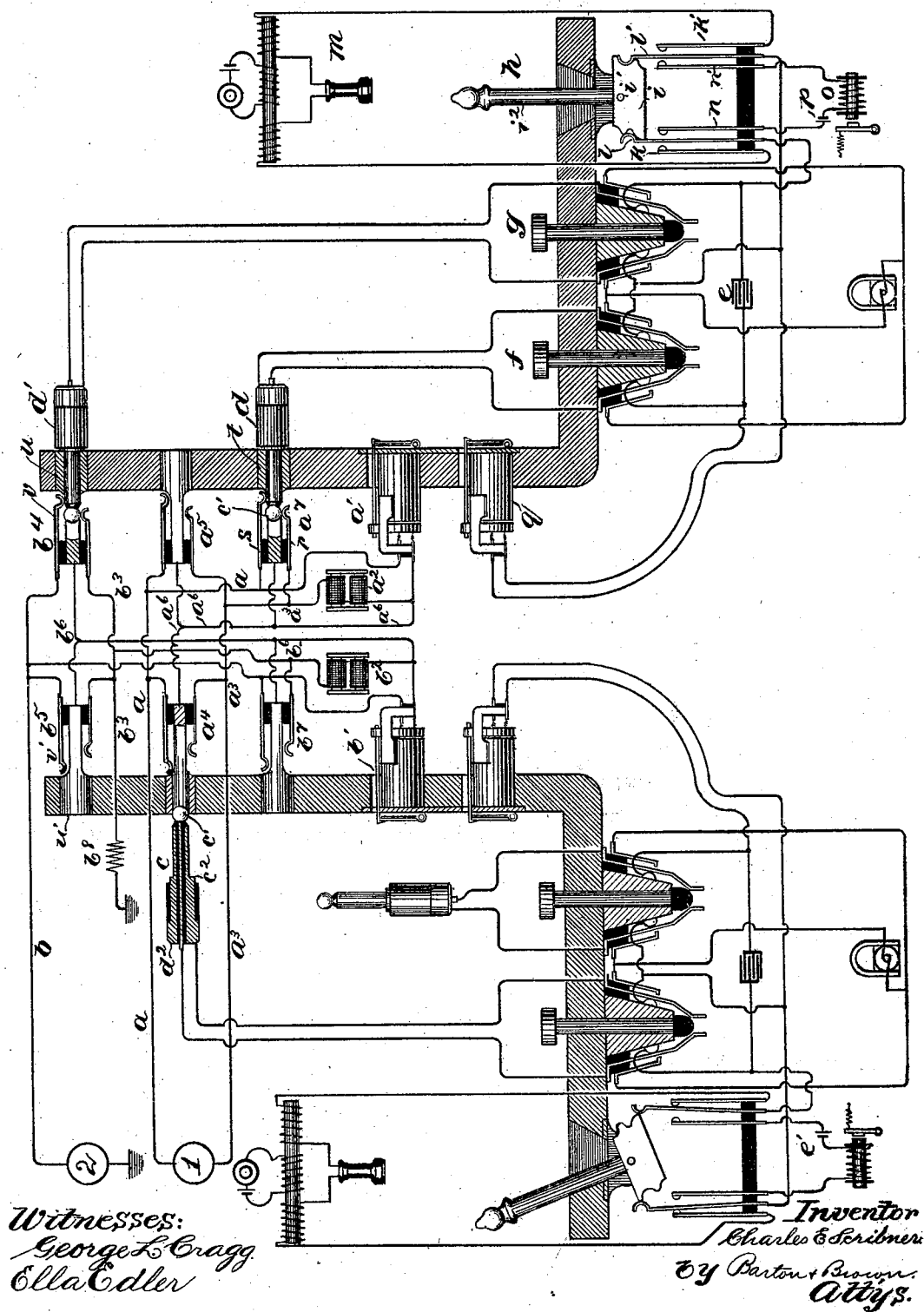


(No Model.)

C. E. SCRIBNER.
MULTIPLE SWITCHBOARD SYSTEM.

No. 503,099.

Patented Aug. 8, 1893.



UNITED STATES PATENT OFFICE.

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

MULTIPLE-SWITCHBOARD SYSTEM.

SPECIFICATION forming part of Letters Patent No. 503,099, dated August 8, 1893.

Application filed October 13, 1891. Serial No. 408,585. (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, (Case No. 266,) 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 switch board systems for telephone exchanges, and its objects are to provide means whereby the individual annunciator of a telephone line is rendered inoperative when a connection is made to the line without the interpolation of contacts in the line circuit, and to provide a suitable means for testing at one section of switch board, to determine whether any telephone line is in use at another board.

My invention comprises, first, telephone lines extending from a substation and permanently connected together through an annunciator and retardation coil and connected each to the corresponding line spring of several spring jacks, the frames of the spring jacks being insulated from the line springs and electrically connected together, and to such a point of one of the lines as to short circuit the annunciator when a connection is established between the line springs of one of the jacks and the frame of its jack; and connecting plugs having two contacts one adapted to engage with one of the line springs and the other to make contact with the other of the line springs and the frame of the jack, whereby the individual annunciator of the line is short circuited when the connecting plug is inserted into a spring jack of its line; and second, included between the two contacts of a connecting plug, a battery and an electro magnetic signaling device, whereby a signal is given by the signaling device when the two contacts of the connecting plug are short circuited, and means whereby the two contacts of the plug shall be short circuited when the plug is inserted into a spring jack of the line already in use.

My invention will be more readily understood by reference to the accompanying drawing which is illustrative thereof.

In the drawing I have shown two substations 1 and 2 connected to their respective spring jacks on two sections of multiple switch board and to their individual annunciators and retardation coils; at each of the switch boards I have shown connecting plugs of the character necessary in carrying out my invention, calling keys and a special three position key, adapted, when in one of its positions, to connect the operator's telephone in a branch circuit between the contacts of the connecting plugs; in another position to disconnect the operator's telephone from the plug circuit; and in the third position to connect the testing battery and signaling device to the two contacts of one of the connecting plugs.

The lines from station 1 I have shown as completing a metallic circuit. The circuit may be traced over line *a*, through annunciator *a'* and retardation coil *a²* to line *a³*, and thence returning to station 1. The corresponding line springs of spring jacks *a⁴* *a⁵* and of answering jack *a⁷* are connected to the line *a* and the remaining line springs are connected to the line *a³*. The insulated frames of spring jacks *a⁴* *a⁵* and *a⁷* are electrically connected together by the wire *a⁶* and are connected to the line circuit at a point intermediate between the individual annunciator *a'* and the retardation coil *a²*. The circuit from station 2 is shown as grounded and may be traced over line *b* through annunciator *b'*, retardation coil *b²*, returning over line wire *b³*, through resistance *b⁸* and earth to station 2. The lines *b* and *b³* are similarly connected to the line springs of spring jacks *b⁴* *b⁵* and answering jack *b⁷*, and the frames of the spring jacks *b⁴* *b⁵* *b⁷* are connected together by the wire *b⁶* to the line circuit between the individual annunciator *b'* and the retardation coil *b²*. One of the line springs of each of the spring jacks is made shorter than the other and is adapted to come into contact with a different portion of the connecting plug. A connecting plug *c* is shown in section at the first board, at the left of the drawing. It consists of a core *c'* terminating in a spherical tip which is adapted to come into contact with the shorter line spring of the spring jack. Surrounding the central core and insulated

from it is the metallic sleeve c^2 , of such diameter and length as to come into contact with both the longer line spring and the frame of the jack into which it is thrust. The connecting plugs $d d'$, shown as part of the operator's outfit at the second board, are of similar construction. Their tips are electrically connected through flexible cords and a condenser e ; their sleeves are connected directly. Two calling keys f, g are included one on either side of the condenser e in a circuit connecting the two plugs. These calling keys are of the ordinary construction and operation; either of them serves, when depressed, to disconnect the terminals of one of the connecting plugs from the other connecting plug and to connect them to the two poles of a calling generator.

Branch connections are extended from the wires joining the corresponding contacts of the connecting plugs to a listening key h . This key consists of a cam i , preferably of insulating material, pivoted at i' , and having attached to it a handle i^2 projecting above the keyboard. At each side of the cam are two springs $k k' l l'$ normally separated, but so disposed with relation to the cam i that when the handle i^2 is pressed in one direction the two extensions of the cam i engage with the curved extremities of the springs $l l'$ and force them into contact with springs $k k'$; the springs $l l'$ are connected to the circuits joining the corresponding parts of the two connecting plugs $d d'$; the two springs $k k'$ are connected to the two terminals of the operator's telephone set m ; hence when the key is in one of its positions the telephone set m is in a branch connection between the tip and the sleeve of the connecting plugs, or between the two sides of the circuit of two subscribers in communication. Two contacts $n n'$ are so disposed as to be normally separated from the springs $k k'$. These springs are given an inward pressure against the cam i but bear against the faces of the cam when it is in its normal position, that is, when the handle i^2 stands vertically, but when the cam is thrown to the left the springs $k k'$ are allowed to close in upon the contacts $n n'$. The springs $n n'$ are connected through the low resistance coil of a sounder o and the test battery p . Thus when the key h is thrown into its extreme left position the springs $k k'$ close upon the contacts $n n'$ and connect the test battery and its sounder to the tip and sleeve of the test plug d' . A clearing out annunciator q is in a branch connection between the wires joining the corresponding contacts of the plugs $d d'$.

Having thus described the apparatus employed in my invention I will now proceed to describe the various operations involved in establishing communication between two subscribers. Suppose, for example, that subscriber at station 1 desires to communicate with subscriber at station 2. The operation of the calling generator at station 1 causes the

shutter of annunciator a' to fall; the operator perceiving this, inserts one of her plugs, as plug d , into the answering jack a' of line from station 1. The tip of plug d comes into contact with the shorter line spring r of the answering jack a' while the sleeve makes contact with both the longer line spring s and the frame t of the spring jack, whereby the annunciator a' is short circuited, since any current entering over line a will find circuit through the line spring s , through the sleeve of plug d , to the frame t of the spring jack, and thence through the retardation coil a^2 to line a^3 . She now throws the cam of listening key h into its right position, whereby the circuit from station 1 is extended to her telephone set m and she is enabled to communicate with the subscriber. Having learned the number of the station desired, the operator proceeds to test to determine whether the line called for is already in use or not. To make this test she throws the key h into its left position, whereby the battery p and the sounder o are connected to the contacts of plug d' . As she inserts the plug into the jack both the tip and the sleeve come into contact with the frame u of the jack b^4 , thus momentarily short circuiting the battery p through the sounder o , contacts $n' l'$, sleeve of plug d' , frame u , tip of plug d' , thence returning to contacts k and n , and the sounder o gives a signal which, however, the operator ignores. Inserting the plug still farther into the spring jack, the tip of plug d' comes into contact with the longer line spring v of jack b^4 and the circuit is completed from the tip of plug d' , through the annunciator b' , returning to frame u of spring jack b^4 , but the battery p is too feeble to operate the sounder o through the resistance of annunciator b' , and the sounder does not respond. This indicates to the operator that the line of station 2 is not in use. Inserting the plug d' still farther into the jack the tip comes into contact with the shorter spring v , while the sleeve is in contact with both the longer spring v and the frame u , whereby the annunciator b' of line from station 2 is short circuited in the same manner as was described of a' when the plug d was inserted into the answering jack a' . Hence to a current arriving from either station 1 or station 2 both annunciators a' and b' would be inoperative. Suppose now that an operator at the first board should test the spring jack b^5 with similar apparatus; the plug at this board is shown in the position for making such a test at spring jack a^4 instead of b^5 . As she thrusts her testing plug d^2 into the jack b^5 her battery e' would be momentarily short circuited through the tip of the plug and frame of the jack to the sleeve of the plug, and her sounder will give a response. As she thrusts the plug still farther into the jack and the tip comes in contact with the longer line spring v' her battery will again be short circuited through the tip of her testing plug d^2 , through the line spring v' , thence to the line

spring v of jack b^4 , through the sleeve of plug d' to the frame u of jack b^4 , thence returning to the frame u' of jack b^5 , thence to the sleeve of her testing plug d^2 , and her sounder will give a second response. Thus two signals from the responsive device indicate to an operator testing a line that the line tested is already in use. Having made the test and found the line not busy the operator allows the key h to resume its normal position. The subscribers at stations 1 and 2 are now in communication, through a circuit which contains no contacts save those of the plugs with the spring jacks and those in the ringing keys f and g . It will be noted that the line wires a and a^3 are still connected together through the retardation coil a^2 , but on account of the very great self induction of this coil an inappreciable portion only of the telephonic currents will be shunted through the coil. This explanation applies also to the lines b and b^3 . When the subscribers have completed their communication either or both send a generator signal for disconnection; this current finds circuit through the clearing out annunciator q which is operated and notifies the operator that the lines may be disconnected.

It is obvious that any other form of signaling device might be employed in connection with the test battery p to replace the sounder o and also that many other forms of switch might be used to perform the functions of key h . These, however, do not form an essential feature of my invention.

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

1. The combination of the spring jack having two line springs of different lengths and a frame insulated from the line springs with a plug having two contact pieces, one adapted to make contact with one of the line springs, and the other to make contact with both the other line spring and the frame of the jack, substantially in the manner and for the purpose specified.

2. In combination telephone lines extending from a substation, connected together through a retardation coil and an annunciator and connected one line wire to corresponding line springs of several spring jacks, and the other line wire to the remaining line springs of the same spring jacks, a plug provided with two contact pieces one of which is adapted to make contact with one of the line springs of a jack, and the other to make contact with both the other line spring and the frame of the jack, and a connection extending from the frames of the jacks to a point of the branch connection joining the two lines intermediate between the retardation coil and the annunciator, whereby the annunciator is short circuited when the plug is thrust into a jack, substantially in the manner and for the purpose specified.

3. In combination two connecting plugs

each having two contact pieces, corresponding contact pieces being electrically connected one pair directly and the other pair through a condenser, keys adapted to disconnect both contact pieces of either plug from the corresponding contact pieces of the other and to connect them to the poles of a calling generator, an annunciator in a branch circuit between the two contact pieces of the plugs, a key capable of being placed in three positions, and provided with contacts adapted when in one of its positions to connect the telephone set in a branch circuit between the two pairs of corresponding contact pieces, and when in another position to connect the test battery and a low resistance electro magnetic signaling device in a similar branch circuit, and when in its intermediate position to disconnect both the telephone set and battery and sounder from the pairs of corresponding contact pieces, substantially in the manner and for the purpose specified.

4. In combination telephone lines extending from two substations, each pair of line wires being connected one to similar line springs of several spring jacks and the other to the remaining line springs of the same spring jacks, and being connected together through a retardation coil and an annunciator, and having a branch circuit extending from a point intermediate between the annunciator and the retardation coil to the frames of the several spring jacks of its own line, two connecting plugs one in a spring jack of each of the telephone lines, each plug being provided with two contacts, one of which engages with one of the line springs of the jack into which it is thrust, and the other of which engages with both the other line spring and the frame of the same jack, whereby a short circuit is completed around the annunciator of that line, conductors connecting corresponding contact pieces of the two plugs and a clearing out annunciator in a branch circuit between the conductors, substantially in the manner and for the purpose specified.

5. In combination telephone lines extending from two substations, each pair of line wires being connected one to similar line springs of several spring jacks, and the other to the remaining line springs of the same spring jacks, and being connected together through a retardation coil and an annunciator, and having a branch circuit extending from a point intermediate between the annunciator and the retardation coil to the frames of the several spring jacks of its own line, two connecting plugs one in a spring jack of each of the telephone lines, each plug being provided with two contacts, one of which engages with one of the line springs of the jack into which it is thrust, and the other of which engages with both the other line spring and the frame of the same jack, whereby a short circuit is completed around the annunciator of that line, conductors connecting corresponding contact pieces of the two plugs, a test battery

and an electro magnetic signaling device in the branch circuit between the two conductors joining the corresponding contact pieces of the loop plugs, and a key adapted to disconnect the branch circuit containing the signaling device and the test battery from the conductors, substantially in the manner and for the purpose specified.

6. In a test circuit for multiple switch boards, in combination, a spring jack furnished with a line spring and a frame insulated therefrom, a plug provided with a contact piece, making contact with both the line spring and the frame of the jack, a second spring jack having a similar line spring electrically connected to the line spring of the first spring jack and a frame electrically connected to the frame of the first spring jack, a loop plug having two contact pieces, one of which makes contact with the line spring and the other with the frame of the second spring jack, and a test

battery and an electro magnetic signaling device included in a branch circuit between the two contact pieces of the second plug, substantially as and for the purpose specified. 25

7. The combination, with a metallic circuit telephone line extending from a substation to a central station, of line terminals at the central station each having two contact pieces connected to the different sides of the line respectively, an electric indicator and a retardation coil included in a bridge between the two sides of the line, and contact pieces adapted to short circuit the electric indicator when a connection is made to one of the line terminals, substantially as specified. 30 35

In witness whereof I hereunto subscribe my name this 14th day of September, A. D. 1891.

CHARLES E. SCRIBNER.

Witnesses:

FRANK R. McBERTY,
GEORGE L. CRAGG.