

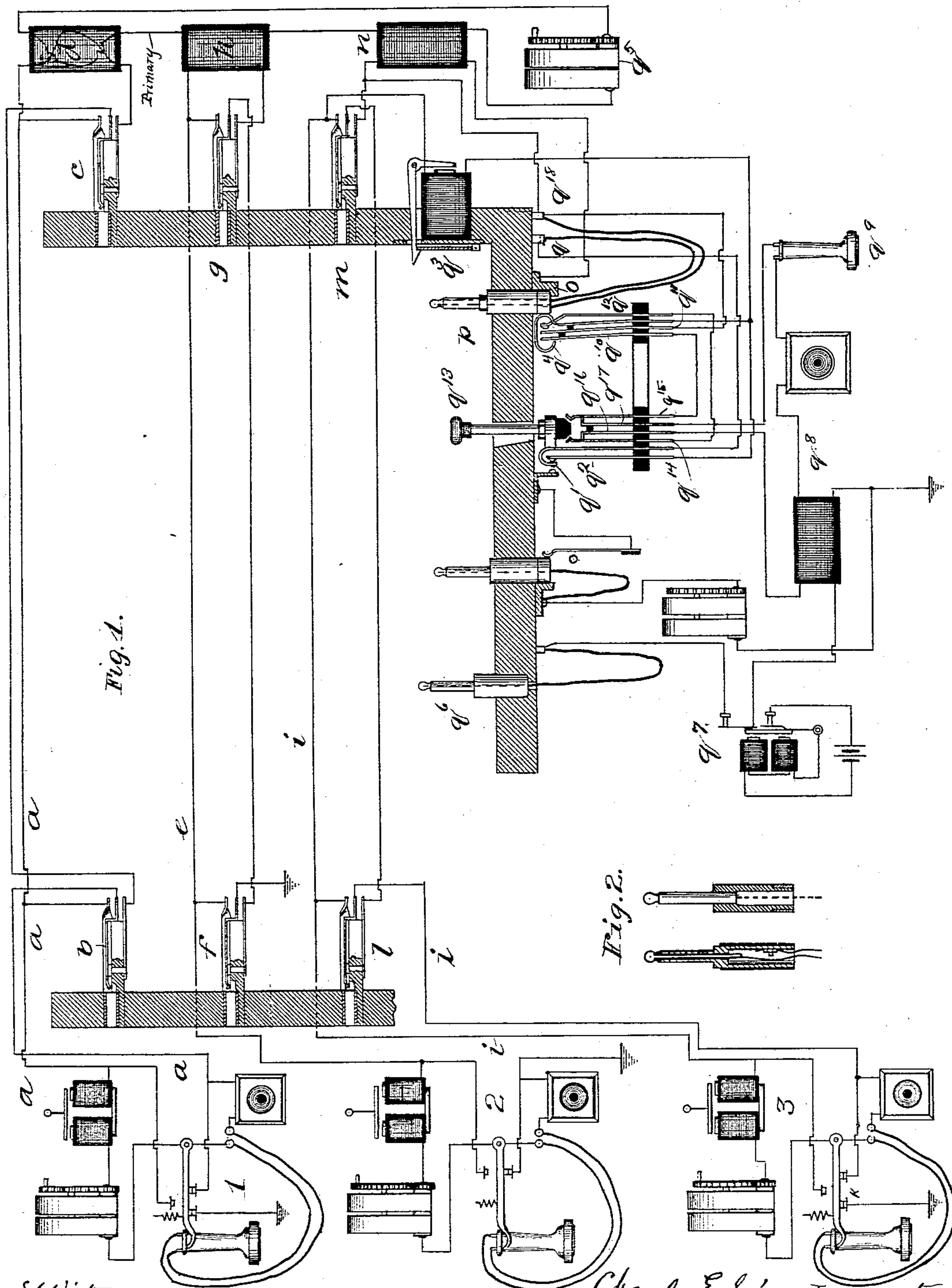
(No Model.)

C. E. SCRIBNER.

TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS.

No. 557,708.

Patented Apr. 7, 1896.



Witnesses:
W. Davenport
Chas. S. Hawley.

Charles E. Scribner Inventor
By George P. Burton
Att'y

UNITED STATES PATENT OFFICE.

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

TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 557,708, dated April 7, 1896.

Application filed June 19, 1888. Serial No. 277,557. (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 Testing Apparatus for Multiple Switchboards, (Case No. 171,) 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 multiple-switchboard systems of telephone-exchanges; and its object is to provide a characteristic test whereby it may be determined at one board whether a line called for is in use or connected at any other of the boards.

My invention relates more especially to that class of telephone-exchanges in which metallic circuits are employed or in which metallic circuits and grounded circuits are used conjointly in connection with the same switchboards.

Speaking generally, my invention consists in providing an induction-coil or converter in the circuit of each line so arranged in connection with a generator that an alternating or pulsatory current of low electromotive force shall be normally induced upon each circuit. The switching apparatus is arranged so as to open the portion of the line which is connected through the converter when any line is in use. A circuit including a vibrator and a telephone is provided at each board for testing the different lines to determine the presence or absence of the pulsatory or undulatory current. Switching apparatus is also provided whereby the telephone is bridged into the circuit of a line or disconnected therefrom, as may be desired.

I have illustrated my invention in connection with circuits each terminating in a flexible cord and loop-plug so arranged that any two lines may be connected together by inserting the loop-plug of one line into the spring-jack switch of another line.

In the accompanying drawings, which are illustrative of my invention, Figure 1 shows three telephone-lines, each connected with different spring-jack switches on each of two switchboards and a converter in each line, the

primary coils of the converters being in circuit with an alternating-current generator. Fig. 2 is a detailed view of one of the loop-plugs or terminal-connecting plugs.

Subscriber's station 1 is connected by metallic circuit *a* with spring-jack switch *b* upon the first board and with spring-jack *c* upon the second board and through the secondary winding of a converter *d*. Station 2 is connected by line *e* with the frames or test-pieces of switches *f* and *g* upon the switchboards and through the secondary coil of the converter *h*. The circuit of subscriber's station 3 is shown complete in connection with the operator's outfit upon the second board. This circuit *i*, when the telephone is hung upon the switch, as shown at station 3, may be traced from the ground at station 3 to the telephone switch or hook *k*; from the switch *k*, as shown, to the spring of spring-jack switch *l*; thence through the contact of spring-jack switch *l* to the spring of spring-jack switch *m* upon the second board; thence through the contact of spring-jack switch *m*, through secondary of converter *n*, and thence to the socket *o* of loop-plug *p*, which forms the terminal connection of circuit *i*. The heel of plug *p*, which is in contact with the socket *o*, is permanently connected with the sleeve of plug *p*, and hence with the strand of the cord which connects with binding-post *q*, and hence the circuit may be traced to said binding-post *q*; thence, as shown, through springs *q'* and *q''*, to individual annunciator *q'''*; thence to the frames or test-pieces of spring-jack switches *m* *l*, and thence over line *i*, through the bell at station 3, to the telephone-switch *k*. The secondary of converter *n* is thus included in the circuit of telephone-line *i*. This metallic circuit is normally provided with a ground branch or half connection at the subscriber's station.

I have traced the circuit of line *i* through a cord of the loop-plug *p*. In order, however, to make the connection more certain, I have provided a short circuit around the cord which may be traced from socket *o* through the heel of the plug *p* to spring *q'* to the wire connecting spring *q''* with the annunciator *q'''*. Thus tracing from the contact-point of switch *m*, the circuit extends through the secondary of the converter to socket *o*, thence through the

heel of plug p to spring q^4 , and thence through the clearing-out annunciator q^3 to the frame or test-piece of switch m .

The generator q^5 may be of the well-known alternating type, or it may be constructed to send pulsatory currents to line. In either case the current which is induced upon line i varies from moment to moment in strength, this variation being of such character that it will produce no sound in a telephone connected in the ordinary way in said circuit.

The test-plug q^6 shown at the second board is connected with a ground-circuit including a rheotome q^7 and an induction-coil or converter q^8 , one coil of the converter q^8 being included in this ground-circuit, while the other coil is included in the circuit containing the operator's telephone q^9 .

The plug p is shown resting in its socket in position to press against spring q^4 of the plug-socket switch. When the plug p is lifted, the bent end of spring q^4 comes in contact with spring q^{10} and serves to press spring q^{11} against spring q^{12} —that is to say, when the plug is lifted spring q^4 is connected with spring q^{10} , while springs q^{11} and q^{12} are at the same time connected together.

The combined listening and calling key is provided with springs q' and q^2 , which are normally in contact, as shown. A guide mounted on spring q' carries a handle q^{13} , which is provided with a rubber head or wedge. When this handle q^{13} is depressed, springs q^{14} q^{15} are lifted from springs q^{16} q^{17} , respectively, with which they are normally, respectively, in contact, as shown. When handle q^{13} is moved to the left, spring q' is closed upon the generator-contact and separated from spring q^2 . In order that the telephone q^9 may be in circuit, plug p must be lifted from its socket, and the handle q^{13} , which carries the wedge, lifted so as to allow spring q^{14} to rest upon spring q^{16} and spring q^{15} to rest upon spring q^{17} .

Assuming that plug p is lifted from its socket, we will trace the circuit from the sleeve of the plug through one of the cords to binding-post q , thence through springs q' and q^2 of the combined listening and ringing key, thence to spring q^4 of the plug-socket switch, thence to spring q^{10} of said switch, thence to spring q^{15} of the combined listening and ringing key, thence to spring q^{17} , thence through the telephone and the converter q^8 to spring q^{16} , thence to spring q^{14} , thence back to spring q^{12} of the plug-socket switch, thence to spring q^{11} of the plug-socket switch, thence to the binding-post q^{18} , and thence to the tip of the plug.

When plug p is lifted, the portion of the circuit containing the converter n is opened at the socket o . When a plug is inserted into any switch of line i , as switch l or switch m , the portion of the circuit containing the converter will be open between the spring and corresponding contact of the switch at which the connection is made. Thus the undulatory current is taken off from the line whenever

it is being used. Therefore it may be determined whether any given line is in use by determining the presence or absence of such current. This may be determined in any suitable manner, but preferably by means of the undulatory-current-indicating apparatus, consisting of a rheotome and a telephone in a circuit and means for closing said circuit to the test-piece of the switch of the line to be tested. Such an apparatus must be provided at each of the multiple switchboards, and I have found the plug q^6 , with the rheotome q^7 and the telephone q^9 connected in circuit therewith, as shown, a convenient and satisfactory undulatory-current-indicating device.

In order to test to determine whether the line called for is connected or in use, it is only necessary to apply the tip of plug q^6 to the frame of a spring-jack of the line—as, for example, the frame of spring-jack g of line e —and listen at the telephone q^9 connected, as shown, in circuit therewith. The undulatory current sent by the generator q^5 upon the line e , while not audible to one listening at a telephone connected directly in circuit therewith, will be heard and distinguished by one listening at telephone q^9 connected in circuit with a rheotome q^7 . The sound in the telephone on account of the rheotome will vary in loudness as the strength of the undulatory or pulsatory current varies.

My invention admits of various modifications such as would readily suggest themselves to those skilled in the art. Any means for opening the circuit of the coil of the converter of a line when said line is connected or in use may be employed without departing from my invention.

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

1. The combination with several telephone-lines connected with multiple switchboards, each being provided with an individual annunciator, of a coil of a different converter included in each line between the switch of the line on the last board and its individual annunciator, the different converters being energized by pulsatory or undulatory currents sent through the circuit of their primaries, and means for automatically opening the portion of the circuit of the line which includes the converter when a connection is made therewith at any of the switchboards.

2. A metallic-circuit telephone-line including a series of spring-jack switches distributed on different boards, and an individual annunciator, in combination with a converter with its secondary included in the circuit between the switch on the last board and the individual annunciator; a pulsatory or undulatory current generator being included in the primary circuit of said converter whereby pulsatory or undulatory current is induced upon the line when the line is not in use, substantially as and for the purpose specified.

3. The combination with a telephone-line
provided with two branches or limbs, one
branch being connected through the spring
and contact of each of a series of switches dis-
5 tributed on the different boards and the other
branch being connected with the insulated
frames or test-pieces of said switches, of a
converter included in said circuit between the
contact-point and insulated frame or test-
10 piece of the switch on the last board, and

switching apparatus; whereby said portion of
the circuit containing said converter is opened
when the line is in use, substantially as and
for the purpose specified.

In testimony whereof I hereunto subscribe 15
my name this 13th day of June, A. D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,
CHAS. C. WOODWORTH.