 427,623.

Patented May 13, 1890.



Witnesses:
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L. M. Page.

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By George P. Barton
Attorney.

UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

TEST-CIRCUIT FOR MULTIPLE SWITCH-BOARDS.

SPECIFICATION forming part of Letters Patent No. 427,623, dated May 13, 1890.

Application filed June 1, 1888. Renewed February 24, 1890. Serial No. 341,404. (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 Switch-Boards, (Case 158,) 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.

My invention relates to telephone-exchange systems; and its object is to provide ready means of testing to determine whether a line wanted is already connected or in use, in order that confusion may be avoided.

My testing apparatus is designed for use in systems having metallic telephone-circuits and single telephone-circuits.

My invention consists in testing apparatus placed at the different switch-boards and the telephone line-circuits and switching apparatus combined with a battery in such manner that on making a test circuit will be closed from the battery through a telephone if the line tested is free. If, however, the line is in use, the battery will not find circuit through the telephone, since the battery will be open or cut off at the spring-jack at which connection has been made with the line tested. I preferably include in the circuit of the telephone a rheotome or buzzer, in order that when the circuit is closed through the telephone there may be a more definite characteristic tone or sound produced as the battery is closed through the same. The simple closing of the battery-circuit, however, through the telephone will produce a click or sound, which will indicate the fact that the battery-circuit has been closed. I preferably place in the circuit of one of the strands of each pair of cords a condenser, in order that when a single line-circuit is connected with a metallic line-circuit the battery may not have a direct ground-connection when the test is made.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a diagram illustrative of two telephone-circuits—one metallic and the other single—each connected with different spring-jack switches and separate annunciators to a

common ground-line at the central office, in which common ground-line is included the test-battery. Fig. 2 is a view of the testing apparatus proper, consisting of a plug and cord connected through a telephone and vibrator to ground. Fig. 3 is a view showing a condenser in the strand of the pair of cords which connect with the tips of the loop-plugs, respectively. Fig. 4 is a diagram showing the two lines connected with switches on two different switch-boards, their annunciators, respectively, and the common ground-line, including the test-battery, the connecting and testing apparatus being shown somewhat in detail at one of the boards. Fig. 5 is a sectional view of one of the loop-plugs, the tip being shown insulated from the sleeve.

Like parts are indicated by similar letters of reference in the different figures.

In Fig. 1 are shown two subscribers' stations and lines connecting said stations with the spring-jack switches of the lines upon the different switch-boards. Station 1 is upon the metallic circuit, the limb *a* of which extends through the springs and contacts of the switches of the line, through an annunciator, to a common line *b* and a battery *c* to ground. The return portion or limb *d* of the metallic circuit extends from station 1 to the test-pieces of the different switches of the line and is normally open at said test-pieces. The line *e*, connecting station 2 with the central office, is connected first with the test-pieces, and thence passes through the annunciator of the line, and thence in reverse order through the contacts and springs of the switches, and thence to the common line *b*. The advantage of thus connecting line *e* with the test-pieces, the annunciator, the contacts, and springs in the order stated will be more particularly pointed out in connection with the testing apparatus.

In Fig. 2 I have shown a ground-circuit *f* passing through a buzzer and a telephone and a flexible cord to terminal test-plug *g*. The loop-plugs *h h'* (shown in Fig. 3) are of the form illustrated in detail in Fig. 5, the tip of the plug being insulated and connected with one strand of the cord, while the insulated sleeve is connected with the other strand of the cord. The condenser *h²*, as shown in Fig.

3, is placed in the strand which connects the tips of the loop-plugs.

In Fig. 4 I have shown the metallic circuit connected through two spring-jack switches on different switch-boards and with a common line *b*. Single circuit *e* is connected with two spring-jack switches—one on each of the boards—passing first to the test-piece of switch *i*, thence to the test-piece of switch *k*, thence through the annunciator *l*, thence through the contact and spring of switch *k*, and thence through the contact and spring of switch *i*, and thence to the common line *b*. The connecting, signaling, and testing apparatus is illustrated at the second switch-board.

I will now describe the manner of receiving and answering the calls, testing the line called for, and completing the connection therewith.

We will suppose the operator at board 2 sees the shutter of annunciator *m* fall. She at once inserts one of a pair of loop-plugs into spring-jack *n* of the line—say plug *h*. Station 1 is thus brought into the circuit of the strands of the cord connecting with plug *h*, the strands being bridged by depressing key *o*, so as to bring the operator's telephone *p* into circuit. The circuit thus formed may be traced from limb *a* of the circuit to the spring of spring-jack *n*, thence to the tip of plug *h*, and from the tip of plug *h* through the upper spring of calling-key *q*, thence to the spring of key *o*, which being depressed, is in contact with key *r*, and said key, being likewise depressed, is separated from terminal contact of ground-wire *f*. Thence the circuit may be traced through the transmitter and telephone *p* to spring *s'*, thence to connection *s''*, and thence to the lower spring of key *q*, which is connected with the strand of the cord leading to the sleeve of plug *h*. This sleeve being in contact with the insulated frame or test-piece of spring-jack *n*, the circuit will be closed to the limb *d* of the metallic circuit, which is connected with said insulated frame or test-piece. If plug *h'* were inserted in switch *n* instead of plug *h*, the circuit would be closed through the telephone *p* on depressing key *o*, as before described. Thus on inserting either loop-plug in the switch of a calling-line and depressing key *o* telephone *p* is brought into circuit. The operator receives the call at telephone *p*, and then proceeds to test the line called for, using for this purpose test-plug *g*. We will suppose the subscriber asks for the line *e*, connecting with station 2. The operator, in order to test, will touch the tip of test-plug *g* to the test-ring of spring-jack *k* of said line *e*. Referring now to Fig. 1, it will be observed that when the tip of plug *g* touches the test-ring of switch *k* the circuit of battery *c* will be closed through telephone *p* in case the other spring-jack switches of the line are closed. If, however, a plug is inserted in any other spring-jack of the line—as, for example, spring-jack switch *i*—the circuit of bat-

tery *c* will be opened at said switch *i*, and it matters not at which board the test is made, since the line *e* runs from station 2 to the test-pieces, and thence back through the contact and spring of each of the switches to common line *b*. Therefore when the tip of plug *g* is touched to any test-ring of the line the battery-circuit will be opened to said plug *g* in case a plug has been inserted in any one of the series of spring-jacks of the lines. As shown in Fig. 4, the spring-jack *i* is closed, and hence when test-plug *g* touches the test-ring of switch *k* the circuit of battery *c* is closed through said plug *g*, the telephone *p*, and ground-wire *f*. The rheotome or buzzer in line *f* constantly interrupts this circuit, and hence when the battery is thus closed through the telephone one listening at the telephone will hear the tone or hum caused by the buzzer. The operator hearing this tone will know that the line is free, and will thereupon insert loop-plug *h'* in switch *k* and signal the subscriber of station 2 by depressing key *q'*.

I have thus described the manner of receiving a call, testing a single-line circuit, making connection between the lines, and signaling the subscriber wanted.

The condenser *h''* in the circuit of the strand of the cords connecting the tips of plugs *h* *h'* prevents battery *c* from being closed to ground when a metallic circuit is thus connected with a ground-circuit.

It is obvious that a metallic circuit may be tested in a similar manner, and that if busy no sound will be heard in the telephone when the test-plug *g* is applied to the test-ring of a spring-jack of the metallic circuit.

As shown in Fig. 1, suppose the tip of plug *g* to be applied to any one of the test-rings of the series of spring-jacks of the metallic circuit composed of limbs *a* *d*. If the springs and contacts of all the spring-jack switches are closed, as shown, the circuit will be formed from the tip of spring *g* to the test-ring of the switch at which the test is made, thence over limb *d*, through station 1, and thence back over limb *a* through all the switches of the line and the annunciator to common line *b*, battery *c*, and ground. If any one of the switches should be open, circuit of battery *c* would be open at the switch at which the connection was made.

It will be understood that at each of the multiple switch-boards I provide apparatus for receiving and answering the calls, making the tests, and connecting and disconnecting the lines. This apparatus admits of innumerable modifications, which would readily suggest themselves to those skilled in the art. I therefore do not limit my invention to the construction shown.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a telephone-line extending from ground at a subscriber's station through the insulated portions of spring-

jack switches distributed on different boards and back through the contacts and springs of said spring-jack switches and a battery to ground, of a telephone in a ground branch including a vibrator or rheotome and means for closing said ground-circuit to the insulated portion of a switch of the line, whereby it may be determined whether said line is open at any other of the series of spring-jacks of the line.

2. The combination, with a metallic circuit looped through a subscriber's station and extending the one limb through the insulated portions or test-pieces of said spring-jacks and the other limb through the springs and contacts of a series of switches, of a single telephone-circuit extending from ground at a subscriber's station through the test portions of a corresponding series of switches distributed on different boards and back through the contact and spring of each of said switches, a common ground-wire, including a battery, loop-plugs inserted in the spring-jacks of said loop-plugs, and a condenser included in one of said strands, whereby two subscribers may communicate.

3. In a telephone - exchange system, the combination, with two or more multiple switch-boards, of one or more metallic circuits connected each with a series of switches distributed on the different boards and with a common line, including a battery, each of said metallic circuits being looped through its subscriber's station therein and extending back to the central office and being connected with and normally open at the test-pieces of

the switches of its line and single-line circuits, each connected through corresponding series of spring-jack switches on the different switch-boards in the following manner: first, through the test-pieces of the spring-jack switches, and thence back through the contact and spring of each of said switches, and thence to a common line, including a battery, and testing apparatus consisting of a telephone included with a vibrator in a ground-circuit at each of the switch-boards, and means for connecting said testing apparatus to the insulated ring or test-piece of the switch of any line, whereby it may be determined at one board whether any line, whether metallic or single, is connected or in use at any other of the boards.

4. The combination, with the telephone-line extending from ground at a subscriber's station through the insulated portions of spring-jack switches distributed on different boards and back through the contacts and springs of said spring-jack switches and a battery to ground, of a telephone in a ground branch and means for closing said ground branch to the insulated portion of the switch of a line, whereby it may be determined whether said line is open at any other of the series of spring-jack switches of the line.

In witness whereof I hereunto subscribe my name this 2d day of May, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

CHAS. G. HAWLEY,

CHAS. C. WOODWORTH.