

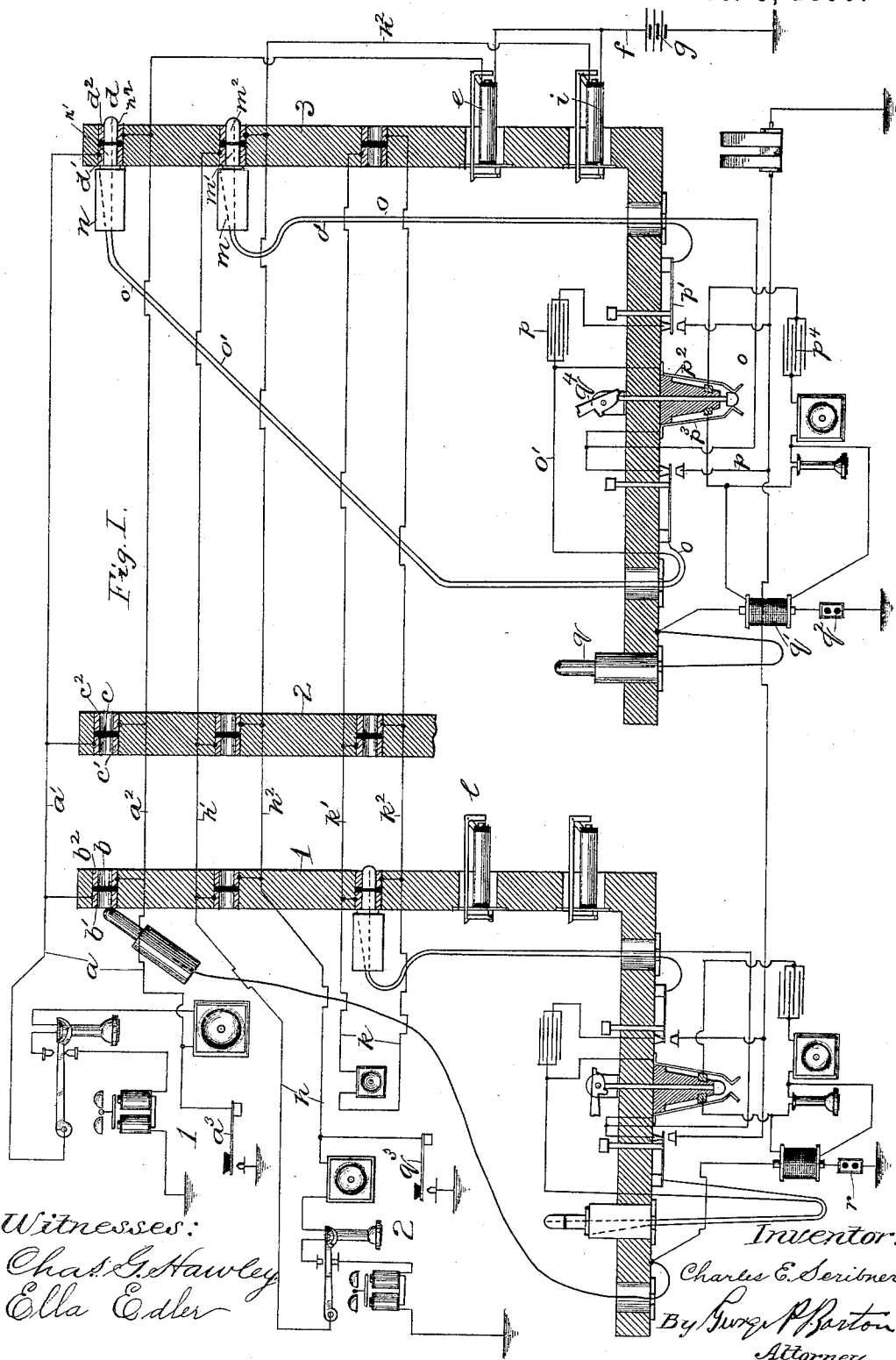
(No Model.)

2 Sheets—Sheet 1.

C. E. SCRIBNER.
TELEPHONE EXCHANGE APPARATUS.

No. 442,144.

Patented Dec. 9, 1890.



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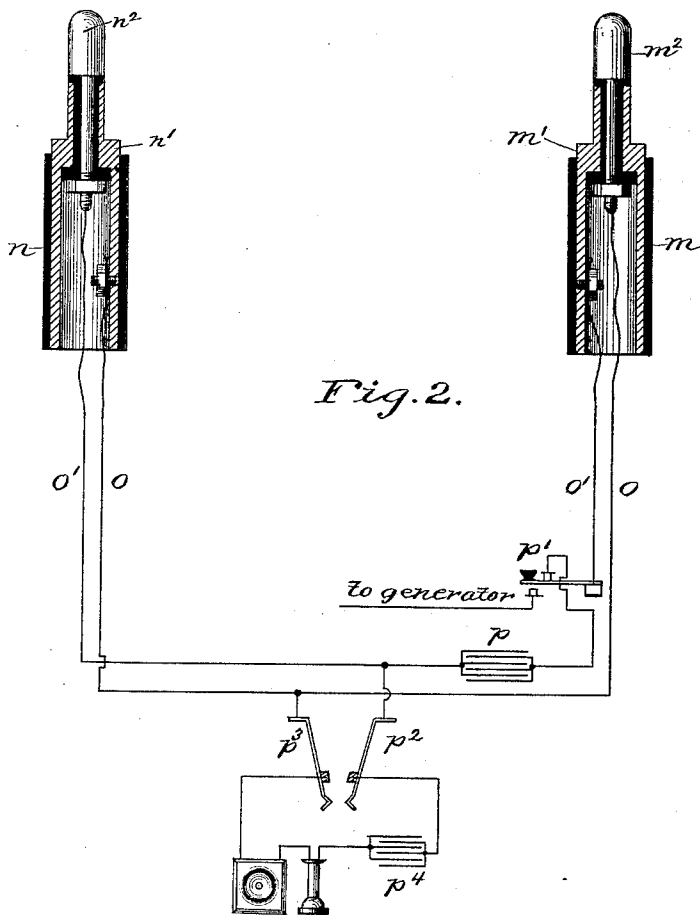


Fig. 2.

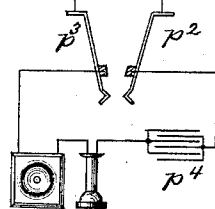


Fig. 3.

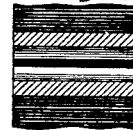


Fig. 4.

Fig. 5.



Fig. 6.



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UNITED STATES PATENT OFFICE.

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

TELEPHONE-EXCHANGE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 442,144, dated December 9, 1890.

Application filed November 23, 1888. Serial No. 291,658. (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 Telephone-Exchange Apparatus, (Case 179,) 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 in which metallic circuits are employed; and its object is to provide for uniting any two circuits together without including in the united circuit thus formed any electro-magnetic device or devices other than the telephones of the subscribers who are thus connected together, while at the same time means are provided for signaling between the central office and the different subscribers for the connections and disconnections, as occasion may require.

My invention consists, first, in telephone-lines, each consisting of two limbs or branches, one limb of each telephone-line being normally grounded at the subscriber's station and open at the central office, the other limb being normally open at the subscriber's station and grounded at the central office through an annunciator and battery, a different annunciator being provided for each telephone-line, and the battery being preferably common to a large number of lines; second, in metallic circuits, each limb being provided with a different terminal upon the switch-board, or in case of multiple switch-boards upon each of the switch-boards at the central office, and double-stranded cords provided with terminal plugs for uniting any two of said telephone-lines together, the plugs each being provided with two terminals adapted to close upon different terminals of the telephone-lines, respectively, the strands of said cords being reciprocally connected from the terminal of one plug to the opposite terminal of the other plug of the pair; third, in a pair of connecting-plugs, each provided with two terminals—as, for example, a metallic tip and a metallic sleeve upon the shank of the plug—said plugs being connected together by flexible cords,

one strand extending from the tip of one plug to the sleeve of the other, and the other strand connecting together the sleeve of the first and the tip of the second plug; fourth, in two telephone-lines, each consisting of two branches connected through the subscribers' telephones at the respective subscribers' stations thereof, one limb of the telephone-line including an individual annunciator of high self-inductive capacity and extending from said individual annunciator through a common battery to ground, and a connection between said telephone-lines at the central office reciprocally uniting the branches, which are normally open, of the two lines, respectively, with the branches which are permanently grounded at the central office, whereby the two telephone-lines are united in metallic circuit and provided with a branch connection through a different self-induction coil on opposite sides of said metallic circuit; and fifth, in providing a condenser in one of the strands of the connecting-cords, a condenser in the operator's telephone-circuit, and a high-resistance ground test-circuit including one coil of an induction-coil, the other coil of the induction-coil including the operator's telephone, as hereinafter described.

In the accompanying drawings, which are illustrative of my invention, Figure 1 is a view illustrative of three telephone-lines extending from the subscribers' stations thereon to the central office, each telephone-line consisting of two branches, one branch of each being connected with a different portion or terminal of a socket on each of the three different switch-boards, and the other limb being connected through the other side or portion of each of said sockets and extending thence through an individual annunciator to a common ground-line, including a battery, together with the operator's apparatus at two of the switch-boards. Fig. 2 is a detailed view of a pair of loop-plugs having their opposite terminals reciprocally connected together. Fig. 3 is a detailed longitudinal section of the preferable form of socket. Fig. 4 is a detailed view of a modified form of loop-plug. Fig. 5 is an end elevation of the loop-plug shown in Fig. 4. Fig. 6 is a detailed sectional view of a modification of the line-terminals,

the socket being divided horizontally and adapted to receive a plug of the form illustrated in Figs. 4 and 5.

Like parts are indicated by similar letters and figures of reference throughout the different figures.

Referring to Fig. 1, subscriber's station 1 is connected with the switch-boards 1, 2, and 3 at the central office by a metallic circuit a , consisting of two branches a' and a^2 . The normal circuit of branch a' may be traced from ground at subscriber's station 1, through the bell at said station, and thence to the central office. The normal circuit of the branch a^2 may be traced from the normally-open grounding-key a^3 at station 1 to the central office. At the central office each branch is provided on each of the switch-boards with a different terminal, the corresponding terminals of the two branches on each board being, preferably, different insulated parts of the same socket. Thus the sockets $b\ c\ d$ of the line a on each of the boards consist each of two parts—that is to say, socket b consists of the insulated parts b' b^2 , socket c consists of the insulated parts c' c^2 , while socket d consists of the insulated parts d' d^2 . Branch a' is connected with the portions b' c' d' , while branch a^2 is connected with the portions b^2 c^2 d^2 . The branch a' is normally open at the central office, while the other branch a^2 extends through an individual annunciator e , constructed to act also as a self-induction coil, and thence to wire f to ground, a battery g being included in the ground-wire f . Subscriber's station 2 is connected in the same manner with the switch-boards 1 2 3 by the line h , branch h' of said line being normally grounded at station 2 and normally open at the central office, while branch h^2 is normally open at station 2 and normally grounded through an individual annunciator i , connected with the ground-wire f through battery g . Station 3, it will be understood, is provided with subscribers' apparatus similar to the apparatus shown at stations 1 and 2, and is connected in the same manner by wire k with the central-office apparatus, branch k' being normally open and branch k^2 being connected through individual annunciator l , and thence to the wire f , which includes the common battery g , as shown. As shown in Fig. 2, m is the answering loop-plug, consisting of two insulated parts or terminals m' m^2 . The other plug n , which may be termed the "connecting plug" is provided with two insulated parts or terminals n' n^2 . It will be observed that the strand o' connects terminal m' of plug m with terminal n^2 of plug n , while strand o connects terminal n' of plug n with terminal m^2 of plug m —that is to say, the opposite terminals of the pair of plugs are reciprocally connected together. In the strand o' is placed a condenser p and the usual calling-key p' , the condenser being nearest to the plug n . The connections $p^2\ p^3$

from the different strands $o\ o'$, respectively, extend to the operator's telephone contact-points, the condenser p^4 being placed in the circuit with the telephone.

The several parts of the operator's apparatus illustrated in Fig. 2 are marked with corresponding letters of reference at board 3 of Fig. 1. The test-plug q (shown at board 3, Fig. 1) is connected through one coil of a converter q' and thence through resistance q^2 to ground, the other coil of the converter being included in circuit with the operator's telephone. Similar operator's apparatus may be provided at each of the boards, as shown at board 1, Fig. 1.

I will now describe the operation of my apparatus. We will suppose subscriber at station 2 desires a connection with the subscriber at station 1. Subscriber at station 2, by pressing on his key q^3 at station 2 closes the branch h^2 to ground, and thus current from battery g is sent through annunciator i . The operator at board 3, seeing shutter i fall, inserts her answering-plug m , as shown in the switch or socket of line h upon board 3, and the subscriber takes down his telephone. The ground-connection of branch h' at station 2 is thus taken off and the telephone looped into the line h in metallic circuit. As soon as the telephone is thus taken down the circuit of battery g is connected over branch h^2 through station 2 to branch h' , and hence to the terminals of the different sockets with which said branch h' is connected. The test consists in determining the presence or absence of battery at any of the said terminals in the manner hereinafter explained or otherwise. The operator at the same time throws down the cam-lever q^4 of her listening-in key, thus looping her telephone into the circuit. The operator is thus brought into connection with subscriber of station 2 and receives the order. She next proceeds to test the line called for. This test is made by touching the point of the test-plug q to the outer portion d' of the socket d —that is to say, the portion of the socket connected with the branch a' of the telephone-line, whatever may be the particular form of the sockets or the position of the different terminals thereof. If the telephone at station 1 is on the telephone-switch and the line is not connected with any other line, no current from battery g will be found present when the tip of test-plug q is applied to the terminal d' . If, however, the telephone is removed from the telephone-switch, or if the line has been called for and connected by a connecting-plug with any other line upon either of the boards, current from battery g will be sent through the test-plug q and the induction-coil q' , and the telephone of the operator being included in the circuit of the other coil of the induction-coil q' . The operator, listening and hearing the sound caused by the induced currents, will know that the line is in use. If the line thus tested has been connected with another line by means

of the connecting-plug n , battery will be present at the test-pieces b' , c' , &c., without regard to the position of the subscriber's telephone. Thus, as shown at board 1, test-plug r is shown applied to the test-piece b' of switch b of line a , and the telephone at station 1 of line a is on the hook. The line will, however, test "busy" since the battery g will be found connected with said terminal or test-piece b' . The circuit may be traced as follows: From battery g by wire f and branch h^2 to the terminal m^2 of answering-plug m , and thence by strand o to the terminal n' of plug n , which terminal n' is in contact with the test-piece d' of plug d , and thence over the branch a' to test-piece b' of switch b . The resistance r , included in circuit with the test-plug, should be such that the current from battery g , thus closed through the test-plug, will not be sufficient to throw down the shutter i when the test-plug is thus made. The object of the condenser p is to prevent the annunciator of the called subscriber from being thrown down when the subscribers are through talking and hang up their telephones. The condenser p^1 has the same function in case the operator should be listening in at the time the calling subscriber hangs up his telephone. When the subscriber called hangs up his telephone, the calling subscriber's individual annunciator is thrown down, thus notifying the operator to disconnect. Thus suppose subscriber at station 1 hangs up his telephone, as shown, while the lines a and h are connected, as shown at board 3. The subscriber at station 1 in this instance would be the "called or answering subscriber," and the subscriber of station 2 would be the "calling subscriber." The telephone of the answering subscriber at station 1 being hung up, branch a' is connected to ground at station 1, and thence to terminal d' of the socket d , and thence to terminal n' of plug n , and thence to the tip m^2 of plug n , and thence by wire h^2 through the annunciator i , and thence to wire f , and through battery g to ground. Annunciator i of the calling subscriber is thus thrown down when the answering subscriber hangs up his telephone. When the calling subscriber hangs up his telephone, as shown at station 2, current from battery g will not be sent through individual annunciator e of the answering subscriber, since the condenser p will be found included in the circuit. The circuit formed through the condenser p and annunciator e may be traced from ground at station 2 over branch h to terminal m' of the plug m , and thence over strand o to condenser p , and thence to the tip n^2 of plug n , and thence over a portion of branch wire a^2 through the answering subscriber's annunciator e , and thence through battery g to ground. The annunciator e will not be operated, therefore, when the calling subscriber hangs up his telephone. In case the operator's telephone were connected into the circuit, still the condenser p^1 would prevent battery-cur-

rent from battery g from flowing through annunciator e .

It is well known in the art that a condenser in a telephone-circuit is not objectionable. Though the line is thus made open as to ordinary battery-currents, still the circuit is complete as to voice currents—that is to say, the two connected subscribers can telephone over a circuit including a condenser the same as if the condenser were not present.

I have described my invention as applied to a multiple-switch-board telephone-exchange system. Certain features thereof, however, it is evident, might be employed to advantage in single switch-board systems. As shown in Figs. 4 and 5, the loop-plug has its two terminals on opposite sides thereof, these terminals being insulated by suitable insulating material. The socket shown in Fig. 6 is divided longitudinally instead of transversely, as shown in Fig. 3. This plug-socket, Fig. 6, is especially designed to receive a loop-plug of the form shown in Figs. 4 and 5.

My invention as thus described admits of various modifications, which would readily suggest themselves to those skilled in the art, and I therefore do not limit myself to the constructions shown.

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

1. A metallic telephone-line circuit consisting of two branches, one branch being normally connected with ground at the subscriber's station, and thence through the subscriber's bell to the telephone-switch, and thence to the central office, said branch being connected with the test portion of a socket on each of two or more switch-boards and being normally open, while the other branch, being normally open at the subscriber's station, extends to the other terminals of the same sockets on said switch-boards, and thence through an annunciator and a battery to ground, in combination with the telephone switch and a ground-key at the subscriber's station, whereby on depressing the grounding-key current from the battery is sent through the individual annunciator, while on operating the telephone-switch the two branches are united in metallic circuit.

2. A pair of loop-plugs and connecting-cords, the strands of said cords being connected, respectively, from one terminal of one of the plugs to the opposite terminal of the other plug reciprocally, in combination with a condenser included in one of said strands, substantially as and for the purpose specified.

3. Two metallic-circuit telephone-lines looped together at the central station, each of said lines being provided with a ground branch through its individual annunciator and a battery to ground, the looping device consisting of a pair of plugs, each having two terminals and different strands, each of the terminals of one plug being connected with the opposite terminals, respectively, of the other plug,

and a condenser included in the circuit between two of said opposite terminals, substantially as and for the purpose specified.

4. Two telephone-lines, each consisting of two branches, one branch of each being normally grounded at the central office through an annunciator and battery and the other branch of each being normally open, a looping device connecting reciprocally the normally-open branches with the closed branches, and a condenser included between two of said connected terminals and switching apparatus at the different subscribers' stations operated by the telephones, whereby on hanging up the telephone of one station the annunciator of the line is operated as a clearing-out signal, while on hanging up the telephone of the other station the current is prevented from flowing through the annunciator of the line of the first station, substantially as and for the purpose specified.

5. The combination, with the telephone-line extending from ground at the central office through a battery to terminals, one on each switch-board, and thence to the subscriber's station and thence back to test-terminals, one on each switch-board, of switching apparatus at the subscriber's station for forming a ground connection for the battery or uniting the telephone-line through the subscriber's station in metallic circuit to connect the battery to the said test-terminals.

6. The combination, with the telephone-line extending from ground at the central office through a battery to terminals, one on each switch-board, and thence to the subscriber's station, and thence back to test-terminals, one on each switch-board, of switching apparatus at the subscriber's station for forming a ground connection for the battery or uniting the telephone-line through the subscriber's station in metallic circuit to connect the battery to the said test-terminals, and testing apparatus for determining the presence or absence of battery-current at said test-terminals at the different boards to determine whether the line is in use.

7. The combination, with a pair of loop-plugs having different terminals reciprocally

connected together by different strands or wires diagonally or oppositely, of a condenser included in one of said strands, and a telephone in a bridge between the cords, a condenser being included, also, in the bridge, substantially as and for the purpose specified.

8. The combination, with a pair of loop-plugs having different terminals reciprocally connected together by different strands or wires diagonally or oppositely, of a condenser included in one of said strands and a telephone in a bridge between the cords, a condenser being included, also, in the bridge, a converter having one coil including the said telephone and the other coil including a branch ground-circuit of high resistance provided with a test-plug or movable terminal adapted to close upon any one of several test-pieces provided upon a telephone switch-board.

9. Two telephone-lines *a* and *b*, each consisting of two branches, branches *a'* and *b'* of the said lines being each normally grounded through the bell of its subscriber's station and each extending to different test-terminals, one for each line on each board, the branches *a*² and *b*² being each permanently grounded at the central office and each extending through a battery and a different individual annunciator and to different terminals, one for each of said branches *a*² *b*² on each board, the test piece and terminal of each line on each board forming a divided socket adapted to receive a loop-plug, said branches continuing to a normally-open grounding-key at the respective subscribers' stations thereof, the telephone and telephone-switch at each subscriber's station, and operator's calling, testing, and connecting apparatus at the different boards, whereby the lines may be united for conversation at one board and tests made at any of the other boards, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 17th day of November, A.D. 1888.

CHARLES E. SCRIBNER.

Witnesses:

GEORGE P. BARTON,
ELLA EDLER.