(No Model.) 2 Sheets—Sheet 1.

J. J. CARTY.

TELEPHONE EXCHANGE APPARATUS.

No. 473,911. Patented May 3, 1892.

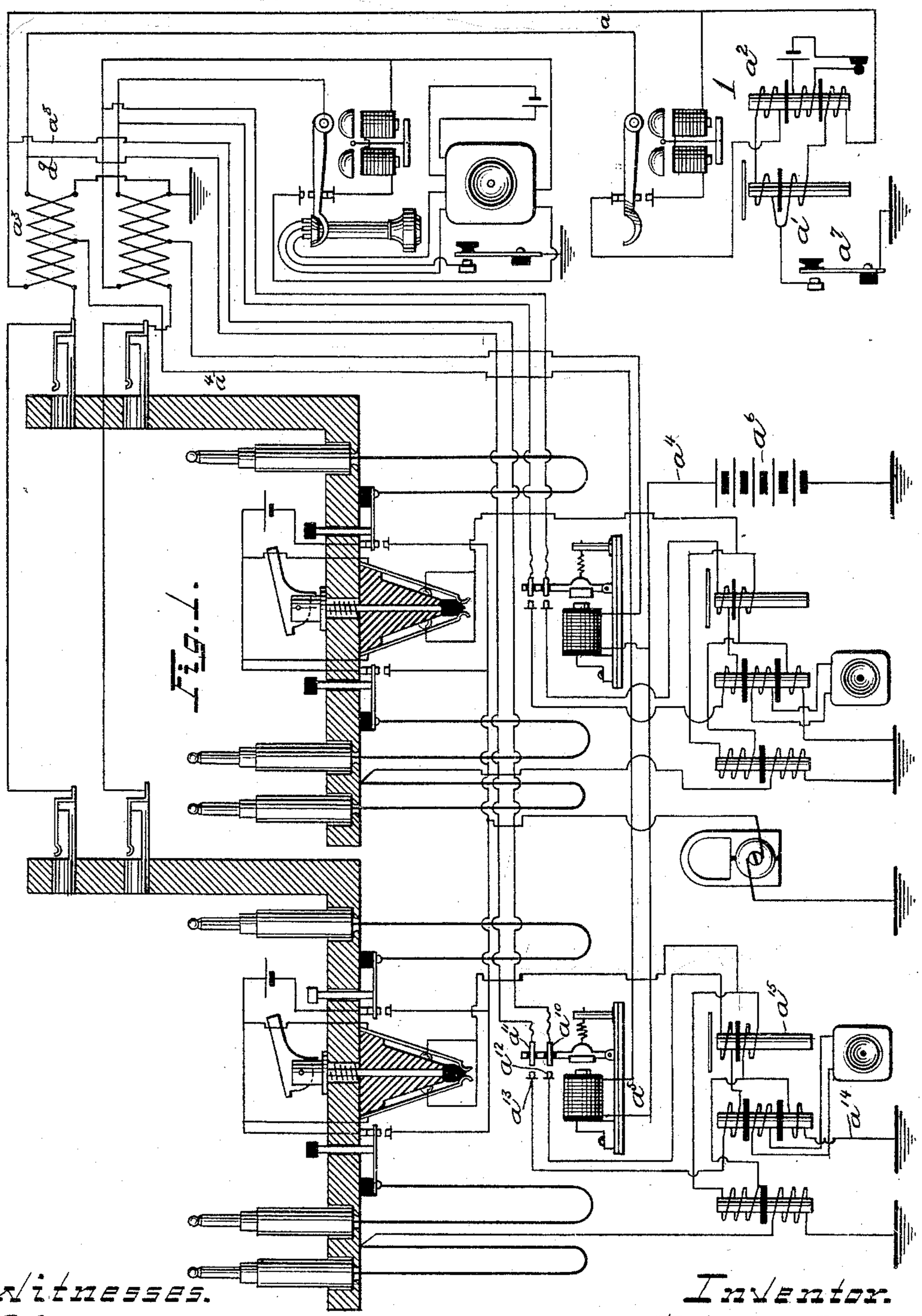

Fig. 1.

Witnesses.
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G. R. Parker.

Inventor.
John J. Carty.
By George P. Barton
Attorney.

(No Model.) 2 Sheets—Sheet 2.

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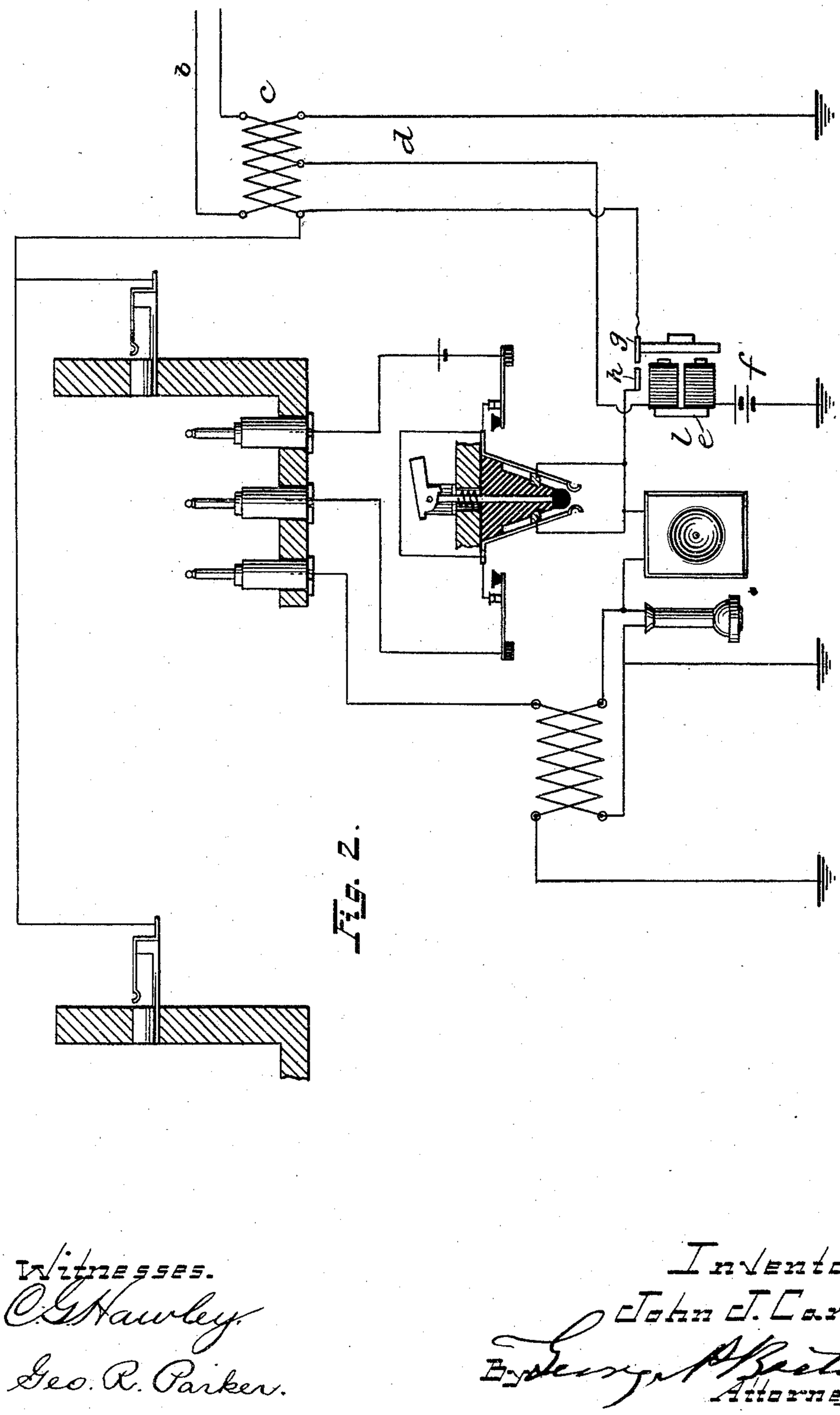

Fig. 2.

Witnesses.
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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. 473,911, dated May 3, 1892.

Application filed November 25, 1889. Serial No. 331,498. (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. 8,) 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 that class of telephone-exchange in which multiple switchboards are employed; and its object is to simplify the apparatus at the subscriber's station as well as at the central office. No generators are required at the subscribers' stations and no individual annunciators at the central office. Each subscriber is provided with a metallic circuit extending to the central office and including one coil of a converter, a branch from the center of said coil extending through a relay and a source of electricity to ground. The subscriber's telephone is wound differentially and the secondary coil of the inductorium is wound in two sections, each section being wound oppositely, each limb of the metallic circuit including a different one of these sections of the secondary winding of the inductorium. A branch circuit, including a normally-open key, extends from the center of the coil of the telephone to ground. Thus by closing said key to ground the two limbs of the metallic circuit may be connected to ground, so as to close the circuit, which may be traced from ground at the subscriber's station, over the two limbs of the metallic circuit to the center of one of the coils of the converter, and thence through the coils of the relay and the source of electricity to ground. The relay is thus actuated and the operator's telephone is bridged between the two limbs of the subscriber's metallic circuit by the closing of the local contacts of the relay. The operator's telephone and the inductorium of his transmitter are wound in two sections each, so that only one section or coil is included in the circuit which is bridged between the limbs of the metallic circuit. The other section or coil is included in a local ground-circuit connected with the operator's listening-key. Bridged across the terminals of this second section of the operator's telephone is the secondary wire of an induction-coil wound to five hundred ohms resistance or thereabout. The primary of this induction-coil extends from ground through a flexible cord provided with a terminal plug, which plug is used for testing. The operator's connecting and listening devices consist in several pairs of flexible cords with plugs attached, each pair including a source of electricity. There is also provided for each pair of connecting-cords two ringing-keys and one listening-key, said listening-key being adapted to switch the operator's telephone-circuit in and out of a pair of cords at will. The operator having received the order from the subscriber at once plugs into the calling subscriber's line to make the line-test busy, and then with her test-plug tests the line of the subscriber called for. If the line tests free the other plug of the pair of loop-plugs is inserted in the switch of the called subscriber's line and current is thrown upon his line. The connection is thus established. The operator having thrown up her cam-lever to disconnect her telephone is now ready for the next call. The calling subscriber does the clearing out by closing his circuit to ground, as at first, through the relay to connect with the listening operator, as at first, so as to give his order to disconnect direct.

A modification of the circuits and apparatus at the central office consists in a branch leading from the middle of one coil of the converter through the coils of a relay and a source of electricity to ground. One end of the operator's telephone is permanently connected to ground, and a branch from the other end extends through the secondary of the transmitter-coil to one of the local contact-points of a relay. The other local contact-point of a relay extends through the remaining coil of the converter to ground. By this means the call from the subscriber is received by the operator by induction through the converter, while in the other instance the

operator receives the call through a circuit bridged directly between the two limbs of the subscriber's metallic circuit.

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

Figure 1 shows two subscribers' stations, their telephone-lines extending to the central office and connected each with two switch-boards, together with the operators' outfits at said boards. Fig. 2 is a diagram showing the modification of the circuits at the central office.

I will first describe my invention in detail, as illustrated in Fig. 1. At station 1 I have shown in detail the winding of a subscriber's telephone and transmitter-inductorium. Each subscriber is provided with a metallic circuit extending to the subscriber's station and including a coil of a converter at the central office. Thus line a of station 1 extends, starting from the center a' of the winding of the telephone, through the coils of the telephone, the secondary coils of the transmitter-inductorium a^2, and thence to the converter a^3 at the central office. From the coil of the converter a^3, which is included in the telephone-line a, a branch a^4 extends through the electro-magnetic circuit-closing device or relay a^5 through the battery a^6 to ground. At the subscriber's station is provided a key a^7, by means of which the central portion a' of the coils of the telephone may be closed to ground. It is by closing this key a^7 that the subscriber is enabled to operate the circuit-closing device a^5, so as to connect his telephone with the telephone of the listening operator.

I will now describe the connections which are formed with the operator's telephone when this relay a^5 is operated by the subscriber closing the key a^7. The branch wires a^8 a^9 extend from the different sides of the circuit a to the local contacts a^{10} a^{11} of the relay. Now when the armature of the relay is attracted, these contacts a^{10} a^{11} are closed, respectively, upon opposing contacts a^{12} a^{13}, these opposing contacts a^{12} a^{13} including between them one of the coils of the inductorium a^{14} and one of the coils of the operator's telephone a^{15}. Thus when circuit is closed and held closed by key a^7, through the coil of the relay a^5 and the battery a^6, the telephone a^{15} of the operater will be bridged between the two sides of the metallic circuit a of the subscriber, and thus the subscriber may at will connect himself telephonically with the operator having charge of his line at the central office, so as to speak directly and give his order. The operator having thus received the order proceeds to make the connections required in the ordinary manner. When the subscribers are through talking, the one who sent in the call—as, for example, the subscriber of station 1—will depress his key a^7, and thus put himself again into telephonic communication with the operator.

Briefly, then, the steps required for a subscriber to get communication with another subscriber are to take down his telephone and at the same time press the grounding-key, and while holding said grounding-key depressed give his order to the operator. Then the operator must make the connections required, testing the line called for in case of multiple switch-boards, and, finally, the conversation being finished, the subscriber again puts himself in telephonic communication with the operator and tells her to disconnect.

As shown in Fig. 2, the telephone-line b is connected through one winding of the converter c. From this winding a branch circuit d extends through the coils of a relay e and a battery f to ground. The subscriber is provided with apparatus similar to the apparatus shown at station 1 of Fig. 1, and may thus send current through the coils of the relay to close the local contacts thereof. Instead of two pairs of local contacts, we have a single pair g h. The contact g is connected with a wire extending to ground and including the other coil of the converter. The contact h is connected through the telephone to ground. Thus the subscriber holding his line closed to ground will maintain the connection between contacts g h, so as to bring the operator's telephone into a closed circuit, including one winding of the converter, while his metallic circuit is included in the other winding thereof. Thus he may speak directly to the listening operator. This modification, it will be seen, requires less wiring than is required, as illustrated in Fig. 1.

It will be observed that the battery-current will flow through the different differential coils, the subscriber's telephone, and transmitter-inductorium in opposite directions, and therefore the battery-current will not in any wise impair the telephone when used at the same time for conversation—that is to say, the two grounds thus formed upon the metallic circuit are so arranged with respect to the coils of the telephonic instruments included therein as not to create any disturbance in these instruments.

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

1. A metallic circuit normally disconnected from ground at the subscriber's station thereon, a branch from said metallic circuit at the central office through a circuit-closing device, and a source of electricity to ground, in combination with a grounding-key at the subscriber's station, whereby the circuit-closing device may be operated on grounding the metallic circuit at the subscriber's station.

2. The combination, with the metallic-circuit telephone-line, including the differential coils of the telephone and transmitter-inductorium of a subscriber's station, of a key for closing the said line at the center of the coils of said telephone to ground and a branch

from said line to ground through a circuit-closing device and a battery.

3. The combination, with the metallic-circuit telephone-line, including the differential coils of the telephone and transmitter-inductorium at a subscriber's station, of a key for closing the said line at the center of the coils of said telephone to ground, the coil of a converter included in said circuit at the central office, a branch from said coil to ground through a circuit-closing device and battery, and a telephone at the central office telephonically connected with the metallic circuit of the subscriber by the circuit-closing device on grounding the line at the subscriber's station.

4. The combination, with the metallic-circuit telephone-line, including the differential coils of the telephone and transmitter-inductorium at a subscriber's station, of a key for closing the said line at the center of the coils of said telephone to ground, the coil of a converter included in said circuit at the central office, a branch from the center of said coil to ground through a circuit-closing device and battery, and a telephone at the central office telephonically connected with the metallic circuit of the subscriber by the circuit-closing device on grounding the line at the subscriber's station.

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

JOHN J. CARTY.

Witnesses:
C. G. HAWLEY,
ELLA EDLER.