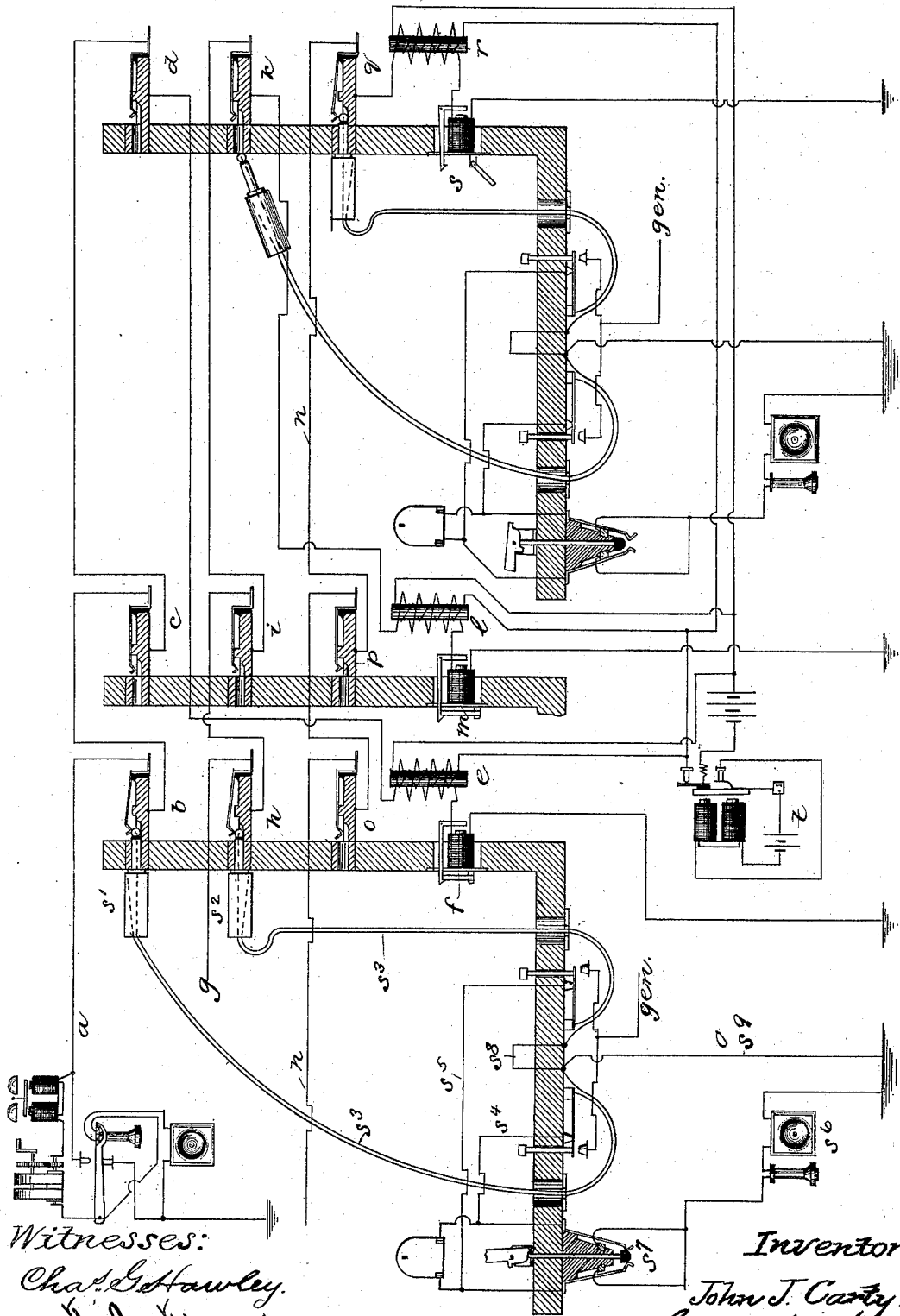


(No Model.)

J. J. CARTY.
MULTIPLE SWITCHBOARD APPARATUS.

No. 505,188.

Patented Sept. 19, 1893.



Witnesses:

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UNITED STATES PATENT OFFICE.

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MULTIPLE-SWITCHBOARD APPARATUS.

SPECIFICATION forming part of Letters Patent No. 505,188, dated September 19, 1893.

Application filed February 2, 1889, Renewed October 16, 1891. Serial No. 408,877. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. CARTY, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Multiple-Switchboard Telephone-Exchange Apparatus, (Case No. 4,) 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 the circuits and other apparatus at the central office of a telephone exchange system in which multiple switch boards are used.

My invention, speaking generally, consists in providing means for automatically grounding the cut off portions of the telephone lines when the lines are connected together, in connection with a source of current for throwing current upon the telephone lines, this ground connection being of such lower resistance as compared with the resistance of the operator's telephone that, when the telephone is connected to the cut off portion of any telephone line at the test piece of a switch included therein, there will be no appreciable current, and, hence, no sound in the telephone. Heretofore in such systems special circuit wires have been employed. Usually each line has been provided with a special test wire or test circuit. By my invention I dispense with such test circuits, thereby greatly simplifying the apparatus, while at the same time I provide suitable means for receiving the calls, testing the lines to avoid confusion and making the connections and disconnections.

My invention is illustrated in the accompanying drawing, in which telephone line *a* extends from its station through switches *b c d*, one switch on each of the switch boards and thence through the secondary of an induction coil *e* and thence through individual annunciator *f* on the first board to ground. Line *g* is connected in a similar manner through switches *h i k* and from the switch *k* on the last board through the secondary of induction coil *l* and thence through annunciator *m* to ground. Line *n* in like manner is connected through switches *o p* and *q*, one on each of the switch boards and from the switch *q* on the

last board through the secondary of induction coil *r* and thence through individual annunciator *s* to ground. It will be observed that the switches *b c*, &c., may consist simply of two insulated parts, the spring and the frame. As shown at board 1 the plugs *s' s''* are each provided with two terminals, the tip and the sleeve. The tips are connected together by strand *s'''* in the usual manner.

By means of branches *s''''* and *s'''''* connection may be made between the tips of the plugs and the telephone *s''''*, a switching apparatus *s''''''* being provided for this purpose in the usual manner. The strand *s''''''* connecting together the sleeves of said plugs *s' s''* is provided with a ground connection *s''''''*. The cord connections are arranged in a similar manner at all the switch boards. As before stated each line is connected through the secondary of an induction coil as induction coils *e l* and *r*, or other vibratory current inducing device. A rheotome *t* connected through the primaries of these induction coils serves to induce currents of a particular characteristic upon each of the lines as long as they remain closed; inserting a plug in the switch of any line cuts off that line from the portion which contains the secondary winding. When a test is made the tone of the rheotome *t* will not be heard in the telephone of the operator if the line tested is connected or in use at any other board. If the test is made at a board on the line side of the connection it is evident that the test signal cannot be heard since the portion of the line containing the secondary coil will be entirely cut off; if, however, the test is made at a board on the ground side of the connection, that is to say, on the cut off portion of the line, the test signal will not be heard because the portion of the line tested containing the secondary winding will be connected directly to ground through the sleeve strand of the cords with which the connection is made at the other board as, for example, through sleeve strand *s''''* and ground connection *s''''''* of the first board. Suppose a signal sent in over line *a* throwing down shutter *f* the operator at the first board seeing shutter *f* fall will insert plug *s'* in switch *b* and throw down the cam lever of switching device *s''* so

as to bring the telephone s^6 into circuit; she will receive the order at telephone s^6 . We will say this order is for connection with line g and suppose line g is not connected at either of the other boards, that is, suppose no plug is inserted in either of the spring jack switches i k . The operator at the first board, touching the tip of her plug s^2 to the frame of spring jack switch h will get the hum of rheotome t in her telephone s^6 , and this will be notice that line g is idle; she will therefore at once insert plug s^2 as shown into switch h , thus completing the connection, whereupon she calls up the subscriber of line g with her calling key in the usual manner. Plugs s' and s^2 being inserted as shown, the lines a and g are connected through the tips of said plugs and the strand connecting said tips as before described. The lines a and g , will be cut off at switches b and h respectively from induction coils e l . The portion of the lines thus cut off at the central office will, moreover, be provided with direct ground connections through the sleeves of the plugs s' s^2 , the sleeve strand s^3 and the connection s^6 .

We will suppose now that a call is sent over line n throwing down shutter s at the last board. The operator at the last board inserts one of a pair of plugs in switch q of line n and having received the order, we will say, for line g proceeds to test said line g . This she does by touching tip of the other plug of the pair as shown to frame of spring jack switch k . Tracing the cut off portion of line g from the central office ground through annunciator m , secondary of induction coil l , switch k and switch i to frame of switch h we find, as before stated, a direct ground connection through strand s^3 and connection s^6 ; therefore, all the current induced on the cut off portion of the line through the converter e will pass to ground and practically no current will be drawn off through the tip of the plug, applied to switch k , since the resistance of the telephone set will be included in the branch formed from the tip of said plug through the operator's telephone set at the last board to ground. Therefore, the operator at the last board listening at her telephone will hear no sound and this will be notice to her that the line is busy at some other board. Suppose a similar test were applied to switch o or p when a plug is inserted in switch q as shown. As the secondary of induction coil r or other current inducing device, would be cut off from the portion of line n including switches o p there would, of course, be no vibratory current present at the frames of switches o p and no sound would be produced in the telephone of the operator who should make the test at switch o or p on the line side of the break at switch q .

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

1. The combination with telephone lines, each line connected through a different spring

jack switch on each of two or more switch boards, and each line being connected through a current inducing device to ground, of pairs of loop plugs and cords at the different boards, the strand of each pair connecting the sleeves of the plugs being provided with a ground connection, whereby on connecting any two lines together at one board the portion cut off from each line will be closed directly to ground, substantially as and for the purpose specified.

2. Two telephone lines connected together at the central office through one strand of a pair of cords in combination with the cut off portions of said lines connected together through another strand of the cords, said strand being connected to ground, whereby the cut off portions of the lines are grounded and the talking circuits cut off from the source of the test current.

3. Two telephone lines connected together at one of the multiple switch boards of said lines, the cut off portions of said lines which include each a vibratory current inducing device being closed through a ground branch when the lines are thus connected and a branch circuit to ground through a telephone at another switch board adapted to be closed to the switch of either of said lines upon said switch board, whereby it may be determined whether either of said lines is thus connected or in use.

4. The combination with two telephone lines each extending from ground at the subscriber's station thereon to the central office and thence normally each through a different switch on each of two or more switch boards and through an annunciator to ground, of a pair of looping devices having two of their terminals connected together while the other corresponding terminals of the said plugs are connected to ground, said plugs being adapted to be inserted in switches of said telephone lines, whereby the lines may be looped together for conversation while the portions of said lines cut off at the switches by the insertion of the plugs are connected to ground, substantially as and for the purpose specified.

5. The combination with a telephone line, of switches upon the different boards at the central office, a source of electricity and an annunciator between the last switch and ground, switching apparatus at the different switch boards, for establishing connection between different lines, and means controlled by said switching apparatus adapted to cut off a portion of the line and close the same directly to ground, substantially as described.

6. The combination with a telephone line, of switches upon the different boards at the central office, a source of electricity and an annunciator between the last switch and ground, switching apparatus at the different switch boards for establishing connection between different lines, means controlled by said switching apparatus adapted to cut off a portion of the line and close the same directly

to ground, and operators' testing sets at the different boards provided with connecting apparatus adapted to close the circuit of the telephone at any one of the boards with the
5 test piece of any switch; whereby on making said test at either of said boards the sound will be heard in the telephone, if the line tested is free, while no sound will be produced in the telephone if the line tested is busy,
10 though the test should be made at the switch included in the cut off portion of the line, substantially as described.

7. The combination with a telephone line, of switches upon the different boards at the
15 central office, a source of electricity and an annunciator between the last switch and

ground, switching apparatus at the different switch boards for establishing connection between different lines, and means controlled by said switching apparatus adapted to cut off a
20 portion of the line and close the same to ground, and telephonic testing apparatus at each board; whereby any line may be tested to determine whether it is in use, substantially
25 as described.

In witness whereof I hereunto subscribe my name this 12th day of January, A. D. 1889.

JOHN J. CARTY.

Witnesses:

W. M. RUMBAUGH,
O. A. BELL.