

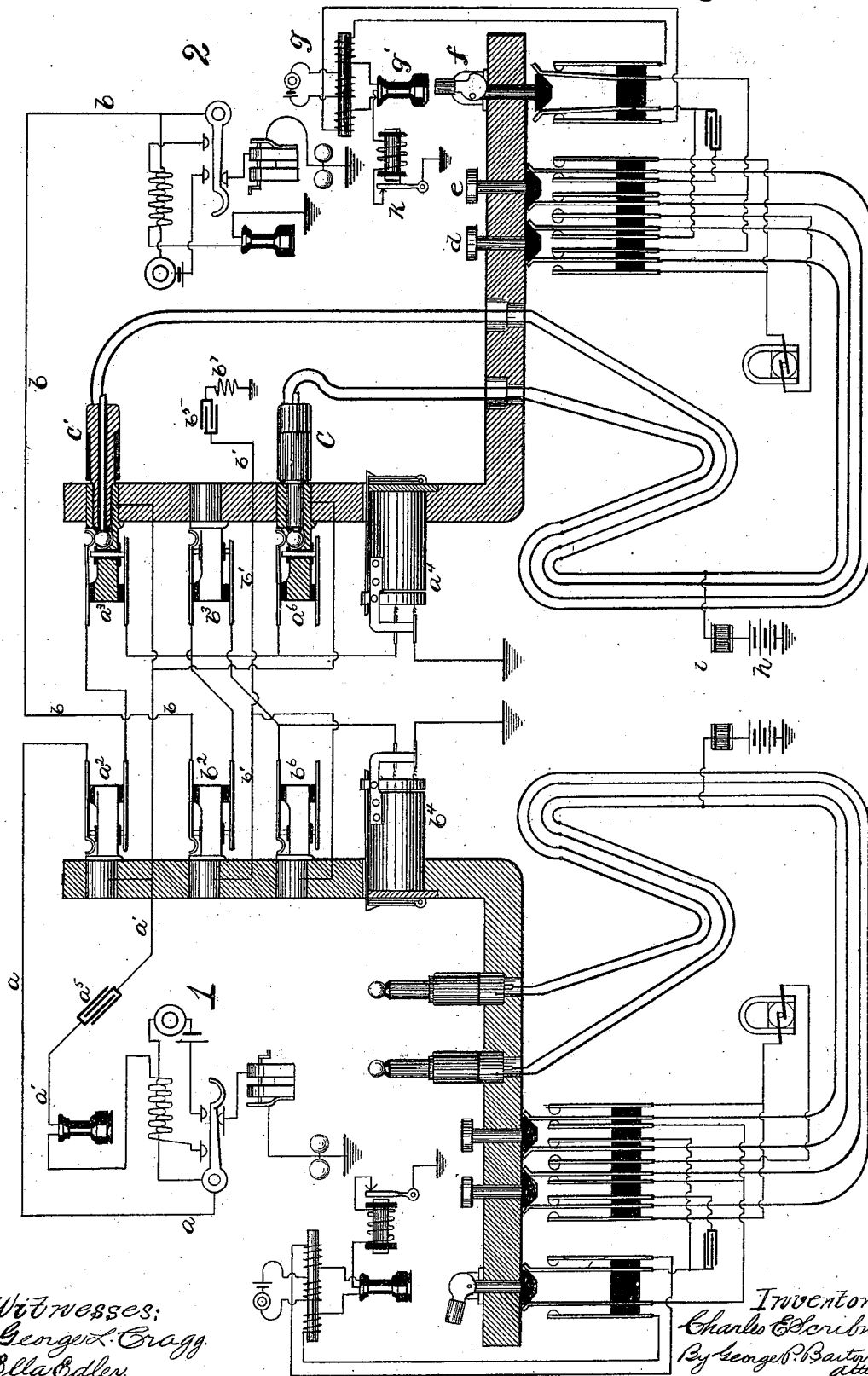
(No Model.)

C. E. SCRIBNER.

TEST CIRCUIT FOR MULTIPLE SWITCHBOARDS.

No. 502,774.

Patented Aug. 8, 1893



Witnesses:
George L. Bragg
Ella Adler

Inventor:
Charles E. Scribner
By George P. Barton
att'y

UNITED STATES PATENT OFFICE.

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

TEST-CIRCUIT FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 502,774, dated August 8, 1893.

Application filed July 7, 1891. Serial No. 398,718. (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 No. 269,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to testing systems for multiple switch boards of telephone exchanges; its object is to provide means whereby stray currents in the telephone lines arising from causes external to the telephone system may be prevented from flowing through the test circuit and causing false test signals.

My invention relates more specifically to that class of switch board circuits in which the frames or test rings of the spring jacks of a line are connected to one of the line wires from the substation, and in which a portion of this conductor is included in the test circuit which is completed when a test of a busy line is made. It is a fact of common experience that when the line wires of such a system extend parallel or in proximity to conductors carrying heavy and varying currents, such as electric light and railway lines, currents are induced upon the telephone lines, which escape to earth through the testing apparatus when a test is made, and cause false and misleading signals.

In my invention I include a condenser in that line wire which is connected to the test rings of the spring jacks, between the line wire and the frame of the first spring jack. The condenser transmits the undulatory or alternating telephonic currents undiminished in volume, but serves as a complete rupture of the circuit to approximately steady currents. It is still possible to employ the line which includes the condenser, as the return line for the calling circuit, since the rapidly alternating current from the calling magneto will be transmitted through it; but I prefer to arrange the apparatus at the substations and the individual annunciators so that the earth shall act as return for the calling currents. In a telephone exchange system thus

protected from external currents I am enabled to employ any of the well known test systems whose test circuits are local; I prefer, however, to include a rheotome at some part of the test circuit, to produce a tone in the telephone of the testing operator when a line which is already in use is tested.

My invention may be applied indifferently to grounded and to metallic circuits.

My invention is illustrated in the accompanying drawing, and will be more readily understood by reference thereto.

In the drawing I have shown two substations connected by lines, one line wire of each of which includes a condenser, to their respective spring jacks and annunciators at two sections of multiple switch board. The switch board I have shown provided with apparatus for performing the various operations involved in establishing communication between two substations, comprising connecting cords and plugs, calling and listening keys, and means for determining at one switch board whether or not a line is in use at another board.

This apparatus is all of well known construction and operation; hence I will describe it only briefly.

The subscriber's apparatus at substation No. 1 comprises a signal bell, which is normally included in a branch connection from the line a to earth, a calling generator which is automatically included in the same branch connection when the generator is operated, a telephone set, and a switch whereby when the telephone set is in use the call bell and generator are disconnected from the line a , and the telephone set is included in a branch connection between lines a and a' . Thus a call signal is sent over line a , to return through the earth, while the telephonic or talking circuit is over line a , returning by line a' . The line a may be traced to a spring jack a^2 at the first switch board, at the left of the drawing, through its line spring and contact anvil, thence to and through the line spring and contact of jack a^3 at the second board, thence to answering jack a^6 where it is connected to the line spring, thence through annunciator a^4 to earth. Line a' may be traced to condenser a^5 , thence to the spring jacks a^2 a^3 a^6

where it is connected to the frames or test rings of the jacks.

The circuit of station 2 is shown as grounded. The apparatus at the substation differs from that at station 1, in that the telephone switch, when the telephone is in use, disconnects the calling apparatus from the line b and includes the telephone set in a connection from line to earth. The line b may be traced to the line spring of its spring jack b^2 at the first board, thence to jack b^3 , at the second board, thence returning to answering jack b^6 at the first board, thence through annunciator b^4 to earth. The telephonic current from station 2, is provided with a metallic circuit throughout the switch board system. The telephonic current returning from station 2, finds circuit through resistance b^7 , condenser b^5 to line b' , which is connected to the test rings of spring jacks b^2 b^3 b^6 .

The operator's outfit comprises, to describe it more specifically, the two loop plugs c c' , each provided with a tip and sleeve adapted to make contact, the tip with the line spring and the sleeve with the frame or test ring of a spring jack into which it may be thrust. Corresponding contact pieces are electrically connected together, the tips through a condenser, and the sleeves directly. Two calling keys d e are included in the circuit between the two connecting plugs, one on either side of the condenser, and each is adapted, when depressed, to disconnect both contact pieces of one of the plugs from those of the other, and to connect them to the two poles of a calling generator. Branches are extended from the conductors joining corresponding parts of the plugs to the contact anvils of a listening key f which is adapted, when its lever is placed in the vertical position as shown, to connect the two terminals of a telephone set g to the contact anvils; whereby the telephone set is included in a branch or shunt circuit between two subscribers placed in communication by means of connecting plugs c c' . Another branch connection is extended from the conductor joining the sleeves of the connecting plugs, through a test battery h to earth. A self induction or retardation coil i is included in the branch between the battery and the sleeve of the plug, in order that several pairs of connecting plugs may be similarly connected to the same test battery without crossing together the different pairs of plugs, it being understood that no appreciable portion of the telephonic current will pass through the retardation coil. Obviously when the plug c is thrust into any spring jack, the sleeve of the plug coming in contact with the test ring of the spring jack, a difference of electrical potential is set up between the test rings of all the spring jacks of that line and the earth. If now a connection is completed from earth to the test ring of a spring jack of that line at another board, a current will be established in the circuit and will give a signal in an appropriate responsive device in-

cluded in the circuit. In the system shown, the plug c' is used as this second branch connection, to complete the circuit. A connection is extended from the middle of the operator's telephone coil g' to earth; consequently when the tip of plug c' is applied to the test ring of a telephone line, to which a connection already exists, a current finds circuit from tip of plug c' through the listening key f , one half of the coil of operator's telephone g' , to earth; the telephone g' serves as a responsive device. A rheotome k is included in the branch connection from telephone g' to earth, which serves to interrupt the current flowing through the telephone, and the response becomes a musical tone.

It will be obvious that if the condenser in the line circuit were charged statically from an induced current on the portion of the line between the substation and the central office when the test was made, it would be discharged at the first touch of the testing plug, and could produce no further signal in the telephone,—that is, no continuous sound.

I will now proceed to describe the operation of the system shown. Suppose that subscriber at substation 1 desires to communicate with subscriber at station 2. Turning his generator, a current flows over line a , through the spring jacks a^2 a^3 , and annunciator a^4 to earth. The shutter of the annunciator is released, and falls, indicating to the operator that a connection is desired by subscriber at station 1. She inserts plug c into answering jack a^5 and throws the listening key f into the position shown, whereby the telephone set g is connected to line. Subscriber at station 1 has meanwhile removed his telephone from its hook, and is therefore in communication with the operator at the second board; the circuit between them is a complete metallic circuit. The operator having learned that a connection with station 2 is desired, proceeds to test that line to determine whether the line is already in use at some other board or not. Applying the tip of plug c' to the test ring l of jack b^3 at her board, if she hear a tone in her telephone upon each touch of the plug to the test ring, she knows that the line is already in use. Suppose, however, that she hears no sound; this is indicative that the line is not in use, since no source of electro motive force is in connection with the lines. She now thrusts plug c' into jack b^3 , whereby the two substations are placed in connection, and depresses key e , sending a calling current over line b through the signal bell at station 2. When subscriber at station 2 has removed his telephone from its hook, the two telephone sets are in connection over a circuit which is metallic from station 1 to the resistance b^7 , thence through earth to substation 2.

Obviously, electro motive force induced upon the line wire a' could produce no further effect than to charge the condenser a^5 ; when connection was made to earth, as in

testing, no effect would be produced in the testing operator's telephone.

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

1. In combination, telephone lines extending from a substation, spring jacks having line springs connected to one of the lines and test rings connected to the other of the lines, and a condenser included in the circuit between the test rings of the spring jacks and the line to the substation, substantially as and for the purpose described.

2. In combination, telephone lines *a* and *a'* extending from a substation, calling apparatus at the substation included in a connection between line *a* and earth, and a switch adapted to connect the line *a* through a telephone set to line *a'*, spring jack switches having line springs connected to line *a* and test rings connected to a conductor, a condenser included between the said conductor and line *a'*, and an annunciator included in a branch connection from line *a* to earth.

3. In combination, two telephone lines extending from a substation, calling apparatus at the substation normally included in a branch from one of said lines to earth, a switch adapted to disconnect the said line from earth and to connect it through a telephone to the other line, and at the exchange, spring jacks having line springs electrically connected to that line which is normally grounded at the substation, and test rings electrically connected through a condenser to the other line, a branch connection extending from one of the test rings through a source of electricity to earth, and another branch connection extending from another of the test rings through an electro magnetic responsive device to earth, substantially as and for the purpose described.

In witness whereof I hereunto subscribe my name this 25th day of April, A. D. 1891.

CHARLES E. SCRIBNER.

Witnesses:

ELLA EDLER,
GEORGE L. CRAGG.