

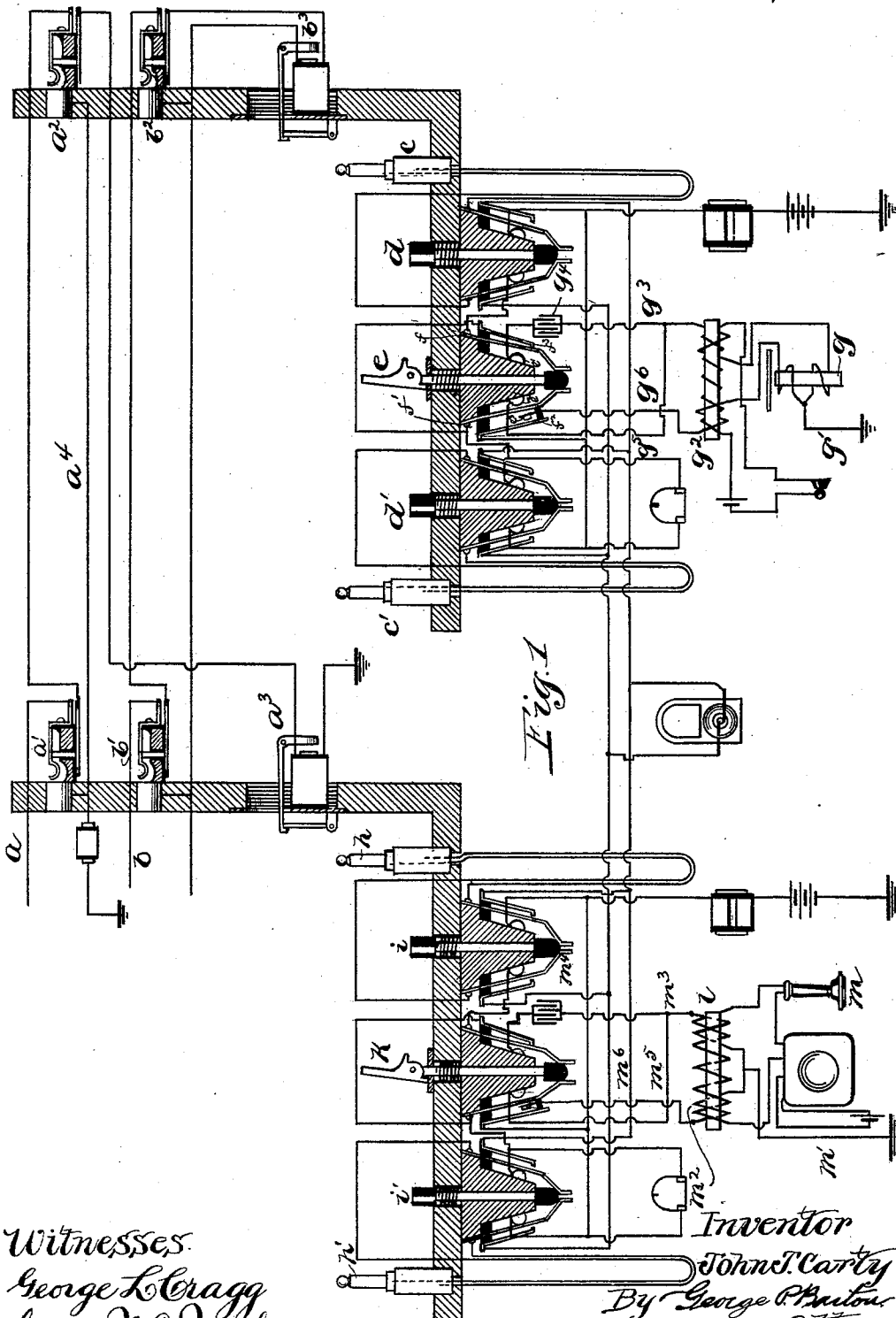
(No Model.)

2 Sheets—Sheet 1.

J. J. CARTY.
TELEPHONE EXCHANGE APPARATUS.

No. 484,626.

Patented Oct. 18, 1892.



Witnesses
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(No Model.)

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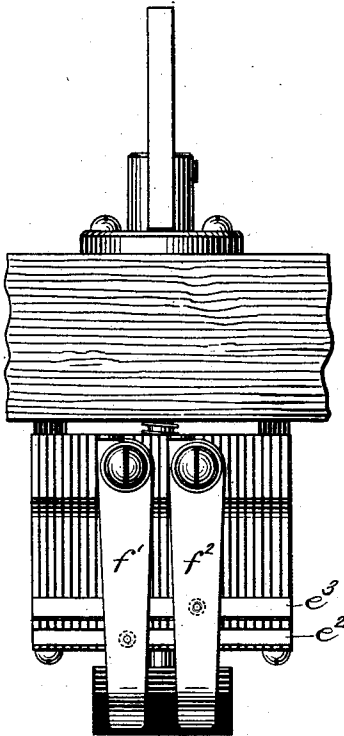


Fig. 2.

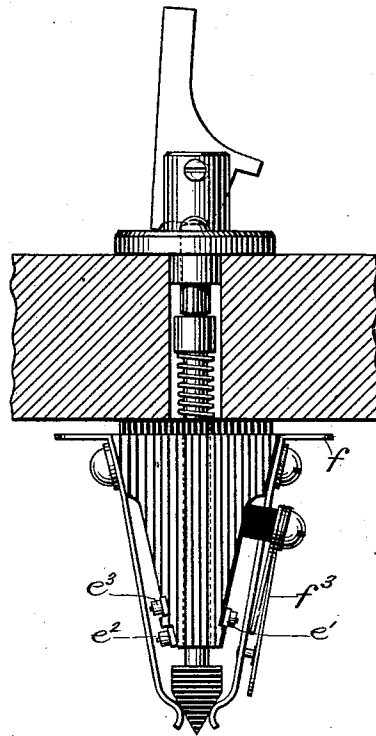


Fig. 3.

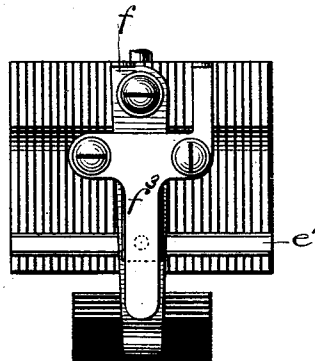


Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN J. CARTY, OF NEW YORK, N. Y., ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 484,626, dated October 18, 1892.

Application filed November 29, 1889. Serial No. 331,909. (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 Telephone-Exchange Apparatus, (Case No. 10,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to telephone-exchange systems; and its object is to provide switching apparatus and circuits in connection with the operator's telephone apparatus, so arranged that the different lines may be tested and so that the operator may bring her telephone into connection with any line or pair of lines without creating disturbances thereon or destroying the balance thereof.

My invention relates especially to multiple-switchboard systems in which metallic circuits and grounded circuits are used conjointly upon the same switchboards.

The looping-in key which I preferably use is of novel construction and consists in contact springs and connections so arranged that the operator's telephone apparatus may be bridged across the two sides of a metallic circuit—that is to say, across the strands of the pair of cords—and so that a condenser may be looped into the circuit of one of the cords to prevent the test-battery with which this cord is connected from causing a false test when one of the connecting-plugs is used in testing the line called for after the other has been inserted in the switch of a metallic-circuit line. The operator's telephone is wound differentially, the center of the differential coils being provided with a direct ground connection. The secondary winding of her transmitter-inductorium is also wound differentially, the circuit on one side of these differential windings being branched in one direction through a condenser to one strip of the loop-key and in the other direction directly to another strip of the loop-key, while from the other side of these differential windings the circuit extends to a third strip upon the loop-key.

Instead of using a differentially-wound tele-

phone with the center of the coils thereof connected to ground, I have sometimes provided an ordinary single-coil telephone connected with a transmitter in the usual manner, but including in its circuit a coil of a converter, the other coil of this converter, however, being connected with the loop-key thereof precisely in the manner in which the differentially-wound telephone when used is connected therewith, this coil of the converter being, moreover, provided at its center with a direct ground connection.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a diagram illustrative of two telephone-lines—one a single or grounded line and the other a metallic circuit line—each connected with two switchboards, together with the operator's apparatus at the different boards, the operator's telephone at the second board being wound differentially, while at the first board the operator's telephone is shown in connection with the converter. Fig. 2 is a rear elevation of my loop-key. Fig. 3 is a side elevation thereof. Fig. 4 is a front elevation of the portion thereof below the table.

The grounded-circuit telephone line *a* extends from ground at the subscriber's station thereon through the switches *a'* *a*² of the different boards and thence through its individual annunciator *a*³ to ground. The test portions of the switches *a'* *a*² are connected by the test-wire *a*⁴, this test-wire *a*⁴ being provided with a connection through high resistance to ground in the ordinary manner. The metallic-circuit telephone-line *b* extends through the switches *b'* *b*² on the different boards and through its individual annunciator *b*³ on the last board, and thence to the test-piece of switch *b*² and to the test-piece of switch *b'*, and thence back to the subscriber's station.

At each of the switchboards I have provided a set of loop plugs and cords, an ordinary generator loop-key being connected in the circuit of the strands of each cord. A listening-in key or loop-key for bridging the telephone into circuit is provided, also, in connection with each pair of plugs and cords. Thus at board 2 we have the plugs *c* *c'* and

their flexible cords. The ringing-key d is included in the strands of cord c and the ringing-key d' in the strands of cord c' in the usual manner.

5 I will now describe the loop-key e with reference to Figs. 2, 3, and 4, in which said loop-key is shown in detail, it being understood that several such keys will be mounted upon the same support of insulating material and
10 three metallic strips e' e^2 e^3 provided thereon, as shown. The spring f is connected with the strand leading to the tip of one of the plugs, as plug c , while the spring f' is connected with the strand leading to the tip of the other plug, as plug c' . The spring f^2 is connected with
15 the wire leading to the test-battery. The spring f^3 is connected by a wire with the spring f' and is placed in front of the spring f . When the wedge or plunger is down, as shown most clearly in Fig. 3, the spring f is
20 closed upon the spring f^3 to make electrical contact therewith.

One side of the operator's telephone is connected with the strip e^2 and the other side with
25 the strip e^3 , while the branch from the telephone through the condenser is connected with the contact e' —that is to say, the strips e^2 e' are connected with one side of the telephone and the strip e^3 with the other side
30 thereof, the branch which connects with contact e' , however, containing the condenser. The plunger of this key is worked by a cam-lever in the usual way, a spring being provided for raising the plunger when the pressure
35 from the cam-lever is taken off. Thus by throwing down the cam-lever the spring f will be closed upon strip e' and separated from spring f^3 , while spring f' will close upon strip e^2 and spring f^2 upon strip e^3 .

40 The operator's telephone g , as shown at board 2, is wound differentially, the center of the differential coils being connected to ground by the branch g' . The secondary of the transmitter-inductarium g^2 is also wound differentially, the wire g^3 from one side of these
45 differential windings extending through the condenser g^4 to the strip e' of the loop-key. The branch g^5 from wire g^3 is designed to preserve the continuity of the test-circuit when
50 the plug c' is used in making a test and to preserve the circuit between two subscribers when the operator listens in and is connected with the contact or strip e^2 of the key. Thus when the operator's telephone is not in circuit the circuit between the tips of the plugs
55 is as follows: From tip of plug c' , through the contacts of key d' to spring f^3 , thence to spring f , thence through the contacts of key d to tip of plug c . When the operator's telephone g is brought into circuit by raising the plunger of
60 key e , the circuit is from tip of plug c' to spring f' , thence through contact e^2 , wire g^5 , condenser g^4 , through contact e' and spring f , thence to tip of plug c . When the plug c' is used in testing, the test-circuit is completed, as before,
65 through wire g^5 to wire g^3 , thence through one

differential coil of the coils g^2 through one coil of telephone g , wire g' , to earth. The wire
70 g^6 from the other side of the differential coils of the inductorium is connected with the strip e^3 of the loop-key. When the cam-lever of key e is thrown down, the plunger will be raised and the telephone will be bridged into
75 circuit, the test-battery will be prevented from finding circuit through the cord of the plug c' , which connects with the tip thereof, so that plug c' may be used as a test-plug, and when thus used if the tip is applied to the test-piece of a busy line—that is, if the
80 tip is connected with a source of electricity—the current will find circuit through the tip of plug c' , through the cord connected with the tip thereof to the spring f' of switch e , and thence by wire or branch g^5 to wire g^3 ,
85 and thence through one of the coils of the inductorium g^2 and one of the coils of the telephone g to ground through branch g' . The plugs h h' , their cords, the ringing-keys i i' , and the listening-in key k are the same in all
90 respects as the corresponding devices shown at board 2 and hereinbefore particularly described.

The converter l has one of its coils included in the circuit of the telephone m . The other
95 coil thereof is provided with a branch m' to ground from the central point thereof. This coil m^2 of the converter is connected on one side by wire m^3 through a condenser m^4 to contact or strip e' of the loop-key, a branch
100 m^5 from wire m^3 leading to the strip e^2 of the switch. The other side of this coil m^2 is connected by wire m^6 with strip e^3 of the loop-switch, these connections, it will be seen, corresponding in all respects with the connections
105 g^3 , g^5 , and g^6 at board 2. One plug h is used for testing, and when applied to the test-piece of a busy line the circuit will be completed through branch m^5 , one-half of the winding m^2 of the converter, and the wire m'
110 to ground. Thus the closing of the battery over the circuit thus formed will cause the usual click in the telephone m and notify the operator that the line tested is busy.

I have not deemed it necessary to describe in detail all the steps in making the connections and disconnections between the lines
115 upon the switchboards. These connections and disconnections may be made in the ordinary manner, as is well understood.

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

1. The coil of a telephone apparatus, connected between the strands of a flexible cord, and a branch connection to ground at the
125 center of said coil, in combination with a metallic circuit including the strands of said cord in different sides thereof, substantially as and for the purpose specified.

2. A pair of loop-plugs and their cords for
130 connecting together and testing telephone-lines, the strands of said cords including a

loop-key, said loop key having contacts with
different sides of the coil of a telephonic appa-
ratus, said coil being provided with a ground
connection at its center, substantially as and
5 for the purpose specified.

3. The combination of a pair of loop-plugs
and their cords for connecting together and
testing telephone-lines and a switching de-
vice connecting with the strands of said cords,
10 said switching device having contacts with

different sides of the coils of a telephonic ap-
paratus, said coil being provided with a
ground connection at its center, substantially
as and for the purpose specified.

In witness whereof I hereunto subscribe 15
my name this 5th day of October, A. D. 1889.

JOHN J. CARTY.

Witnesses:

C. G. HAWLEY,
ELLA EDLER.