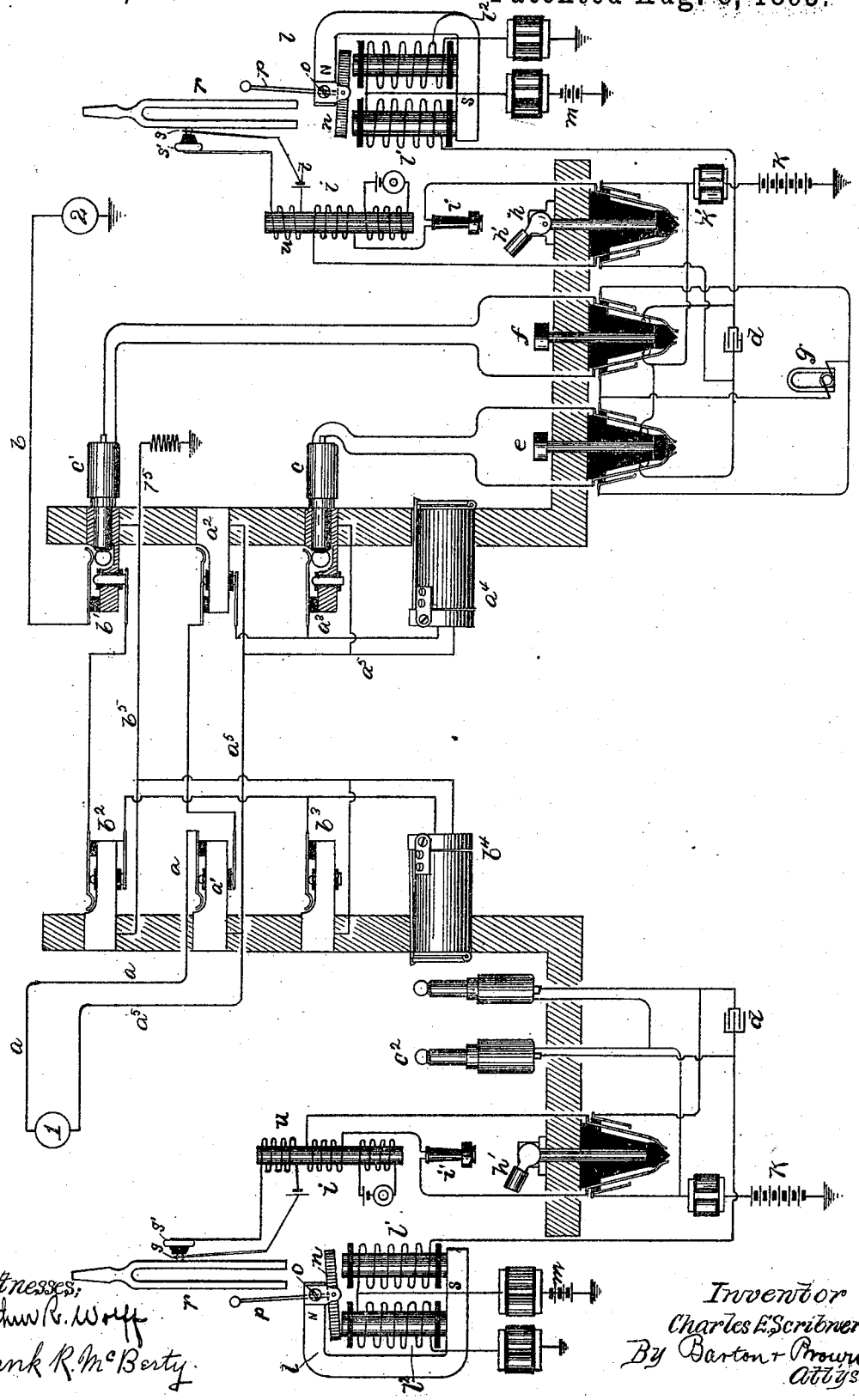
(No Model.)

C. E. SCRIBNER.

TESTING APPARATUS FOR MULTIPLE SWITCHBOARDS.

No. 502,775. Patented Aug. 8, 1893.



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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. 502,775, dated August 8, 1893.

Application filed August 1, 1891. Serial No. 401,370. (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. 273,) 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 switchboards for telephone exchanges.

Its object is to provide a responsive device for the test circuit, which shall produce a test signal of momentary duration and of a character distinct and different from any sound which may be caused by extraneous and accidental causes.

Heretofore, in testing systems for multiple switchboards, the test signal has been the click produced in the operator's telephone by the passage of the testing current through the telephone, or a hum or buzz caused by including in the test circuit some form of rheotome. In the former case a click is frequently produced in the telephone by the escape of static charges or induced currents from the line; in the latter case conditions sometimes arise whereby the test circuit remains completed, and a continuous buzz is produced in the telephone, or the contact points of the rheotome fail to close the circuit, and no sound is produced.

My invention is designed to obviate all these difficulties. It comprises a novel method and means for producing in the telephone of an operator making a test, at each completion of the test circuit, a distinct musical tone which shall be of short duration without interrupting the continuity of the test circuit during the test. To accomplish this result, I include in the test circuit an electro magnet whose armature is adapted to strike a resonant body, as a tuning fork or stretched wire; and in connection with the resonant body, I provide microphone contacts, one of which bears upon some vibrating portion of said body, included in a local circuit with a battery and coil adapted to act inductively upon the operator's telephone. Thus, when the test circuit is completed, the armature of the electro magnet is actuated to strike said resonant body, which transmits its sonorous vibrations to the microphone contacts, which in turn causes the tone to be reproduced in the telephone of the operator testing. The sonorous body soon comes to rest after having been struck, and no further tone can be produced in the telephone until the test circuit is interrupted and again completed.

While my invention is applicable to any of the test systems in common use, it is particularly adapted for use with my improved test system described in an application filed June 29, 1891, and in the accompanying drawing, which is illustrative of my invention, I have shown it in connection therewith.

In the drawing I have shown two multiple switchboards and two sub-stations, 1 and 2, connected to their respective spring-jacks upon the switchboards. The circuit from one of the substations, 1, is shown as metallic. It may be traced over line a, through line spring and contact anvil of jack a' at the first board; similarly through jack a^2 at the second board; thence to line spring of answering jack a^3 through annunciator a^4, returning over line a^5 to station 1. Line a^5 is connected to the test rings of the various jacks in the usual manner. The circuit from station 2 is grounded. It is connected through lines b, b^5 and earth, to jacks b', b^2, b^3, and annunciator b^4.

The operator's outfit at the boards is of the usual character. It comprises connecting cords and plugs, calling and listening keys and a telephone set. That at the second board at the right of the drawing is shown complete; that at the first board is shown incomplete in order to show the connections and apparatus of the testing system more clearly.

I will describe in some detail the apparatus of the second board.

Corresponding contact pieces of the connecting plugs c, c', are electrically connected together, the tips through a condenser d and the sleeves directly. Included in the conductors joining the two plugs are two calling keys, e and f, one on either side of condenser d provided with contact points and connected in such manner that each is adapted to discon-

nect both contact pieces of one of the plugs from those of the other, and to connect them to a calling generator g when the keys are depressed. Branch connections are extended from the conductors joining the plugs to the two contact springs of a listening key h, adapted when its lever h' is thrown into the vertical position to connect the terminals of a telephone set i to the contact springs.

The testing system shown is fully described in the before mentioned application, hence I will describe it here only briefly.

A branch connection extends from the conductor joining the sleeves of the connecting plugs through a test battery k to earth. A retardation coil k' is included in this branch between the battery and the said conductor, in order that branch connections from other pairs of connecting plugs may be extended to the same test battery. To the conductor joining the tips of the plugs is connected a second branch extending to earth through one coil l' of a polarized responsive device l, and a battery, m. The other coil l^2 of the responsive device is also connected to the same pole of the battery m, and the other end through a retardation coil or a resistance to the earth. The direction of winding of the coil l^2 is such that a current from the battery m to earth will retain the armature n of the responsive device in the position shown; that of coil l^2 is such that a current from battery m through the coil l' and the test circuit will throw the armature into its alternate position. The batteries k, m are so arranged as to send current in the same direction through the test circuit. The armature n is pivoted at o; it carries a tongue p, which is adapted to strike a tuning fork r when it is thrown into its alternate position. Against the fork r bear the microphone contacts s, s' included in the local circuit of the battery t; this local circuit also includes the the primary of the induction coil u, whose secondary is included in circuit with the operator's telephone i. Suppose that subscriber at station 1 sends a call signal to the exchange. The shutter of annunciator a^4 falls, notifying the operator at that board that a connection is desired. She inserts plug c of her pair into the answering jack a^3 of the line from station 1, and throws the lever of the listening key h into its vertical position. The telephone i is thus included in circuit with station 1. Having received the order, say for a connection with station 2, she proceeds to test the lines from that station to determine whether they are already in use or not. This she does by applying the tip of the remaining plug to the test ring of the jack of that line at her board. This operation may be more readily followed, however, by referring to the first board where the testing circuits are shown divested of apparatus not concerned in this operation. Upon applying the tip of plug c^2 to the test ring of a metallic line which was not in use, the operator would perceive no response from her responsive device, since the test battery m would find no circuit to earth from the test ring tested. If she tested a jack of an idle grounded line, as b^2 of line station 2 in its normal condition, a slight current would flow through coil l' to the tip of test plug c^2, thence through the conductor b^5 joining the test rings, thence to earth. But this current would be so weak as not to actuate the responsive device. If, however, she tested a jack of a busy line, as b^2 of line to station 2 as shown, current would find its way from the battery k to the sleeve of plug c', thence to test ring of jack b', thence by conductor b^5 to test ring of jack b^2, thence by the tip of plug c^2 and its conductor through coil l' to earth, through battery m and through coil l^2 and its retardation coil. The armature n would be attracted, striking in its movement the fork r, and thus throwing it into vibration, and these sonorous vibrations would be electrically reproduced in the telephone i'. The sound thus produced in her telephone the operator would interpret as a signal that the line to station 2 was already in use.

I do not confine myself to the use of a tuning fork as a resonant body. I have used stretched wires, bells and reeds in place of tuning fork r.

In all cases certain positions may be found for the point of striking and the point against which the microphone contacts bear, which give the most clearly defined tone in the telephone. In the tuning fork r the microphone contacts should bear upon a point about one-third of the length of the prong from the bend, and the stroke should be made upon a point an equal distance from the extremity of the prong.

When it is desired to apply my invention to the test system of the usual construction, the electro magnet of the responsive device is not polarized, the coils are included in some part of the test circuit,—as in the usual branch, from the center of the coil of the operator's telephone to earth,—and its armature is held away from the magnets by a retractile spring.

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

1. The combination with an electro magnet and a movable armature therefor, of a resonant body adapted to be struck by said armature, microphone contacts bearing upon some vibrating portion of said resonant body, and a local circuit including a battery and said microphone contacts and adapted to act inductively upon a telephone, substantially as described.

2. The combination with the test circuit of a multiple switchboard system, of an electro magnet included in said test circuit, a pivoted armature adapted to be actuated by said electro magnet, a resonant body adapted to be struck by said armature, microphone contacts bearing upon said resonant body, and a local circuit including a battery and the microphone contacts and adapted to act induct-

ively upon a telephone, substantially in the manner described.

3. The combination with a test system, comprising an electrically connected series of test rings of spring jacks, a branch from one test ring to earth including a battery, and a second branch to earth including a battery of the same polarity as the first, of an electro-magnet having one coil included in said second branch circuit, and another coil included in a connection from the grounded end of the first coil, a centrally pivoted polarized armature adapted to be actuated by the electro magnet, a resonant body adapted to be thrown into vibration by said electro magnet, microphone contacts bearing upon the resonant body, and a local circuit including a battery and the microphone contacts and adapted to act inductively upon a telephone, substantially as described.

In witness whereof I hereunto subscribe my name this 15th day of July, A. D. 1891.

CHARLES E. SCRIBNER.

Witnesses:

FRANK R. MCBERTY,

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