

(No Model.)

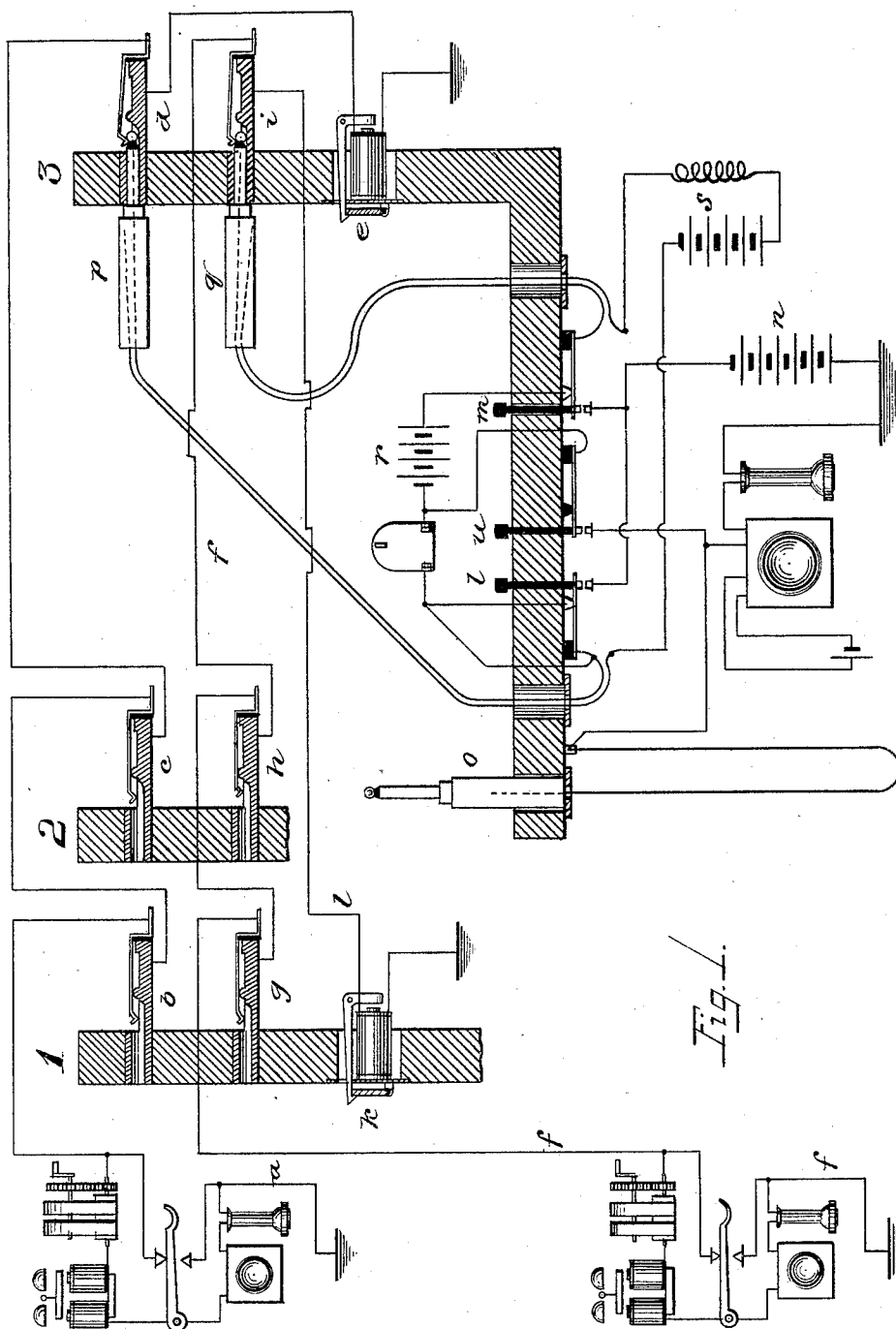
2 Sheets—Sheet 1.

W. E. McKIVITT.

MULTIPLE SYSTEM FOR TELEPHONE EXCHANGES.

No. 461,887.

Patented Oct. 27, 1891.



Witnesses.

Chas. G. Hawley.
Geo. R. Parker.

Inventor.

William E. McKivitt.
By George R. Barton
Attorney.

(No Model.)

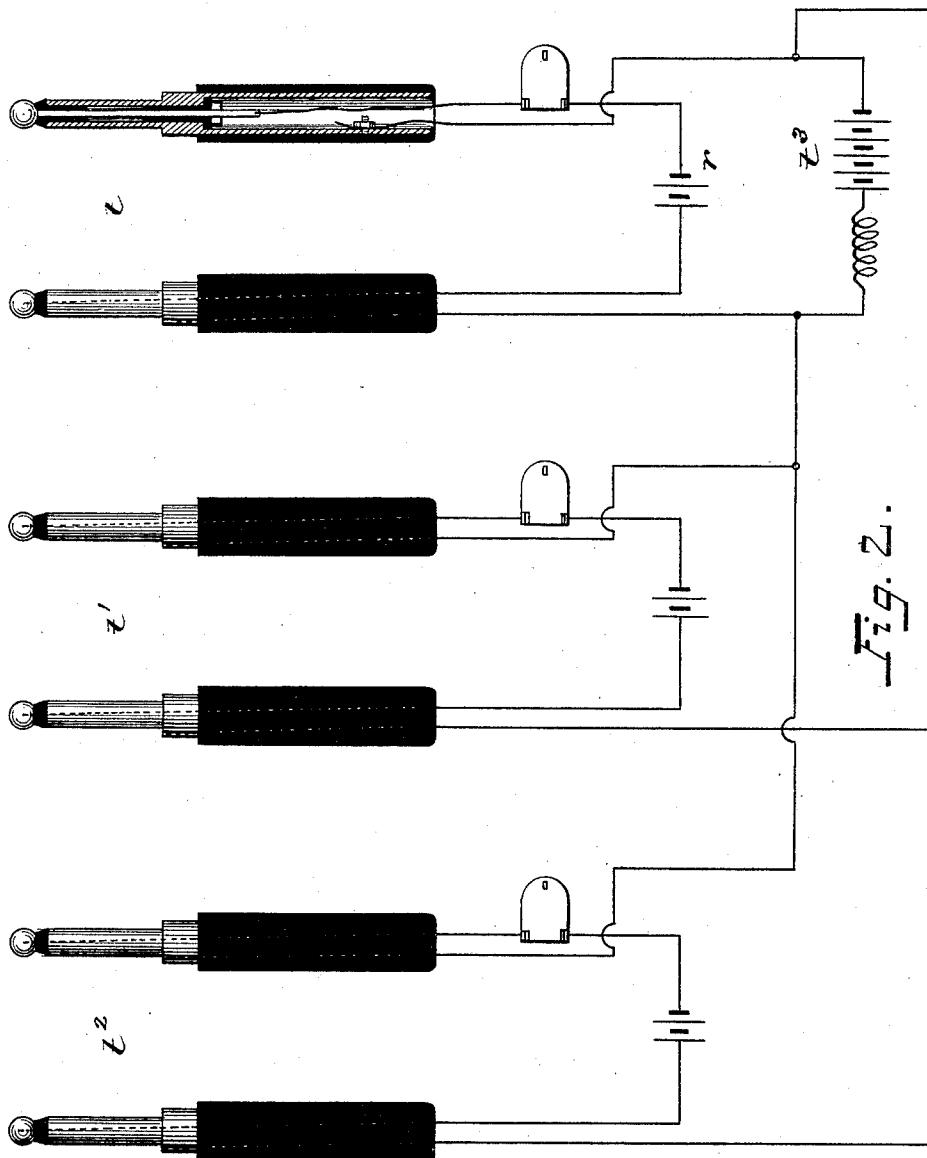
2 Sheets—Sheet 2.

W. E. McKIVITT.

MULTIPLE SYSTEM FOR TELEPHONE EXCHANGES.

No. 461,887.

Patented Oct. 27, 1891.



Witnesses.

Chas. G. Hawley.

Geo. R. Parker.

Inventor.

William E. McKivitt.

By *George P. Barton*
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM E. MCKIVITT, OF ST. PAUL, MINNESOTA, ASSIGNOR TO THE
WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

MULTIPLE SYSTEM FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 461,887, dated October 27, 1891.

Application filed March 30, 1885. Serial No. 160,567. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. MCKIVITT, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented a certain new and useful Improvement in Testing Apparatus for Multiple Switch-Boards, (Case 2,) 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 apparatus; and its object is to provide ready means of determining at any given board whether a line wanted or called for is connected or in use at any other of the boards. Heretofore various circuit systems have been devised for doing this work. The systems which have been most generally adopted require a special test-wire for each telephone-line. As to the prior state of the art, reference is made to Letters Patent granted Charles E. Scribner, No. 305,021, September 9, 1884, and No. 308,315, granted Milo G. Kellogg, November 18, 1884.

My invention herein relates more especially to the operator's key-board apparatus and test-batteries used in connection therewith. Upon the switch-board simple spring-jack switches are employed and special test-circuits are dispensed with.

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

Figure 1 is a diagram showing two telephone-lines connected with different switches on each of three switch-boards, and each through its individual annunciator to ground, together with the operator's connecting, signaling, and testing apparatus at one of the switch-boards. Fig. 2 is a diagram view illustrating my method of furnishing a current from one main battery to two, three, or more pairs of connecting plugs.

As shown in Fig. 1, telephone-line *a* extends from ground at the subscriber's station through usual subscriber's apparatus to the central office, and thence through spring-jack switches *b c d*, distributed on the different switch-boards, and from the switch on the last board through individual annunciator *e*

to ground. Telephone-line *f* is connected in a similar manner from ground at the subscriber's station thereon through switches *g, h, and i*, and from the switch *i* on the last board through individual annunciator *k* to ground. There will be many such lines thus connected in the exchange, their individual annunciators being distributed upon the different boards in the usual manner, as is most convenient.

It will be observed that the spring-jack switches are of well-known construction, consisting each of a frame and a spring, which is adjusted to press against the same. When the spring is lifted each is insulated from the frame.

The connecting-plugs are provided each with two terminals. On inserting a connecting-plug in a switch the spring is separated from the frame and connected to one of the terminals of the plug, while at the same time the frame is connected with the other terminal of the plug, all in a well-known way.

The calling-keys *l m* are of usual construction and are arranged to send current from battery or generator *n* over any line with which connection has been made. The test-plug *o* is the terminal of a normally-open branch wire extending through the telephone, as shown.

The pair of loop-plugs *p q*, as before stated, are provided each with two contacts or terminals, one contact being adapted to be closed upon one portion of a spring-jack switch and the other terminal upon the other portion of the switch in which the plug may be inserted. Thus the tips of the two plugs, as shown in Fig. 1, are connected with the springs of switches *d i*, while the sleeves of said plugs are connected with the frames, respectively, of said switches *d i*.

The battery *r* is included in the circuit of the strand of the cords which connects the tips of said plugs, while the battery *s* is included in the circuit of the strand of the cords which connects the sleeves of said plugs. It is the use of these batteries, one in each of the strands connecting the different terminals of the loop-connecting plugs, which constitutes the principal feature of my invention, since by their use current will always be found

present at all the frames of the spring-jack switches of any line which is in use, whether the connection is made at one board or another—that is to say, without regard to
5 whether the test is made at a spring-jack of a board on the line side or upon the individual annunciator side of the board upon which the connection has been made.

It will be understood that there will be several pairs of plugs at each of the switch-boards—say, for example, twenty pairs for each operator—so that a number of pairs of telephone-lines may be connected together at the same time at each board. In Fig. 2 I have
15 shown three such pairs of plugs. A separate test-battery *r*, together with an annunciator, is shown in the strand connecting the tips of the different pairs *t t' t''*, while a common battery *t³* is provided and so arranged as to afford
20 current to the strands which connect together the sleeves of the several pairs.

To illustrate the working of my system, suppose subscriber of line *a* wishes to talk with the subscriber of line *f*. He first sends current from his generator over line *a*, throwing
25 down his individual annunciator *e* at board 3. The operator, seeing shutter *e* fall, inserts plug *p* in spring-jack *d* and presses down upon listening-key *u*, listens at her telephone,
30 and asks through the microphone who is wanted, and on getting the answer that it is the subscriber on line *f* she immediately taps the frame of spring-jack switch *i* of that line with the test-plug *o*, and as she does not hear
35 any click in the telephone when the test-plug *o* is thus applied to the frame of spring-jack *i* she knows that the line is clear, and thereupon inserts the other plug *q* of the pair in the spring-jack switch *i*, thus connecting to-
40 gether the telephone-lines *a f*, as shown in Fig. 1. The lines being thus connected, she notifies the subscriber of line *f* by pressing down upon calling-key *m*, thus connecting the generator
45 with line *f*, so as to ring the bell of the subscriber upon said line. If, however, when the test was made by tapping test-plug *o* upon the frame of spring-jack *i*, the line *f* had been connected at some other board a click would have been heard in the telephone, this click being
50 produced by current from one of the test-batteries. Thus, suppose at board 2 a connection made between spring-jack switches *c* and *h* by a pair of loop-plugs corresponding to plugs *p q* and arranged with similar
55 circuits and batteries connected therein. In case of such connection at board 2 a ground circuit including battery *s* would be formed, which circuit could be traced from ground at the central office of line *f*, through annun-
60 ciator *k*, through spring-jack *i*, thence to frame of switch *h*, thence to the sleeve of the plug inserted in switch *h*, and thence through the battery *s* to the frame of switch *c*, and thence over the cut-off portion of line *a*, through spring-
65 jack *d*, through annunciator *e* to ground. Thus a circuit would be closed through the

battery included in the strand of the cords connecting the sleeves of the plugs. The spring-jack switch *i* being in this battery-circuit it is evident that current from said battery
70 would be derived through the test-plug when applied to said switch *i*. We will suppose now that two lines are connected, as shown upon board 3, and that the test is made at a preceding board—for example, at switch *h* of
75 line *f* on board 2. In this case it will be seen that the test-battery *r* is connected with the said switch *h*, and thus when a test is applied to said switch *h* current will be derived from said battery *r*, which passing through the tele-
80 phone will cause the click which indicates the busy-test. The battery *s* should not be of sufficient force to throw down the shutters of the lines. If desired, resistance may be introduced in the circuit with battery *s*, to
85 cut down the current of said battery so low as to prevent any danger of the annunciators being thrown down.

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

1. The combination, with telephone-lines connected with two or more switch-boards through simple spring-jack switches, of pairs of connecting plugs at different boards, said
95 plugs being provided with two terminals and corresponding terminals of each pair being connected together through different test-batteries, and a test-plug at each of the boards connected with a branch leading through the
100 operator's telephone, whereby it may be determined at any given board whether a line wanted or called for is in use or connected at any other of the boards.

2. The combination, with a pair of loop-plugs and the double-stranded cords connected therewith, of battery in each of said strands, and telephone-lines provided with spring-jack switches upon different switch-boards, where-
105 by on inserting a pair of plugs in the switches of two lines on any given board the cut-off portions of the lines are connected in a circuit including one of the batteries while the connected lines are brought into the circuit containing the other battery, substantially as
110 and for the purpose specified.

3. The combination, with pairs of loop-plugs upon one of several multiple switch-boards, of separate battery included in the strand connecting together the tips or line
120 terminals of each of the pairs of plugs, and a battery common to the other terminals of said plugs, substantially as and for the purpose specified.

In witness whereof I hereunto subscribe my
125 name in the presence of two subscribing witnesses.

WILLIAM E. McKIVITT.

Witnesses:

H. G. UNDERWOOD,
HERMAN J. FORSYTH.