

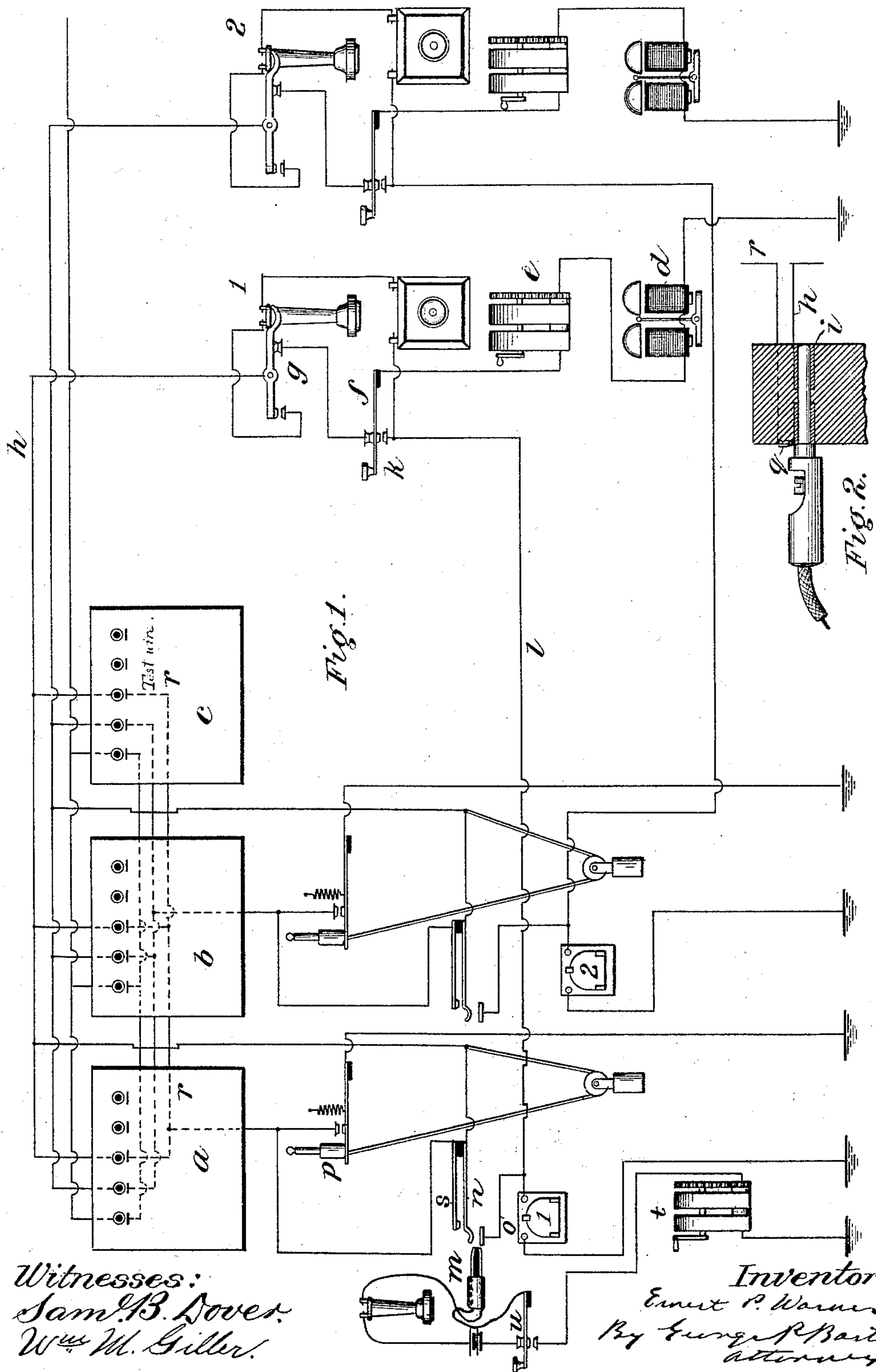
(No Model.)

2 Sheets—Sheet 1.

E. P. WARNER.  
MULTIPLE SWITCH BOARD SYSTEM.

No. 433,636.

Patented Aug. 5, 1890.



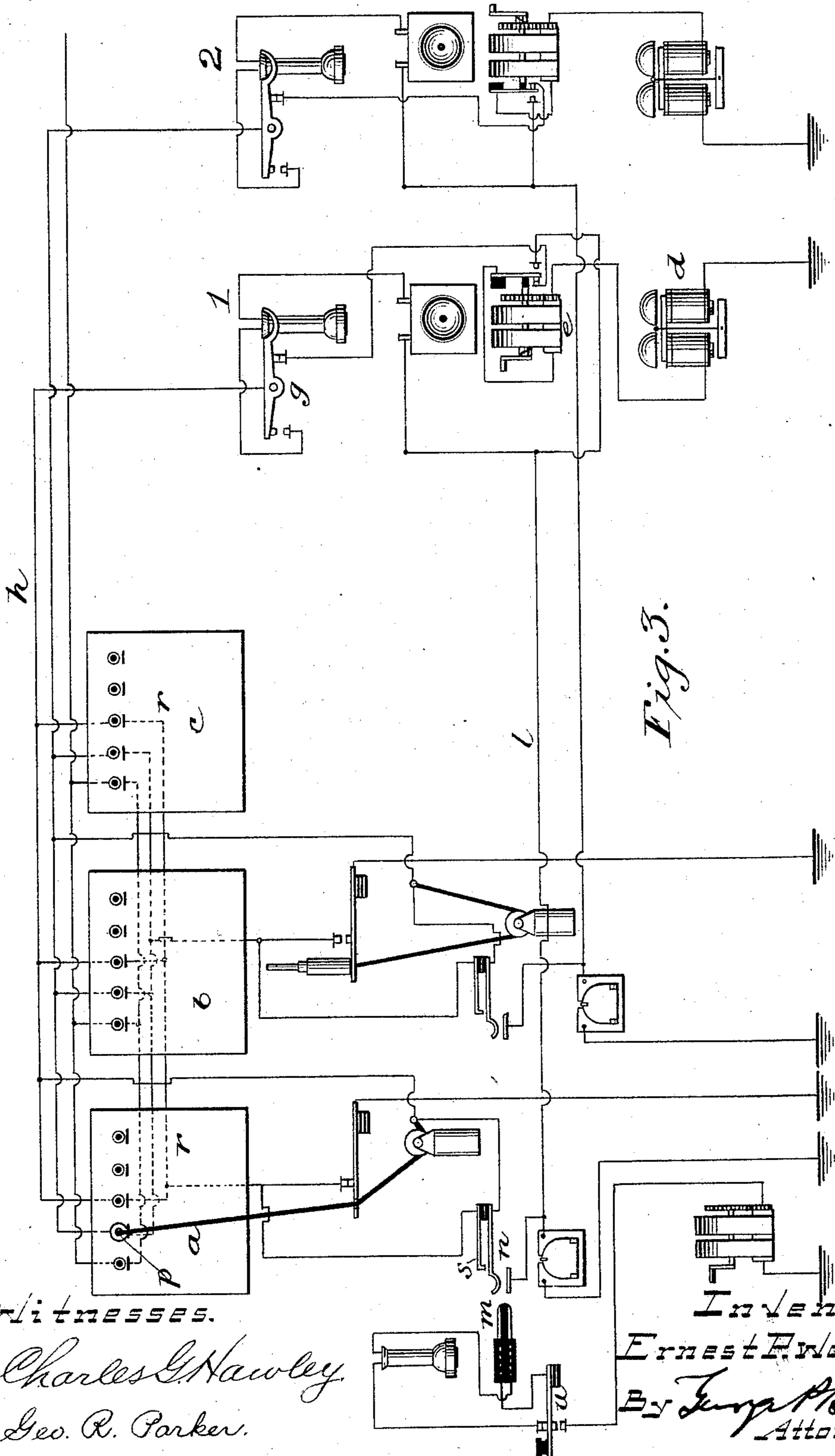
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# UNITED STATES PATENT OFFICE.

ERNEST P. WARNER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

## MULTIPLE-SWITCH-BOARD SYSTEM.

SPECIFICATION forming part of Letters Patent No. 433,636, dated August 5, 1890.

Application filed January 31, 1887. Serial No. 225,984. (No model.)

*To all whom it may concern:*

Be it known that I, ERNEST P. WARNER, 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-Switch-Board Systems, 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 metallic circuits for multiple-switch-board systems of a telephone-exchange, and its object is to reduce, as far as possible, the number of contacts and connections between the lines and the different switch-boards. By dispensing with a large number of the connections heretofore necessary I am enabled to greatly simplify the apparatus and bring the switches on the different switch-boards within a comparatively small space, while the connections are made with greater facility and with more certainty than heretofore.

My invention consists in providing on each of the multiple switch-boards a socket or terminal for each line, which is permanently connected with one side thereof. The limb over which the subscriber sends his signal extends from ground at the subscriber's station through the subscriber's bell and generator to a key, which key on being depressed connects with the branch extending through the subscriber's drop at the exchange and thence to ground.

My invention also consists in providing a ground-connection for the test-wire of the line, whose plug is inserted in the socket of another line, and also a ground-connection for each of the different test-wires, whereby any test-wire is grounded when the operator connects his listening-telephone with the line.

My invention further consists in switching apparatus, whereby one subscriber may ring up the subscriber with whom he is connected without signaling the exchange. By well-known switching apparatus connected with the crank of the generator turning the generator in one direction may be made to direct current to the subscriber's shutter at the central office, while turning the generator in the opposite direction will direct the current over

the other branch or limb of the line, so as to call up the connected subscriber without signaling the central office. Each subscriber is thus provided with a branch or limb which is connected normally from ground at his station through his bell and generator, and thence to the subscriber's switch and thence to a different normally-open terminal on each of the switch-boards at the central office. In addition to these fixed terminals or connecting-sockets, a normally-open branch is provided, which terminates in a flexible cord and plug. I provide switching apparatus in this normally-open branch, so that the telephone or generator may be connected with the line as desired.

The calling-limb of each subscriber, as before described, is normally open at the subscriber's telephone-switch. By means of suitable switching apparatus at the central office the different limbs may be connected with the different ends of the loop containing the operator's telephone. Thus when a subscriber takes down his telephone the operator at the central office on looping in his telephone will be connected in metallic circuit with the subscriber.

Any well-known test may be provided for indicating at any given board whether a line wanted is connected or in use at any other board. I have shown the test system described and claimed in United States Letters Patent granted C. E. Scribner, September 9, 1884, No. 305,021.

My invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagram showing two subscribers' stations with their lines extending to terminals upon three different switch-boards at the central office connected with their individual annunciators and switching apparatus, whereby the calls and connections may be made. Fig. 2 is a detail view of the terminals of a line and its test-wire with a plug inserted. Fig. 3 is a diagram showing two telephone-lines connected together upon one of the boards, and the generator at the subscriber's station arranged to automatically switch the generator to send current over either branch of its subscriber's metallic cir-

cuit accordingly as the generator is turned in one direction or the other.

As many switch-boards *a b c* are provided as may be necessary to afford room for the operators necessary to do the switching. Each telephone-circuit is provided with a separate connection on each of the boards. Thus the telephone-circuit of subscriber's station *l* may be traced from ground at the said subscriber's station through bell *d* and the generator *e* to switch *f*, and when the switch is in position shown, thence to telephone-switch *g*, and thence by the receiving branch *h* of the metallic circuit to a separate switch or socket on each of the boards *a b c*.

The connection of wire *h* with a metallic socket *i* is shown in Fig. 2. The line *h* is thus connected with a different socket *i* on each of the switch-boards, and these connections are preferably permanent, the line *h* being soldered or otherwise securely fastened to each of the sockets *i* on the different switch-boards. Thus on each of the boards is provided a normally-open terminal or socket for each subscriber's telephone-line. Now going back to switch *f* at the subscriber's station, we find the contact point *k* in the calling branch *l* of the metallic circuit. On closing the switch upon point *k* the circuit of the generator *e* is closed through individual annunciator *l* at the central office. Thus by depressing key *f* and turning generator *e* the shutter of annunciator *l* may be thrown down, thus signaling the central office. Instead of depressing the key *f* by hand, as above described, the work may be done automatically when the generator is turned in the proper direction, as shown in Fig. 3, the incline *k'* upon the hub of the crank acting upon the shaft to thrust the same endwise in the well-known way to operate a switch. Any other of the well-known forms of automatic devices for doing this work might be employed. The call being thus sent, the subscriber takes down his telephone, and the position of the telephone-switch being thus changed the ground at the subscriber's station is taken off and the branches *h* and *l* of the circuit are connected together through the telephone. The operator at the same time, having seen the shutter fall, loops his telephone into the line. This he does, preferably, by means of a loop-plug or wedge *m*, which he inserts between the points or strips *n o*. The subscriber and operator are thus connected together in metallic circuit. The operator having found out what connection is desired, at once takes up plug *p* and first tests the line wanted by touching the point of the plug to the test-piece, and then, if the line tests free, inserts the plug in the socket of the line wanted, as shown at board *a*, Fig. 3. In Fig. 2 a connecting-plug is shown thus inserted in a switch. The point of the plug coming against the socket *i* is electrically connected therewith. The shank of the plug comes against the tube or test-piece *q*, and hence a cross or connection is made be-

tween the test-wire *r* and the line *h* through the plug, when inserted, as shown in Fig. 2.

Immediately on lifting any plug *p* from the switch on which it normally rests the switch rises against its upper contact, which contact is connected with the test-wire *r* of the line with which the plug *p* is connected. Thus immediately on taking up the plug of any line its test-wire is provided with a ground-connection; also, when the operator loops in his telephone by inserting wedge *m* between points *n o*, the strip *n* is lifted to contact *s* of the test-circuit, so that the test-wire is connected to ground through the annunciator *l* of the line. It will thus be seen that whenever a line is in use it will test "busy."

The generator *t* is provided at the central office, as shown. By simply depressing key *u* the operator's telephone may be disconnected while the generator is connected to branch *h*. Thus signal from a subscriber may be received at the central office over branch *l*, while the central office may call the subscriber over branch *h*.

It will be seen that no special clearing-out annunciator is required, since the subscriber, on hanging up his telephone, may depress key *f* and turn in generator, thus throwing down his shutter *l*. The operator seeing plug *p* in use, will know that the signal means to disconnect. As shown in the drawings, key *f* must be brought into contact with point *k* while the subscriber is calling.

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

1. A telephone-circuit consisting of two limbs or branches, one of said limbs being connected from ground at the subscriber's station to a switch device and thence normally through the telephone-switch, and thence to the central-office switch-board, where it is normally open, the other limb being connected from a normally-open point of the telephone-switch through the subscriber's telephone and thence through the subscriber's annunciator to ground at the central office, in combination with a loop-switch at the central office and the operator's telephone and generator, whereby signals may be sent out and received and the operator's telephone looped in metallic circuit with the telephone of the subscriber.

2. In a multiple-switch-board system, the combination, with the normally-open switches or sockets of each of the lines, of a test-circuit, and a branch from each test-circuit to the switch or strip *s* upon the loop-switch of each, whereby the test-circuit of any given line is closed to ground when the operator inserts a loop-plug in the loop-switch of said line.

3. In a telephone-exchange system, the combination, with multiple switch-boards and metallic-circuit telephone-lines, each provided with a normally-open terminal on each of the boards, of test-circuits, one for each telephone-

line, each test-circuit being connected with a test-piece near each terminal of its line on the different boards, a loop-switch in each of the metallic circuits at the central office and a branch circuit from the test-circuit of each line to a contact-piece upon the loop-switch of the line, and switching apparatus whereby any two lines may be connected together on either of the boards, while at any board it may be determined whether any line wanted or called for is connected or in use at any other board.

4. The combination, with the test-circuit of a multiple-switch-board system, of contact piece or strip, the loop-switch, and the loop-plug, whereby the test-circuit is connected to ground automatically when the loop-plug is inserted in the loop-switch, substantially as shown and described.

5. In a metallic-circuit telephone-line extending from an open switch or terminal of the switch-board through the subscriber's outfit and through an annunciator at the central office to ground, normally-open branch connections at the central office from each limb of the circuit to different contacts or strips, a loop-switch and a loop-plug, and a telephone in the circuit of said plug, whereby on inserting the said loop-plug in the loop-switch the said telephone will be connected in metallic circuit with the subscriber's outfit, while the annunciator will be out of the metallic circuit.

6. The combination, with a metallic telephone-circuit, one branch being normally open at the switch-boards and the other branch connected through an annunciator to ground at the central office, of the subscriber's outfit consisting of the bell and generator in a ground branch normally closed through the telephone-switch to the branch of the circuit extending to the switch-boards, which branch is open at the said switch-boards, the subscriber's telephone included in the branch which includes the annunciator at the central office, said branch being normally open at the telephone-switch when the telephone is hung on the switch, whereby on removing the telephone from the switch the ground branch at the subscriber's station which includes the bell is opened, while the subscriber's telephone is looped into the metallic circuit.

7. In a telephone-circuit, the telephone-switch permanently connected with branch or limb *h*, which is normally open at the central office, in combination with branch *l*, closed to ground through an annunciator at the cen-

tral office, a branch to ground from the telephone-switch including a generator, and a switching device whereby current from the generator may be sent over branch *l* through the annunciator at the central office, as described.

8. The combination, with the different branches or limbs of a subscriber's telephone-line, of a switching device at the subscriber's station, said switching device being connected with the ground branch at said station containing the generator and adapted to be closed to either branch of the telephone-line, and another subscriber's telephone-line united with the telephone-line of the first subscriber at the central office, and electrical connections whereby current may be directed over either branch or limb of the telephone-line, according to the position of the switching device to call up the central office or a connected subscriber, as described.

9. A telephone-circuit composed of two lines or branches leading from a central office to a subscriber's station, one of said lines being permanently grounded at the central office through an annunciator and normally open at the subscriber's station, the other line being normally grounded at the subscriber's station and open at the central office, in combination with switching apparatus whereby the two lines may be united in metallic circuit between the subscriber's station and the central office, while at the same time the ground is removed at the subscriber's station.

10. The combination, with the different branches or limbs of a subscriber's telephone-line, of a switching device at the subscriber's station, said switching device being connected with the ground branch at said station, the generator included in said ground branch, contacts with the different branches of said telephone-line, with either of which contacts said switching device is adapted to be closed and another subscriber's telephone-line united with the telephone-line of the first subscriber at the central office, whereby current may be directed over either branch or limb of the telephone-line according to the position of the switching device to call up the central office or a connected subscriber, as described.

In witness whereof I hereunto subscribe my name this 14th day of January, A. D. 1887.

ERNEST P. WARNER.

Witnesses:

GEORGE P. BARTON,  
WM. M. GILLER.