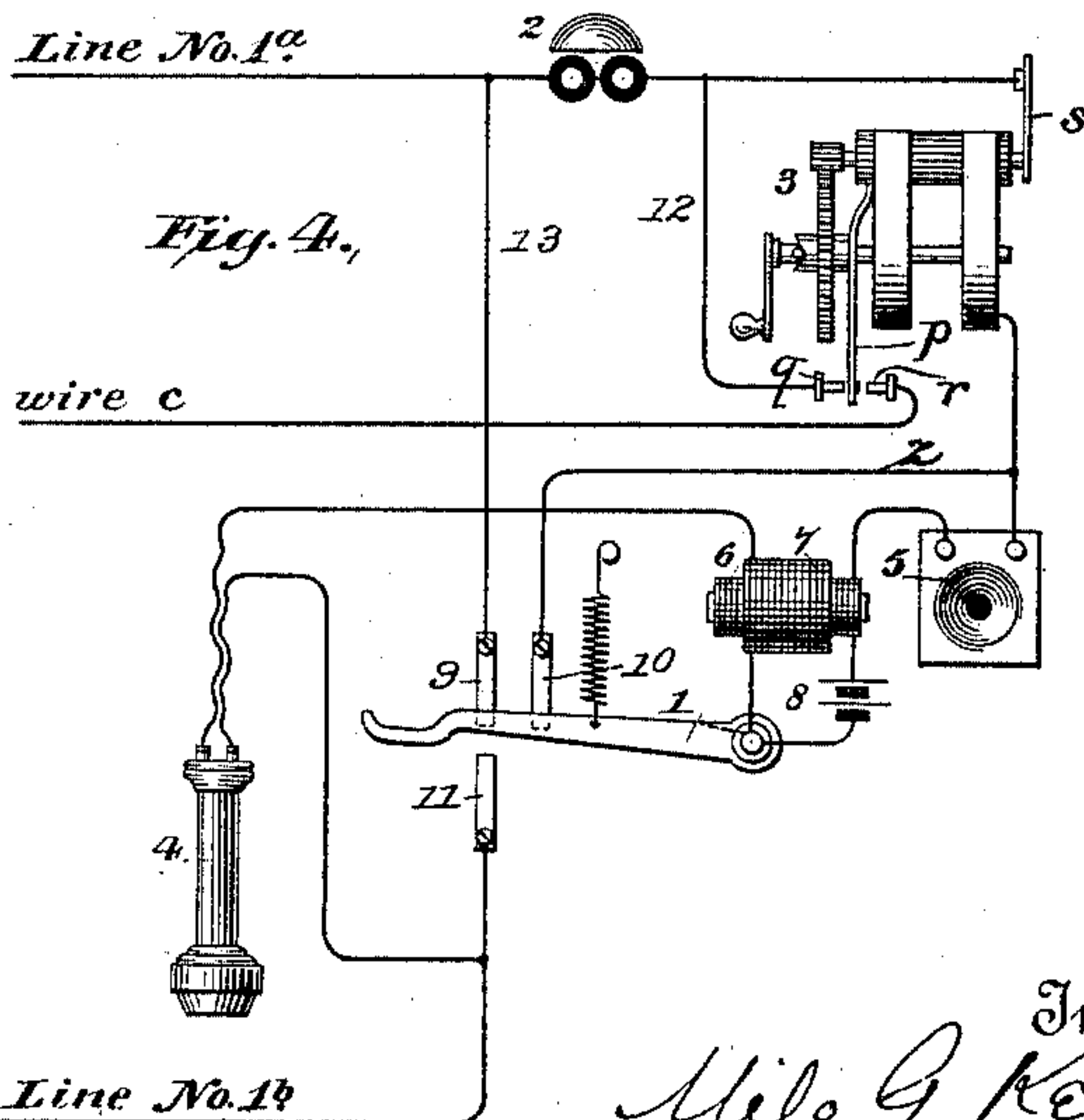
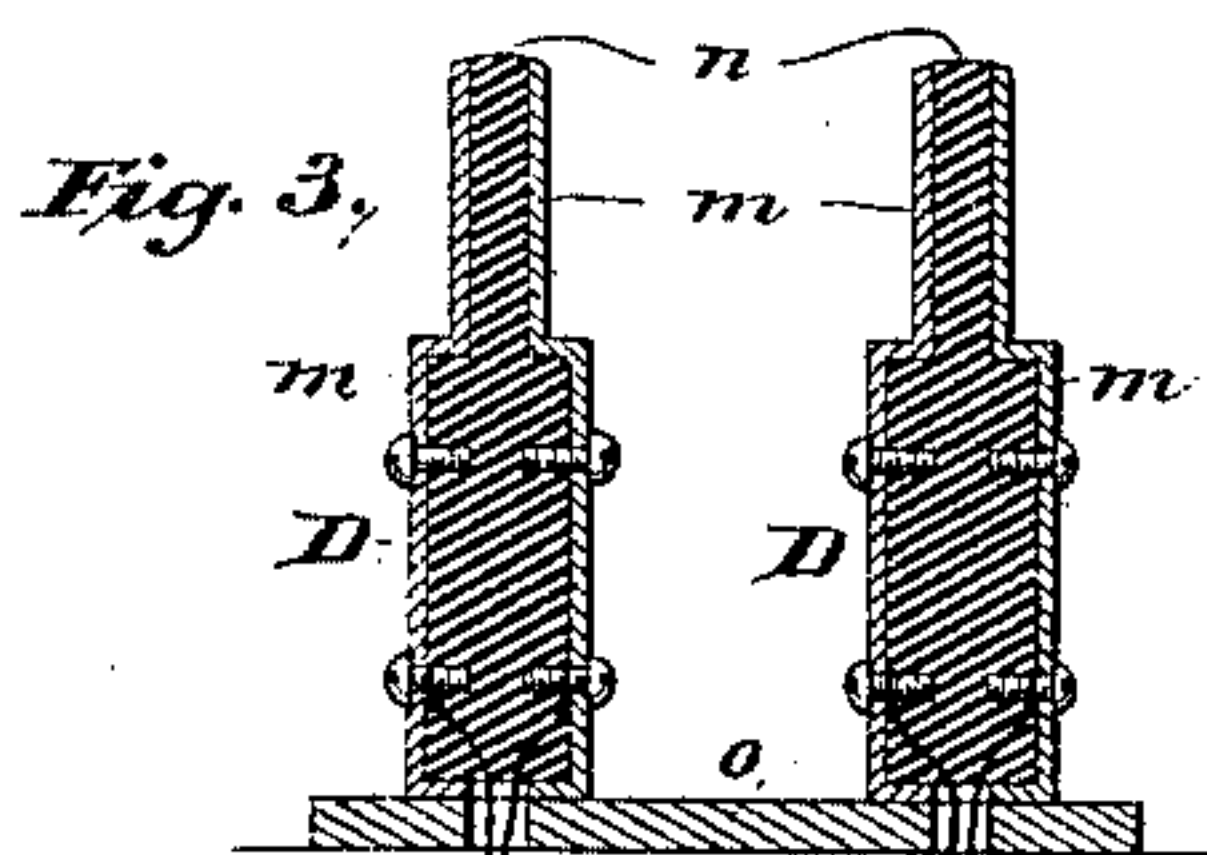
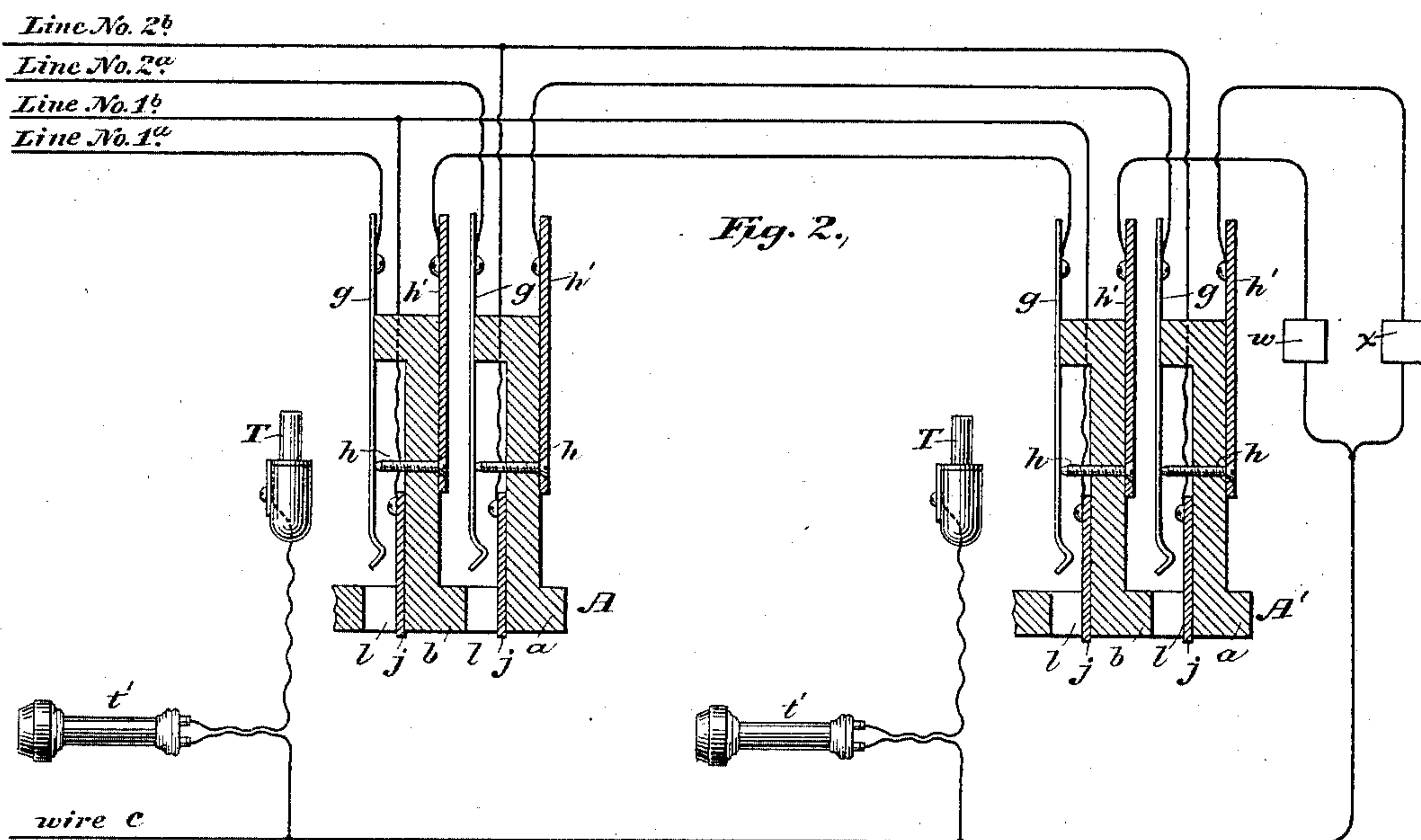
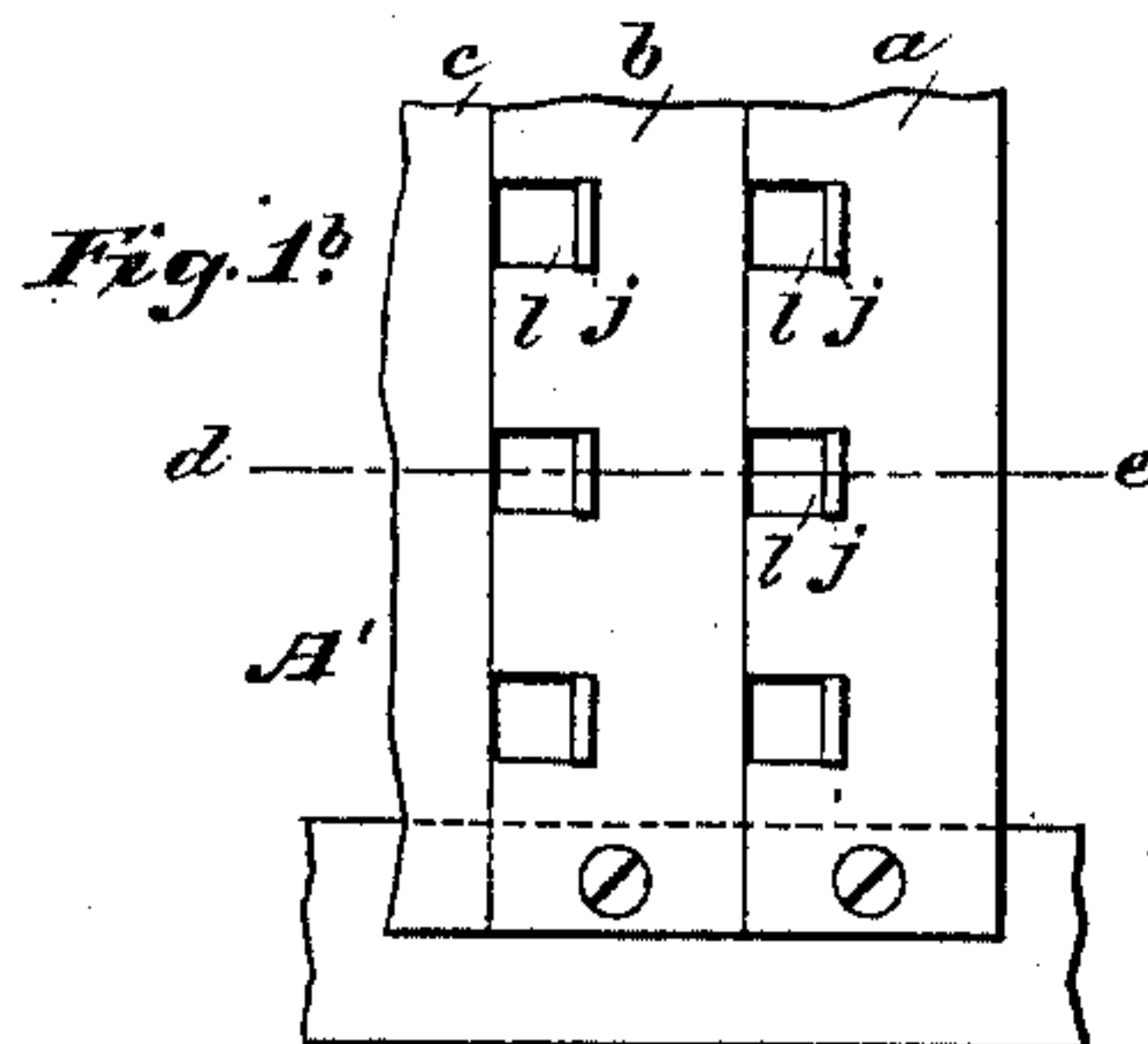
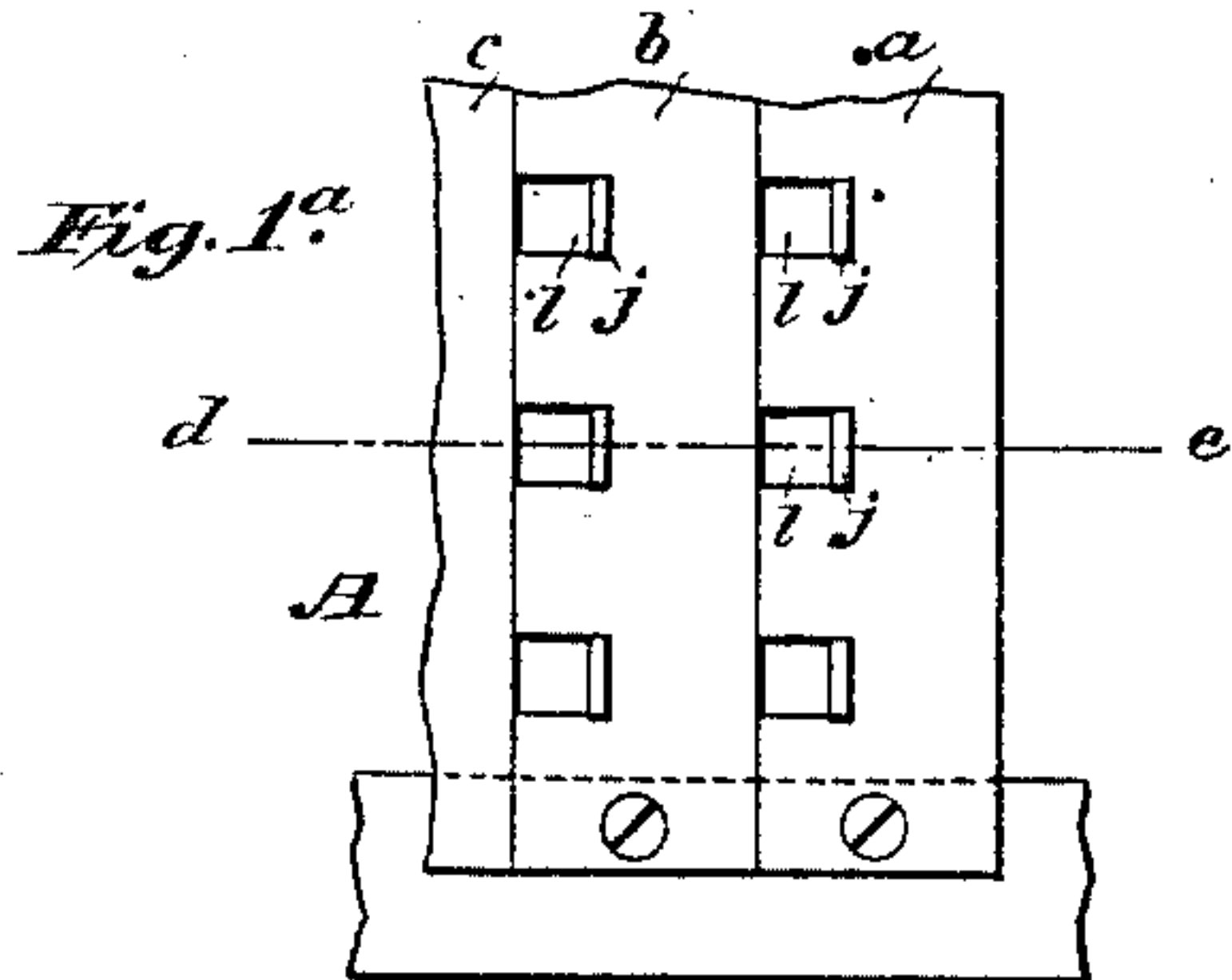


(No Model.)

M. G. KELLOGG.
MULTIPLE SWITCHBOARD.

No. 592,328.

Patented Oct. 26, 1897.



Witnesses
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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF SAME PLACE.

MULTIPLE SWITCHBOARD.

SPECIFICATION forming part of Letters Patent No. 592,328, dated October 26, 1897.

Application filed December 11, 1889. Serial No. 333,341. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Chicago, Illinois, temporarily residing at Stuttgart, in the Empire of Germany, have invented certain new and useful Improvements in Multiple Switchboards for Telephone-Exchanges, 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 a telephone-exchange system in which the subscribers' lines are metallic-circuit lines; and it consists in a system of calling, switching, and testing such lines which I shall describe and claim.

I place as many switchboards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines. On each board I place for each line a spring-jack or similar switch having two insulated contact-pieces which are normally in contact and a third contact-piece normally insulated from the rest, (except by the circuit connections,) said switch being adapted to receive a loop-switch plug, and when the plug is inserted to disconnect the contact-pieces of the switch which are normally in contact and connect one of them with one contact-piece of the plug, while the other contact-piece of the plug is connected with said third contact-piece of the switch. The third contact-pieces of the switches mentioned above are so placed and arranged that the operator may at will apply a test-plug or similar device to them.

At each subscriber's station is a battery which for purposes of testing should be in the circuit of his line when the line is not in use and which may be in said circuit all the time.

Figures 1^a and 1^b of the drawings are front views of sections of two multiple switchboards to which the same wires are connected. Fig. 2 is a diagram of the boards and the circuit and connections necessary to illustrate my invention. Fig. 3 shows an operator's cord system adapted for use with the boards. Fig. 4 is a diagram of a subscriber's-station apparatus necessary to illustrate my invention.

In the drawings like parts and apparatus

are indicated by the same letters and figures of reference.

In Fig. 2, A is a sectional view of the switchboard shown in Fig. 1^a, and A' is a sectional view of the switchboard shown in Fig. 1^b, each as indicated by the line *d e*. *a b* represent rubber strips of the shape substantially as shown, on which the metal parts of the switches are mounted. These strips may be of a length to receive any convenient number of switch parts. *l l* are square holes through the fronts of and at the edges of the strips, adapted to receive and guide the switch-plugs. The contact-springs *g* are mounted to the rear of and are parallel to the switch-holes *l l*, to which they belong, as shown. The contact-points *h h*, corresponding to the contact-springs, pass through the rubber strips, as shown, and are connected with the connecting-strips *h' h'*. *j j* are the contact-pieces of the switches, insulated from the rest of the parts, except by the circuit connections, each adapted to connect one side of its line to one of the contact-pieces of a loop-plug when the plug is inserted into a switch and also to be the test-piece of the line at its board.

The switch-plugs are substantially as shown in Fig. 3. These several parts mentioned above are so made, shaped, arranged, and adjusted that when a plug is inserted into any switch-hole it raises the spring in the rear of the hole from the contact-point, (on which it normally rests,) and the spring is connected to one of the contact-pieces of the plug, while the other contact-piece of the plug is connected to the contact-piece *j* of the switch which is used. Each section of a rubber strip with its contact-spring, contact-point, contact-piece, and the hole, all arranged and operating as shown, may be considered as a spring-jack switch.

t' t' in Fig. 2 are test receiving instruments, and T T are test-plugs, one instrument and one plug for each operator, and each plug connected to one side of its test receiving instrument by a flexible cord, as shown. The plugs and cords are so constructed that the operators may at will bring the metal tips of the plugs in contact with any contact-pieces *j j* at their respective boards.

Wire *c*, Fig. 2, is an insulated wire which extends to all of the subscribers' stations and is connected to the subscriber's-station apparatus, as hereinafter described.

5 The circuit of each subscriber's line may be traced as follows: One branch, starting out from the subscriber's - station apparatus, passes to the central office and is connected with all the contact-pieces *j j* of the switches
10 of the line on the several boards. The other branch, starting out from the other side of the subscriber's-station apparatus, passes to the central office, and successively through the pairs of contact-pieces of the switches of the
15 line which are normally in contact, being connected in each case to the spring *g* first. From the last contact-piece *h* the line passes through the calling-annunciator and thence is connected to the common wire *c*.

20 Two lines are shown in Fig. 2, the two branches of one line being marked line No. 1^a and line No. 1^b, respectively, and the two branches of the other line being marked line No. 2^a and line No. 2^b, respectively. Two
25 line-annunciators are shown, one for each line, and marked *w* and *x*, respectively.

In the operator's cord system shown in Fig. 3, *D D* represent a pair of plugs in sectional view. *n* is the rubber insulation of the
30 plug, and *m m* are its two contact-pieces. They extend to the bottom of the plug, as shown, and are adapted to rest normally, or when the plug is not in use for switching, on the metal strip *o*, which thereby temporarily
35 connects them together. Weights, as is usual, or similar devices may be used to bring the plugs into contact with the strip and form a good connection.

Y is a looping-in switch having three pairs
40 of contact-bolts, on which the operator may at will place the levers of the switch.

v is the clearing-out annunciator of the pair of cords connected to the pair of bolts *s s*.

45 *B'* is the operator's calling generator or battery, connected to the pair of bolts *r r*, and *t* is her telephone, connected to the pair of bolts *q q*.

50 The circuits and connections are substantially as shown. Each operator should have as many pairs of plugs with double flexible cords *d d*, looping-in switches, and clearing-out annunciators as she may need for the service of the lines assigned to her. She
55 will need only one calling-generator and telephone for her cord system, and their connection with the various pairs of cords and the other apparatus will be apparent to those skilled in the art.

60 In the subscriber's-station apparatus shown in Fig. 4, 1 is the telephone-switch. 2 is the signal-bell. 3 is the calling-generator. 4 is the hand-telephone. 5 is the transmitter. 6 is the primary, and 7 is the secondary, of the induction-coil, and 8 is the transmitter-battery.

65 These parts may be the usual forms of apparatus and are connected as shown or in other ways, so as to produce the required results.

The calling-generator is, however, modified, as will hereinafter be described. Line No. 1^a and line No. 1^b are the two branches of a metallic circuit, and wire *c* is an ungrounded
70 common conductor extending to or common to all the subscribers' stations.

The generator has an automatic device (shown in the drawings) by which when the
75 crank is not in motion the wire of the armature is shunted and the line is disconnected from the common wire *c* at the subscriber's station, and when it is turned or operated the shunt is automatically removed from the
80 armature, and the line is temporarily connected to the common wire. The reason for this will hereinafter be apparent. The automatic device shown is a modification of a form very generally used, the modification
85 being substantially in the arrangement of the contacts. It contains a V-shaped attachment to the hub of the driving-wheel, a pin in the shaft, which engages in the V-shaped arrangement, and a spring which
90 presses against the wheel and brings the pin normally in the center of the V attachment. The contact-points and the circuits are substantially as shown and such as will produce the results which I have described
95 above—that is, the side No. 1^b of the line after passing through the telephone and other parts of the subscriber's apparatus is connected with the metal frame of the generator. The other side No. 1^a of the line is connected
100 to the spring *s*, that bears on an insulated piece on the armature-shaft, to which piece one end of the armature-coil is connected. The other end of the armature-coil and the spring or finger *p* are in connection with the
105 metal frame of the generator. Contact-point *r* is connected with the common wire *c*, and point *q* is connected to the wire leading to the spring *s*.

The generator should be so connected into
110 the circuit of a line that the temporary connection made between the line and the common wire *c* is such that the armature-coil is in the circuit of the line between such connection and the normally closed switch-contacts
115 at the central office. It will be noticed that the transmitter, the transmitter-battery, and the primary of the induction-coil are in the line-circuit, and that they are shunted by a derived circuit *z* of comparatively low resistance, in which is a pair of contact-points
120 10 11, operated by the telephone-switch, and that when the telephone is on the switch these points are open and a current passes to line, and when the telephone is off from the
125 switch the points are closed and the shunt-circuit is closed, so that there is a short circuit around the transmitter, the primary of the induction-coil, and the battery, and comparatively no current passes to the line.
130 This shunt is marked *z*.

The normal circuit of the subscriber's outfit is from line No. 1^a through bells 2, generator 3, and short circuit 12 in multiple, trans-

mitter 5, primary coil 6, battery 8, switch-lever 1, contact 11, and line No. 1^b. When the telephone is switched for use, the circuit is transferred as follows: line No. 1^a, shunt 13, contact 9, lever 1, secondary coil 7, receiver 4, and line No. 1^b. At the same time the transmitter-circuit is closed and the battery short-circuited from line as follows: contact 10, short circuit *z*, transmitter 5, primary 6, battery 8, and lever 1, now connected to contact 10.

The operation of the system is as follows: When a subscriber desires to call, he turns the crank of his generator, thereby removing the shunt around the generator from contact-point *q* to line No. 1^a and connecting the line with the common wire by throwing the spring *p* against contact-point *r*, so that the armature-coil is between this connection and the line-annunciator. A complete circuit being thus established, in which are the armature-coil and the line-annunciator, the annunciator indicates the call. The operator will then place one of the pair of cord-plugs in the switch of the line indicated, and by conversation find out what line is wanted. He then tests the line wanted by placing the test-plug on the contact-piece *j* of its switch. If it is not switched for use, a complete circuit will be established, in which is the test receiving instrument and the battery, and the instrument will indicate that the line is not in use. This test-circuit is from the common wire *c* to the test-plug used to test contact-piece *j* of line tested, thence through the line by way of the subscriber's station back to central office, thence through the normally closed contacts of the switches of the line to common wire *c*.

If, however, the line is switched at the central office, there will not be a complete circuit established, the circuit being open at the switch of the line where a connecting-plug *D* has been inserted, and the instrument will not respond. When a line is tested and the subscriber's telephone is switched for use, the test-circuit above traced is complete, if the line is not switched at the central office, but the battery 8 is short-circuited, and the test receiving instrument will not, therefore, respond. The instrument not responding, the operator will know that the line is in use. When the test indicates that the line is not in use, the operator will place the other switch-plug of the pair in the switch of the line, and the two lines are thus connected together and their normal connection with the common wire *c* is removed. The operator can, by moving the levers of the looping-in switch, connect his calling-generator into the circuit. Again, he can, by moving the levers of the switch, connect a clearing-out annunciator into the circuit, and again he can, by moving the levers of the switch, loop his telephone into the circuit and determine, by listening, whether the subscribers are through conversation. When two subscribers' lines are switched for conversation, their line-annun-

ciators are switched from their circuit. By this system of calling, switching, and testing the test receiving instruments are not grounded, but are open to the ground at the central office, and an accidental ground on a line tested between the subscriber's station and the line-annunciator would not give a false signal that a line was free when it was switched at the central office, as is liable to be the case were the test receiving instrument connected with the ground. It is well known that such accidental grounds are liable to occur, and it is apparent that such a ground would not affect the testing or other operation of my system.

I claim as my invention and desire to secure by Letters Patent—

1. In a multiple-switchboard exchange, a three-conductor system comprising ungrounded call, test and telephone circuits one of each for a subscriber extending from the subscriber's station to the central office, a line conductor common to each of said circuits, a second line conductor common to said test and telephone circuits, an ungrounded conductor common to said call and test circuits, and a subscriber's individual test-battery in said test-circuit.

2. In a multiple-switchboard exchange, an ungrounded telephone-circuit for a subscriber extending from the subscriber's station to the central office normally open at central, an ungrounded call-circuit for the subscriber normally closed at central but open while the telephone is switched for use, and normally open at the subscriber's station but closed while the generator is actuated for a call, an ungrounded test-circuit for the subscriber normally open at central but closed while testing and while the telephone-circuit is not switched for use but not otherwise, and a subscriber's individual test-battery in said test-circuit.

3. In a multiple-switchboard exchange, a three-conductor system comprising a telephone-circuit for a subscriber, an ungrounded test-circuit associated therewith, said test and call circuits extending from the subscriber's station to the central office, an ungrounded common conductor forming a part of both said test and call circuits extending from the subscriber's station to the central office, normally closed switchboard-contacts in said test-circuit opened while said telephone-circuit is switched for use, and a subscriber's individual test-battery normally in said test-circuit.

4. In a multiple-switchboard exchange, a call and test circuit for a subscriber comprising test-contacts at two or more boards, line conductors including an individual test-battery, a call generator and annunciator for the subscriber, and a connection to an ungrounded common conductor; in combination with test receiving instruments connected on one side to said common conductor and on the

other side adapted to be connected to said test-contacts for testing, an extension from said ungrounded common conductor to the subscriber's station, and contacts at said station adapted to connect said extension to a line conductor for calling.

5. In a multiple-switchboard exchange, in the order named, test-contacts, a line conductor, a subscriber's outfit including a test-battery and a call-generator, a line conductor, normally closed pairs of switchboard-contacts, open while the line is switched for use, an annunciator, an ungrounded conductor, an extension to said conductor, and normally open contacts closing said extension to said call-generator while it is actuated for a call; in combination with a test receiving instrument connected on one side to said ungrounded conductor, and on the other adapted to be connected to a test-contact for testing.

6. In a multiple-switchboard exchange, in the order named, test-contacts, a line conductor, a subscriber's outfit including a test-battery and a call-generator, a line conductor, normally closed pairs of switchboard-contacts, open while the line is switched for use, an annunciator, an ungrounded conductor, an extension to said conductor, and normally open contacts closing said extension to said call-generator while it is actuated for a call; in combination with a subscriber's telephone-switch and connections for switching said battery out of the line-circuit while the telephone is switched for use, and a test receiving instrument connected on one side to said ungrounded conductor and on the other to a test plug or device adapted to be applied to a test-contact for testing.

7. In a multiple-switchboard exchange, in the order named, test-contacts, a line conductor, a subscriber's outfit including a combined transmitter and test-battery and a call-generator, a line conductor, normally closed pairs of switchboard-contacts, open while the line is switched for use, an annunciator, an ungrounded conductor, an extension to said conductor, and normally open contacts closing said extension to said call-generator while it is actuated for a call; in combination with a switch plug or device adapted to open a pair of normally closed contacts, and a test receiving

instrument connected on one side to said ungrounded conductor and on the other to a plug or device adapted to be applied to a test-contact for testing.

8. In a multiple-switchboard exchange, in the order named, test-contacts, a line conductor, a subscriber's outfit, including a combined transmitter and test-battery and a call-generator, normally closed pairs of switchboard-contacts, open while the line is switched for use, an annunciator, an ungrounded conductor, an extension to said conductor, and normally open contacts closing said extension to said call-generator while it is actuated for a call; in combination with a subscriber's telephone-switch and connections for switching said battery out of said line-circuit while the telephone is switched for use, a switch plug or device adapted to open a pair of normally closed contacts, and a test receiving instrument connected on one side to said ungrounded conductor and on the other to a plug or device adapted to be applied to a test-contact for testing.

9. In a multiple-switchboard exchange, in the order named, a test-contact at each of two or more boards, located in a line-jack at each board, a line conductor, a subscriber's outfit including a subscriber's transmitter and test-battery, and a call-generator, a return-line conductor, pairs of normally closed switchboard-contacts, a pair in each jack at each board, a call-annunciator, an ungrounded common conductor, a branch extension therefrom adapted to be connected to said call-generator during a call, two or more additional branches therefrom, one branch at each board, each including a test receiving instrument, and adapted to be connected to a test-contact for testing; in combination with a switch plug or device adapted to be inserted in a jack and thereby open the pair of normally closed contacts in said jack, and a subscriber's telephone-switch and connections adapted to switch said battery from the line-circuit while the telephone is switched for use.

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