

(No Model.)

2 Sheets—Sheet 1.

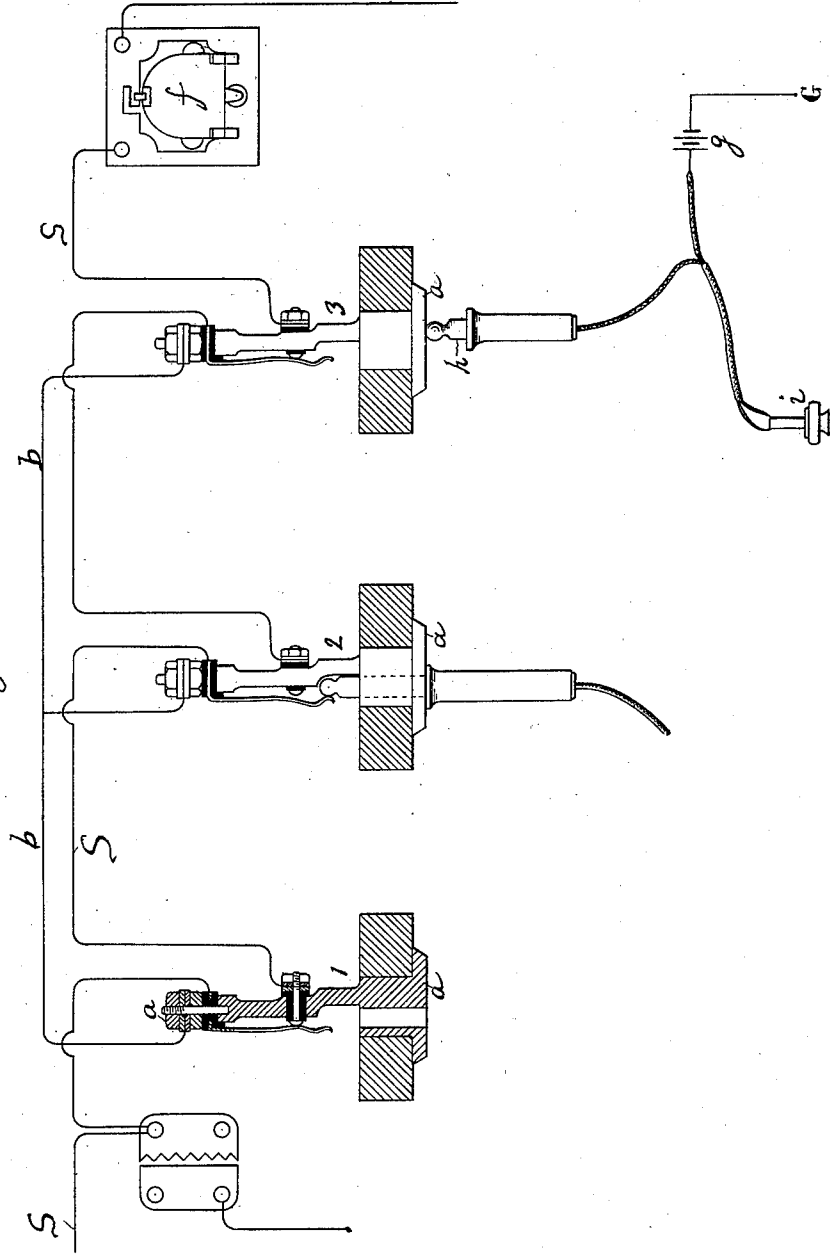
C. E. SCRIBNER.

MULTIPLE SWITCH BOARD FOR TELEPHONE EXCHANGES.

No. 305,021.

Patented Sept. 9, 1884.

Fig. 1.



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Fig. 3.

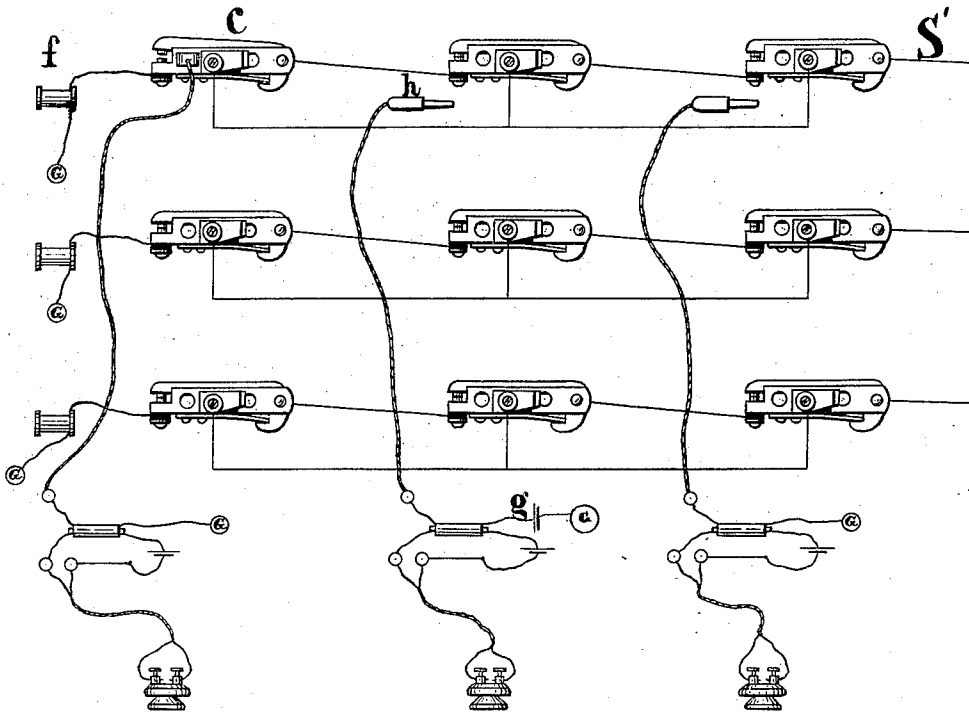
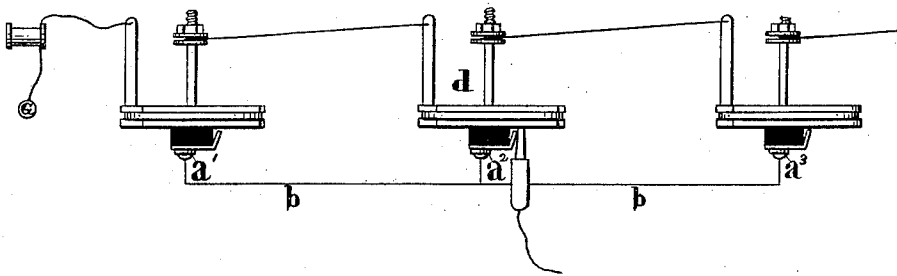


Fig. 2.



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 per: Henry Barton
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UNITED STATES PATENT OFFICE.

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

MULTIPLE SWITCH-BOARD FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 305,021, dated September 9, 1884.

Application filed March 20, 1882. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. SCRIBNER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a certain Improvement in Test-Circuits for Multiple Switch-Boards of Telephone-Exchanges, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, which are made a part of this specification.

My invention relates to the method of ascertaining whether the line of a subscriber asked for at one board is in use at any other of the boards.

Prior to my invention there were several different methods of doing this work. One system is described in British Patent No. 4,903 of 1879. In the electrical systems heretofore used this testing has been done by means of direct currents—that is to say, by opening or closing the test-circuits. It is well known that when a telephone is connected in a closed circuit of any considerable length certain sounds are always audible at the telephone. These sounds or “sputterings” are due to induced currents, which are always found to exist in a closed circuit. If the circuit be opened, these sounds at once cease. These induced currents may be observed by listening at a telephone in a branch which taps a closed circuit. In my system of testing, to determine whether a line called for is in use, I take advantage of these induced currents or other currents that may be present. The telephone-lines in multiple switch-board systems are so arranged that any two lines may be connected together upon either of the boards.

My invention is designed to enable the switchman at one board to determine whether a line called for at his board is in use—that is, connected at any other of the boards; and my invention consists in normally-open test-circuits, one for each telephone-line, and means for crossing or connecting any given telephone-line with its test-circuit while the telephone-line is in use, as herein described and claimed. Each test-circuit is provided with a terminal on each of the boards. I preferably provide on each of the switches upon the

switch-boards a metallic piece or part, which is insulated from the other parts of the switch. These insulated metallic pieces serve as terminals for the test-circuits, and are so placed that when a connection is made with any switch the test-terminal of said switch will at the same time be connected with the line of the switch, thus establishing a “cross” between the said line and its test-circuit. The terminals may, however, be distinct from the switches, and any other device may be used to establish a cross between a line and its test-circuit. At each of the multiple boards I provide a telephone, and preferably a battery, in a circuit which may be connected at will to any one of the terminals of the test-circuits. The switchman listening at the telephone is thus enabled to tell, as the circuit is closed and broken at a terminal, whether a cross exists between the line called for and its test-circuit. If there should be such a cross, he will hear a click or other sound in his telephone, which will be a signal that the line is in use. If no sound is heard when the circuit of the telephone is closed to the terminal of the test-circuit of a line, the switchman will know that the line is free. Any well-known apparatus may be used for receiving and answering the calls of the subscribers and connecting and disconnecting their lines. The individual annunciators are included in the circuits of the different lines between the switches and the ground, so that when a connection is made with any switch of a line the annunciator of said line will be cut off. The annunciators are, however, distributed on the different boards, so that the switchman at a given board may have before him the drops of the lines whose calls are assigned to his board. These annunciator-drops are preferably placed by themselves upon the lower portion of the board, just below the switches, in the usual manner.

My invention is illustrated in the accompanying drawings.

Figure 1 shows a single telephone-line and its test-circuit connected with the switches and terminals, respectively, on three multiple boards.

In Fig. 2 I have shown a top view of three

jackknife-switches through which a telephone-line is connected, and the test-circuit of said line connected with its different terminals, one terminal being on each switch.

5 In Fig. 3 I have shown a front elevation of similar switches for three lines. Each of the switches of a given line is placed on a different board, and at each board I have shown a telephone included in a circuit, and means for
10 closing the circuit of the telephone at any given board, at will, to any one of the test-circuit terminals thereon.

The form of spring-jack illustrated in Fig. 1 is shown and described in my Patent No. 15 262,701, issued August 15, 1882. The spring-jack illustrated in Figs. 2 and 3 is described and claimed in my Patent No. 293,198, issued February 5, 1884. I prefer the form shown in Fig. 1, since a larger number may be in-
20 cluded within a given space; but, as hereinbefore stated, I do not limit my invention to any special form or forms of switch or terminal, since my invention may be used successfully with many well-known forms of switching and
25 connecting devices.

As shown in Fig. 1, the telephone-line S is connected with three spring-jack switches, 1, 2, and 3, each switch being on a different board. The frame *a* of each of these switches is insu-
30 lated from both the line-strip or liner and the ground-connection thereof. It will thus be seen that a given line has a spring-jack terminal on each of the multiple boards, and a test-circuit which connects with the insulated frame
35 *a* of each of these spring-jacks. When a connection is made with a line at any one of the spring-jacks, a cross is established between the line and its test-circuit through the medium of the spring-jack. It is by testing for this
40 cross that an operator at another board is enabled to determine whether the line is busy. This test is made by connecting the circuit of a telephone to the terminal *a* of the test-circuit of the line. I have shown a plug inserted
45 in switch 2. The line S is thus cut off from ground and annunciator *f*, and connected by the plug-point to the flexible cord. The metallic portion of the plug is also brought into contact with the frame *a* of the switch 2. This
50 frame *a* forms one of the terminals of the test-circuit *b*, and hence the "cross" is established, and all terminals *a* of the test-circuit are connected with the telephone-line S. At the last board I have shown a battery, *g*, in a circuit
55 connected to the terminal of the test-circuit upon said board by plug *h*. The telephone *i* is included in the circuit with the battery and said plug or connecting-piece. Since the cross is established, the switchman listening at the
60 telephone will hear a click as he makes and breaks the circuit between the plug *h* and the terminal *a* of the test-circuit, since the battery *g* will find circuit to line S as long as the cross or connection remains at any one of the
65 boards. This click is therefore notice that the line is in use.

As before stated, I prefer to use the battery

g; but without this battery enough current would be derived from the line S and pass through the telephone to indicate to the experienced listener that the cross is established, and hence that the line is in use at some other of the multiple boards. 70

In Fig. 2 the terminals *a' a'' a'''* of the test-circuit *b* consist of springs or plates insulated from the line and ground connections of the switches, as shown. 75

At switch *d* of the second board I have shown a plug inserted, which impinges against the terminal *a''*, thus establishing the cross between the telephone-line and its test-circuit *b*. 80

In Fig. 3 I have shown at the second board a telephone included in circuit with battery *g*. By means of the plug *h* or any other suitable switching device, the circuit of battery *g* may
85 be closed at will to a terminal of any one of the test-circuits, and the switchman listening at the telephone will know whether a cross exists at any other board. If sounds are heard in the telephone, he will know that the line is
90 in use, whether the sounds be from noise-currents, induction, or from other sources.

As shown in Fig. 3, I have omitted the battery from the circuit of two of the telephones.

Simple connecting-plates may be used instead of the spring-jack switches when the lines are not grounded at the central office. 95

On July 28, 1884, I filed a division of this case, said division being application No. 138,932 of the series of 1880. In said division I have made specific claim to the use of a telephone without a battery in a normally-open ground-circuit at each of the multiple boards for testing the different telephone-lines. I therefore disclaim herein the use of the normally-open ground-circuits at the different boards in combination with the test-circuits, except when used with battery. 100

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

1. The combination, with the telephone-lines and test-circuits, of a telephone and battery at each of the multiple boards, and switching apparatus, whereby the circuit of the battery and telephone at any board may be connected to any one of the test-circuits.

2. The combination, with a telephone-line, of a test-circuit, said telephone-line and its said test-circuit being each provided with a connection or terminal on each of two or more multiple switch-boards, and switching apparatus, whereby a cross is established between the said telephone-line and its said test-circuit when connection is made with said telephone-line upon either of the boards.

3. The combination, with a telephone-line and test-circuit, of two or more switches, the said switches being on different boards, each of said switches being provided with a terminal for the test-circuit, and switching apparatus, whereby a cross or connection is established between the telephone-line and test-circuit when a connection is made with the line at any one of the switches. 105

4. The combination, with each of the multiple switch-boards of a telephone-exchange, of a battery-circuit, including a telephone, test-circuits, one for each telephone-line, and 5 terminals for the test-circuits, one terminal for each test-circuit being on each board, whereby a switchman at any given board may make a test to determine whether a cross exists at any other board between any given telephone-line 10 and its test-circuit.
5. The combination, with two or more spring-jack switches placed on different multiple boards, of a telephone-line connected through said spring-jacks and an annunciator 15 to ground, a normally-open test-circuit permanently connected with the insulated frame of each of said switches, and connecting-plugs, whereby when a plug is inserted in any switch a cross is established between the line-terminal of the switch and the insulated frame 20 thereof, while the annunciator is cut off and the circuit of the line directed through the plug, substantially as and for the purpose specified.
6. The combination, with two or more lines, 25 of test-circuits, one test-circuit for each line, and switching apparatus, whereby any test-circuit may be crossed or connected with its line, thereby protecting a line thus crossed from interruption.

CHARLES E. SCRIBNER.

Witnesses:

EDWIN M. SCRIBNER,
GEORGE P. BARTON.

Correction in Letters Patent No. 305,021.

It is hereby certified that in Letters Patent No. 305,021, granted September 9, 1884, upon the application of Charles E. Scribner, of Chicago, Illinois, for an improvement in "Multiple Switch-Boards for Telephone Exchanges," an error appears in the printed specification requiring correction, as follows; In lines 91-92, page 2, the word "noise-currents" should read *voice-currents*; and that the Letters Patent should be read with this correction therein to make the same conform to the record of the case in Patent Office.

Signed, countersigned, and sealed this 23d day of September, A. D. 1884.

[SEAL.]

H. M. TELLER,

Secretary of the Interior.

Countersigned:

R. G. DYRENFORTH,

Acting Commissioner of Patents.