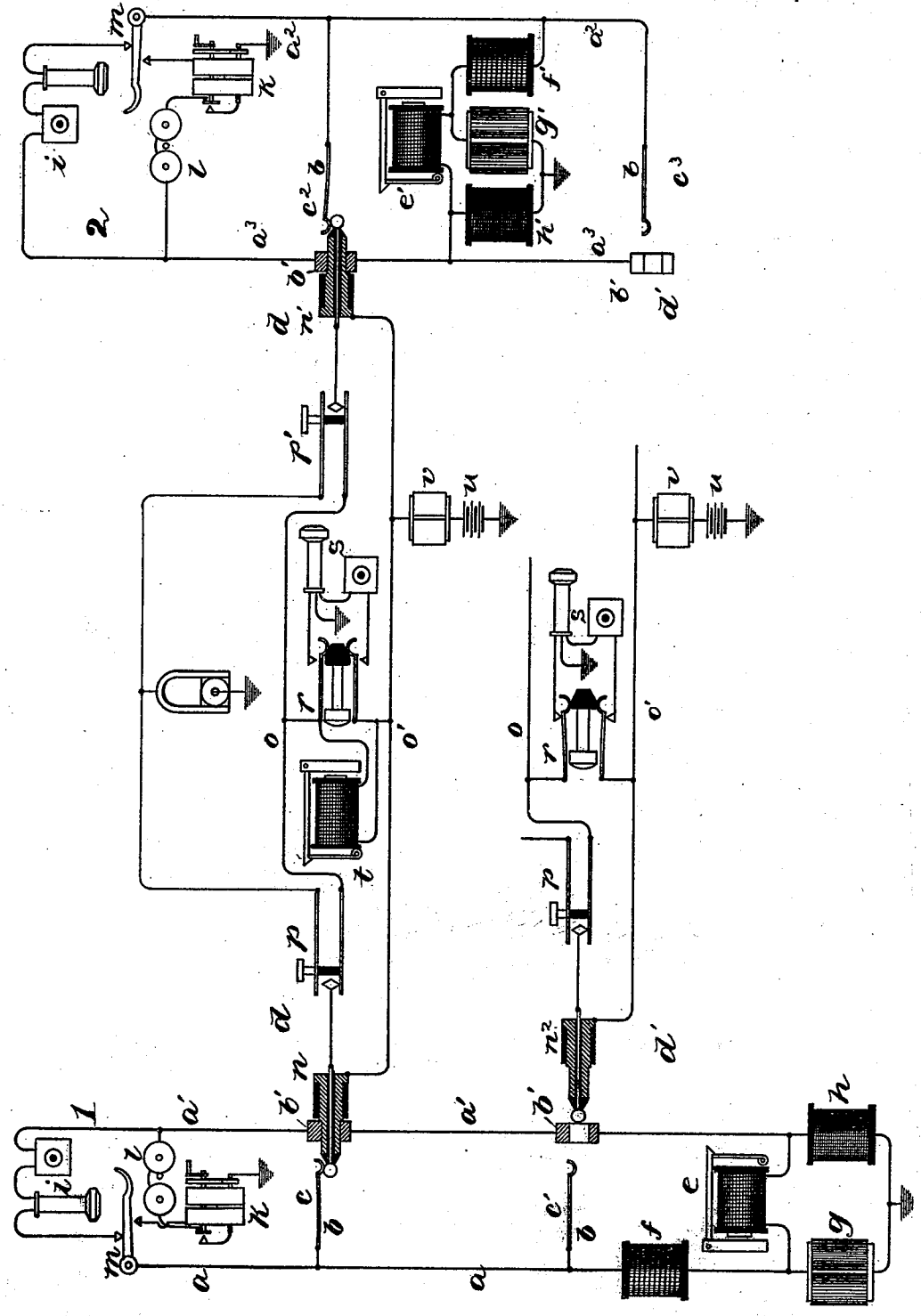
(No Model.)

C. E. SCRIBNER.

MULTIPLE SWITCHBOARD SYSTEM FOR TELEPHONE EXCHANGES.

No. 511,464. Patented Dec. 26, 1893.



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MULTIPLE-SWITCHBOARD SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 511,464, dated December 26, 1893.

Application filed April 26, 1893. Serial No. 471,976. (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 Multiple-Switchboard Systems for Telephone-Exchanges, (Case No. 325,) 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 multiple switchboard systems of telephone exchanges. Its object is to provide a system of circuits such that the signal receiving annunciator of any telephone line, while remaining permanently connected with the line circuit, shall be inoperative or irresponsive to signaling currents in the circuit during the connection of the line with another telephone line.

As is well known in the art to which my invention pertains it is a requirement of the multiple type of switchboard, in which the annunciators of the different telephone lines are distributed upon different sections of the switchboard, that the individual annunciators of any two lines which may be connected by means of the switching appliances must be inoperative or irresponsive to signaling currents in their line circuits during the existence of such connection, in order to prevent the annunciators from giving false call-indicating signals when their lines are already in use upon some other section of the switchboard. Heretofore this has been accomplished in different ways, one commonly employed being the provision of an auxiliary magnet adapted to prevent the actuation of the annunciator when energized, the auxiliary magnet being included in a normally open local circuit extending to each section of the switchboard and adapted to be closed by the act of establishing connection with the line at any section; whereby the annunciator is rendered inoperative as long as such connection exists.

In my invention I have aimed to dispense with local and independent circuits and with all accessory mechanism for the purpose of preventing the actuation of the annunciator. I so arrange the circuits of the telephone line at the central office, in combination with certain resistance and impedence coils and the clearing-out annunciator provided in circuit with the plugs by means of which connection is established between lines, that during the connection of the clearing-out annunciator with the line circuit the individual or permanently connected annunciator is included in a conductor between whose terminals no difference of potential exists when a variable current traverses the line circuit. The arrangement becomes, in fact, similar to the well known Wheatstone bridge, the resistance and impedence coils and the clearing-out annunciator constituting the sides of the bridge, and the individual annunciator being located in the bridge wire thereof. Thus in the system of my invention the individual annunciator of the telephone line is ordinarily included directly in the path of the current through the line circuit so as to be traversed and actuated thereby; but when connection is made with the line through the medium of the connecting plug circuit including a clearing-out annunciator, the individual annunciator is no longer in the path of current over the line, and remains irresponsive, while the temporarily connected clearing-out annunciator receives and indicates the signal for disconnection.

In order to attain the most satisfactory results, certain proportions must be observed among the different resistances and impedence coils, as will be hereinafter fully described.

I have illustrated my invention in the accompanying drawing and will describe it in greater detail with reference thereto.

In the drawing are shown two telephone substations, designated 1 and 2, respectively, connected by line circuits with a central office. At the central office each line circuit is connected with the usual springjacks or terminal sockets, one upon each of the two sections of multiple switchboard, and with an individual annunciator located upon one of the switchboards. Thus the circuit of station 1 may be traced over the line wires a a' to the central station, where they are connected with the line spring b and the thimble b', respectively, of a springjack c; this springjack is assumed to be located upon a section d of a

multiple switchboard. From the springjack c the circuit is continued to the springjack c' upon the section d' of the switchboard. Upon the latter section is also located an individual annunciator e of ordinary construction. The side a of the line is continued from the springjacks through a resistance coil f and thence to one terminal of an annunciator e, and also through an impedence coil g to earth. The other side a' of the line circuit is connected with the remaining terminal of the annunciator, and through a resistance coil h to earth.

The apparatus at the substation 1 is of ordinary character. It comprises a telephone set i, and a generator k of alternating signaling current and a signal bell l adapted to respond to such current. The telephonic and signaling appliances are connected with the switch contacts of a switch hook m which is designed to support the telephone and to be actuated by the weight thereof to switch the telephonic and signaling appliances alternately into connection with the line as the telephone is removed from or placed upon the hook. One terminal of the signaling generator is grounded directly; the other terminal is connected with a contact point of an automatic switch actuated by the rotation of the generator to connect with the line a, the switch being arranged to open the branch including the bell at the same time. The substation 2 is equipped with similar apparatus and is similarly connected by line wires a^2 a^3 with springjacks c^2 c^3 upon the different sections d d', respectively, of the switchboard, and with an individual annunciator e', located upon the section d of the switchboard in order to be under the care of a different attendant operator.

The appliances by which the operator is enabled to switch any line into connection with any other line upon the switchboard are of the usual and well known character. The apparatus consists of a pair of loop plugs n n' adapted for insertion into the springjacks, connected by conductors o o'. When the plugs are inserted into different springjacks, the line springs and the thimbles, respectively, of the springjacks are electrically connected together through the corresponding portions of the loop plugs and the conductors joining the latter together. Two keys p and p' are included in the circuit of the conductor o, the switch contacts of the keys being so arranged that when the plunger of either key is depressed, it disconnects one contact piece of the corresponding plug from that of the other plug and connects it with a grounded generator q of signaling current. A third key r is furnished for each plug circuit adapted to connect an operator's telephone set s with the plug circuit when it is operated. A clearing-out annunciator t is permanently connected in a bridge wire joining the conductors o o' of the plug circuit; it is constructed to be of considerable impedence, in order that it may not permit any appreciable shunting of the rapidly alternating telephonic currents through it from the line conductors. One pole of a battery u is connected with the conductor o' which joins the sleeve contacts of the loop plugs, an impedence coil v being preferably included in the circuit to prevent the escape of telephonic current to earth through the battery. The battery u is provided for testing purposes; its operation will be referred to later. A portion of a similar plug circuit is shown at the section d' of the switchboard, the plug n^2 being in the position of testing the springjack c' at that board to determine whether the line is in use or not.

In the drawings, the substations 1 and 2 are shown connected together through the medium of the plug circuit at the section d of the switchboard, the station 2 being assumed to have initiated the connection. In the process of thus obtaining such connection between stations 2 and 1, the subscriber at station 2 first rotates his signaling generator k, thus sending a signaling current over the line a^2 to the central station, where it finds circuit through the resistance coil f' to one terminal of the annunciator e; therefrom to earth it has two paths—one through the individual annunciator e' and the resistence coil h', and the other through the impedence coil g'. The high self-induction of the latter coil prevents any considerable portion of the rapidly alternating current traversing it, whereby the current is directed through the annunciator and the resistance coil h' to earth. The annunciator being thus operated, attracts the attention of the operator at section d of the switchboard, whereon it is located. The operator inserts one plug n' of a pair into the springjack c^2 and depresses the plunger of her listening key r, connecting her telephone set s in circuit with the apparatus at the substation. When the subscriber has removed his telephone from the hook, the circuits are in condition to permit him to give his order orally to the operator. The operator having thus learned that connection with station 1 is desired, makes a test to determine whether that line is already in use or not upon the other section of the multiple switchboard. This she does by applying to the thimble or test ring b' of the springjack c upon her board the tip of the plug n, as the plug n^2 is shown applied to the test ring of springjack c' upon board d'. If the line tested is in use, a battery u is connected with the thimbles or test rings of the line through the medium of the conductor o and the sleeve of the plug by means of which such connection already exists, the sleeve being in contact with the thimble of the springjack into which it is inserted, whereby the test rings are electrified to a difference of potential from the earth, and a current will flow from the thimble through the tip of the plug to the conductor o and thence through the listening key r and

one half of the coil of the telephone receiver s' to earth, producing a click in the telephone at each application of the testing plug to the springjack. If the line were not in use, obviously no sound would be produced in the telephone since no source of current would be connected with the line. Finding the line to station 1 not in use, the operator inserts the plug n fully into the springjack c', completing a continuous metallic circuit between the two substations, including the line wires $a\ a'$ to station 1, the conductors $o\ o'$ of the plug circuit, and the line wires $a^2\ a^3$ extending to substation 2. The operator then depresses the plunger of calling key p, whereby the grounded calling generator q is connected with the side a of the line circuit, and sends current over the line to substation 1, where it finds circuit through the signaling bell l to the line a', returning over that line wire to the central station and through the resistance coil h to earth. The annunciator e is not operated, since such a proportion exists between the effective resistances of the impedence coil g, the resistance coil h, the resistance coil f, and the circuit through the line a, the signaling bell l and the return line a', that no difference of potential exists between the terminals of the annunciator e, which thus receives no current. The signaling bell l is, however, operated and calls the attention of the subscriber at station 1. When the subscribers have completed their conversation, one of them—for example the subscriber at station 1—may again rotate his signaling generator k to send the signal for disconnection of the lines. The signaling current thus sent finds circuit over the line a as before to springjack c, where it divides, a small portion passing through the resistance coil f and the impedence coil g, while a larger portion passes from the line spring b' of the springjack to the tip of the plug and thence to the conductor o of the plug circuit and thence through the clearing-out annunciator t to the conductor o', thence returning to the sleeve of plug n and to line a', from which it finds circuit through the resistance coil h to earth. The annunciator e' is still not operated by this signaling current since no potential exists between its terminals. In this instance, one side of the parallelogram, of which the annunciator e is the bridge wire, is formed by the resistance coil f and the impedence coil g, while the other side of the parallelogram is formed by the conductors $o\ o'$ including the clearing-out annunciator t, and the resistance coil h.

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

1. The combination in a telephone signaling circuit, of two independent branches of the circuit, one branch being normally open, an individual signaling annunciator in a bridge connection between the different branches, means for temporarily closing the normally open branch through an auxiliary signaling device, resistances in the different branches on each side of the terminals of the bridge wire containing the annunciator excepting that section of the circuit which contains the auxiliary signaling device, and a source of electric current connected with the signaling circuit, the different resistances being so adjusted with respect to each other and to the effective resistances of the auxiliary signaling device that no difference of potential exists between the terminals of the annunciator, whereby the annunciator remains unoperated while the auxiliary signaling device responds, substantially as described.

2. The combination with the signaling circuit of a telephone line including a source of electric current, of two branches, one branch being normally open, a signaling annunciator in a bridge wire between the two branches, means for closing the normally open branch through a resistance when connection is made with the line, and resistances in both branches on each side of the bridge wire, the different resistances being so adjusted that when the normally open branch is closed as described no difference of potential exists between the terminals of the annunciator, whereby the annunciator is not operated by the source of electricity while connection exists with the line, substantially as described.

3. The combination with a telephone signaling circuit, of two parallel branches thereof each arranged to constitute two sides of a Wheatstone bridge or parallelogram, one of the sides being normally open, a signal receiving annunciator in the bridge wire of the parallelogram, resistances in the normally closed sides of the parallogram, means for closing the normally open side through a signal bell and a clearing-out annunciator alternately, and means for connecting a source of signaling current in the circuit external to the parallelogram, the different resistances being so adjusted with relation to each other and to the effective resistances of the clearing-out annunciator or bell that no difference of potential exists between the terminals of the individual annunciator when the normally open side is closed, whereby signaling current may be caused to operate either the clearing-out annunciator or the signal bell without affecting the individual annunciator, or to operate the latter annunciator only.

4. The combination with a telephone signaling circuit extending from a substation to a central station, of a resistance coil in the main circuit, a resistance coil in one of the parallel branches, an individual annunciator and another resistance coil in the other parallel branch, and a source of signaling current included in the circuit at the substation, whereby the annunciator is operated, substantially as described.

5. The combination with a signaling circuit, of a telephone line extending from a substation to a central station and divided into two

parallel branches at the central office, one branch including two resistance coils, the other branch including a clearing-out annunciator and a resistance coil, an individual annunciator connected in a bridge from the point between the resistance coils on one branch to a point between the clearing-out annunciator and the resistance coil on the other branch, and a source of signaling current in the circuit at the substation, the effective resistances of the different coils being so adjusted that no difference of potential exists between the terminals of the individual annunciator, substantially as described.

6. The combination with a signaling circuit extending in two parallel branches from a substation to a central station, of two resistance coils included in one of said branches, a signal bell and a resistance coil included in the other of said branches, an individual annunciator connected in a bridge wire from a point between the two resistance coils of one branch to a point between the signal bell and the resistance coil in the other branch, and a source of signaling current connected with the circuit between the points of junction of the two parallel branches, the effective resistances of the different coils and of the signaling bell being so adjusted with relation to each other that no difference of potential exists between the terminals of the individual annunciator, substantially as described.

7. The combination with a telephone circuit extending in two limbs between a substation and a central office and connected with a springjack at the central office, both limbs being grounded at the central office, of two resistance coils in one branch of said line and a single resistance coil in the other branch, an individual annunciator connected in a bridge wire from the point between the two resistance coils of one side of the line to a point between the resistance coil of the other side and the springjack, a signal bell normally bridged between the two sides of the circuit at the substation, a grounded generator of signaling current adapted, when operated, to disconnect the bell from the side of the line containing the two resistance coils and to connect the generator armature thereto, a loop plug adapted for insertion into the springjack at the substation, a clearing-out annunciator normally included between the contacts of the said plug, a key adapted, when operated, to disconnect the clearing-out annunciator and to connect one pole of a grounded generator to the side of the line containing the two resistance coils, whereby signaling current may be sent from the substation to operate the clearing-out annunciator, but not the individual annunciator thereat, and signals may be sent from the central station to the substation to operate the signal bell thereat without operating the individual annunciator, substantially as described.

In witness whereof I hereunto subscribe my name this 22d day of March, A. D. 1893.

CHARLES E. SCRIBNER.

Witnesses:
ELLA EDLER,
LUCILE RUSSELL.