(No Model.)

3 Sheets—Sheet 1.

M. G. KELLOGG.

MULTIPLE SWITCH BOARD.

No. 362,217. Patented May 3, 1887.

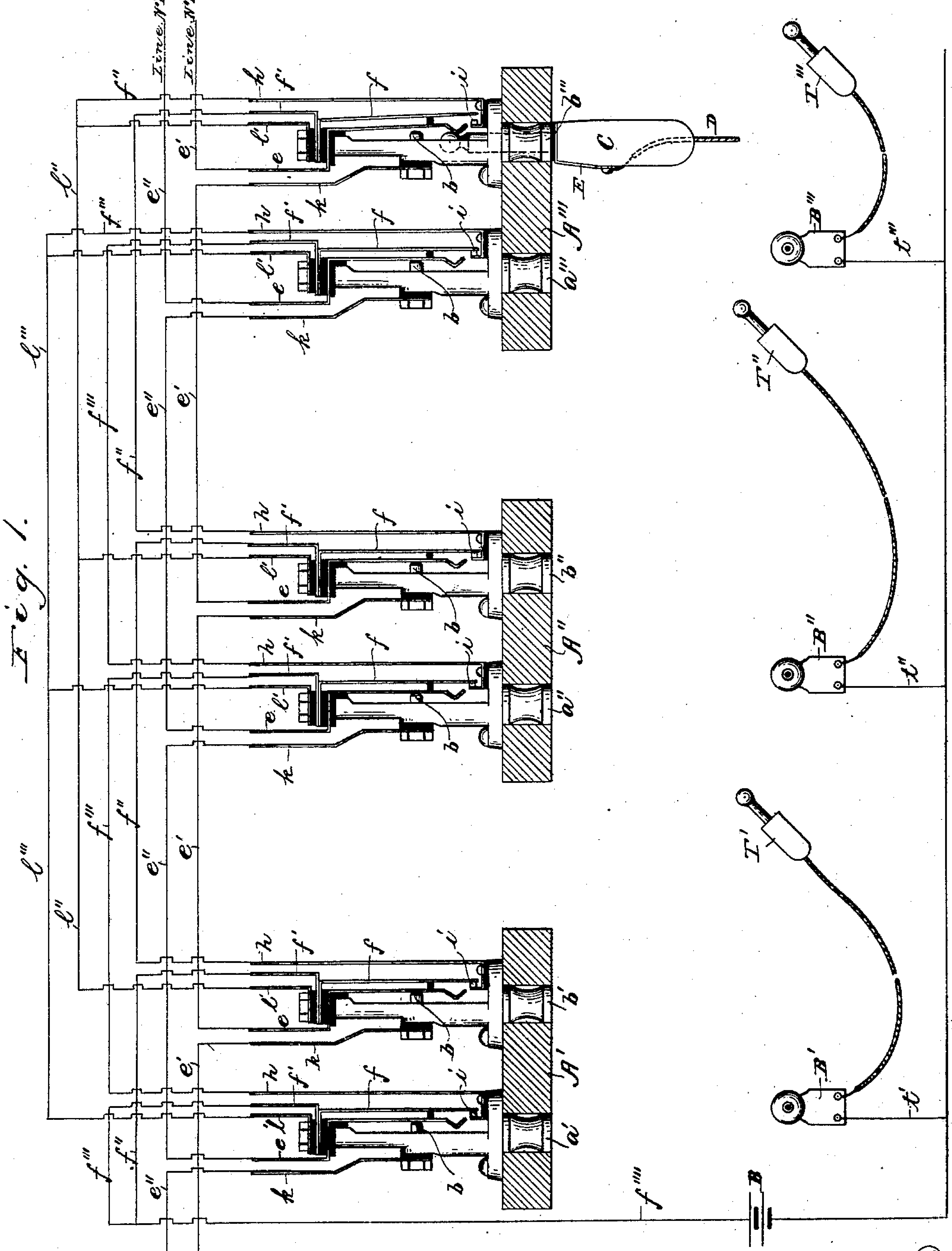

Fig. 1.

Witnesses.

Henry Frankfurter.
Adolfe Hauszagh.

Inventor.

Milo G. Kellogg

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

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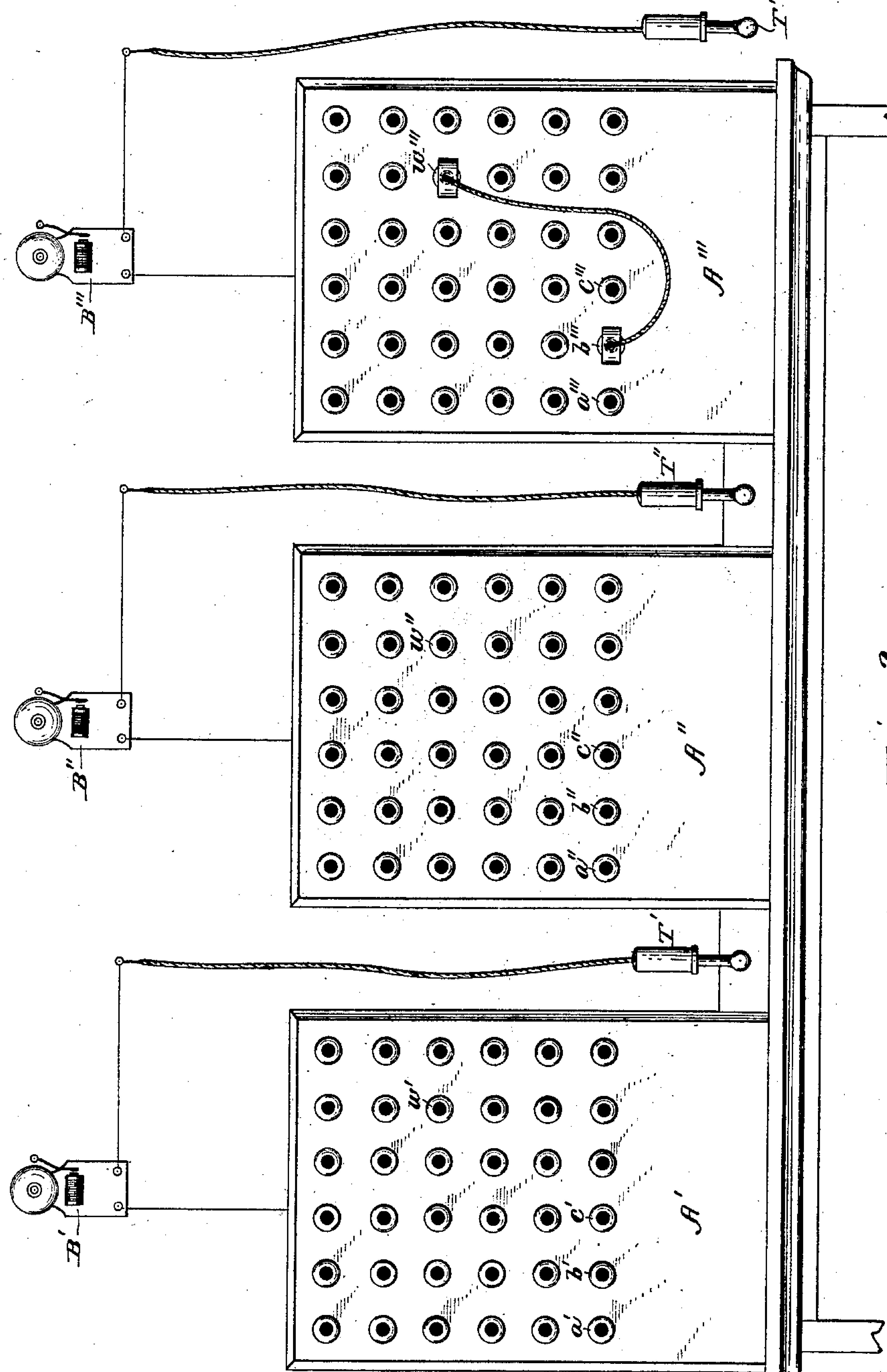

Fig. 2.

Witnesses.

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(No Model.)

3 Sheets—Sheet 3.

M. G. KELLOGG.

MULTIPLE SWITCH BOARD.

No. 362,217. Patented May 3, 1887.

Fig. 3.

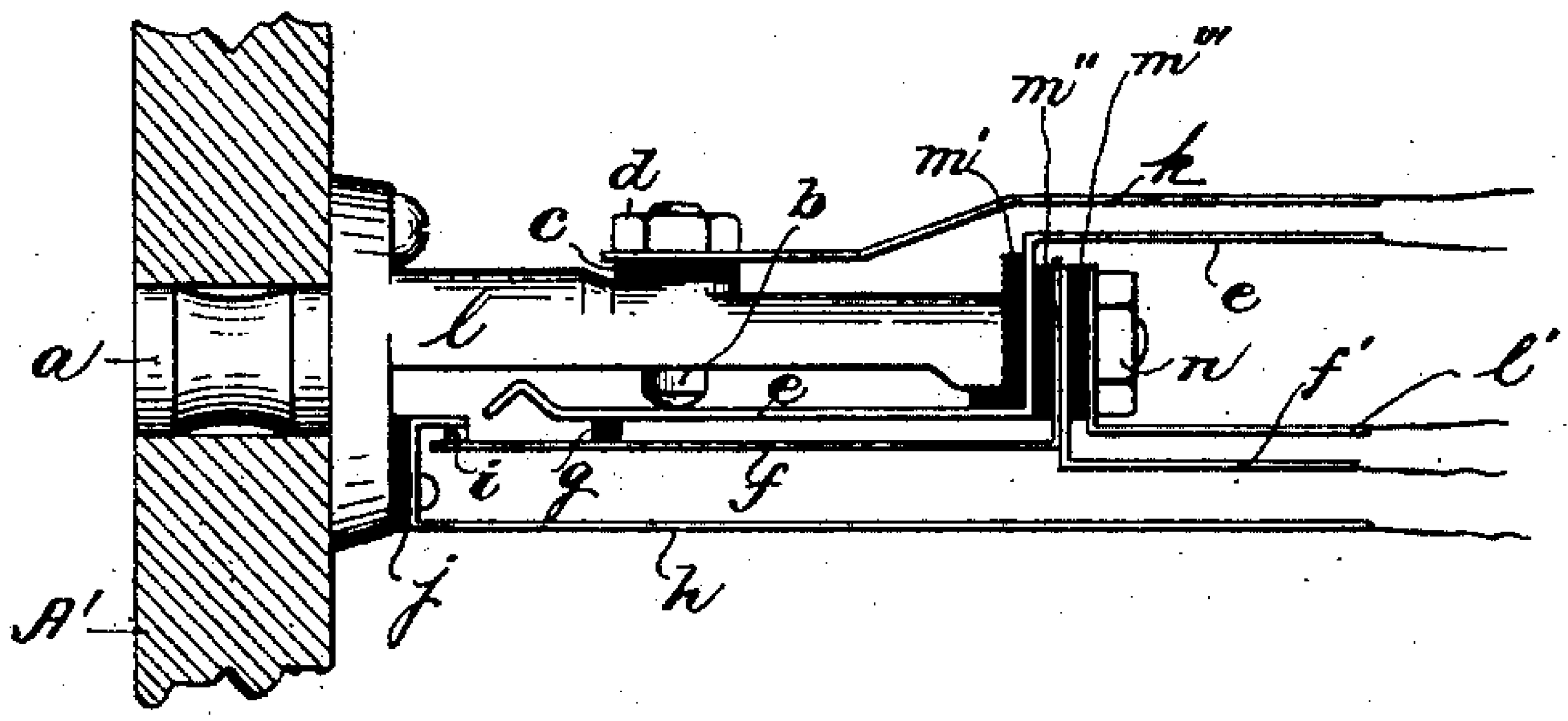


Fig. 4.

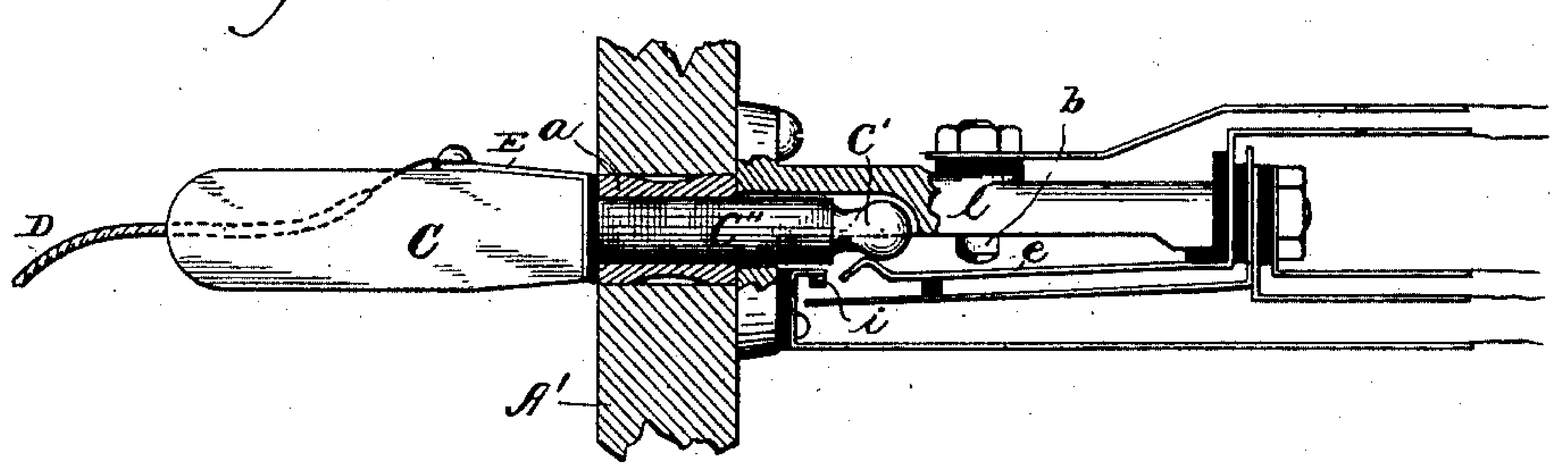
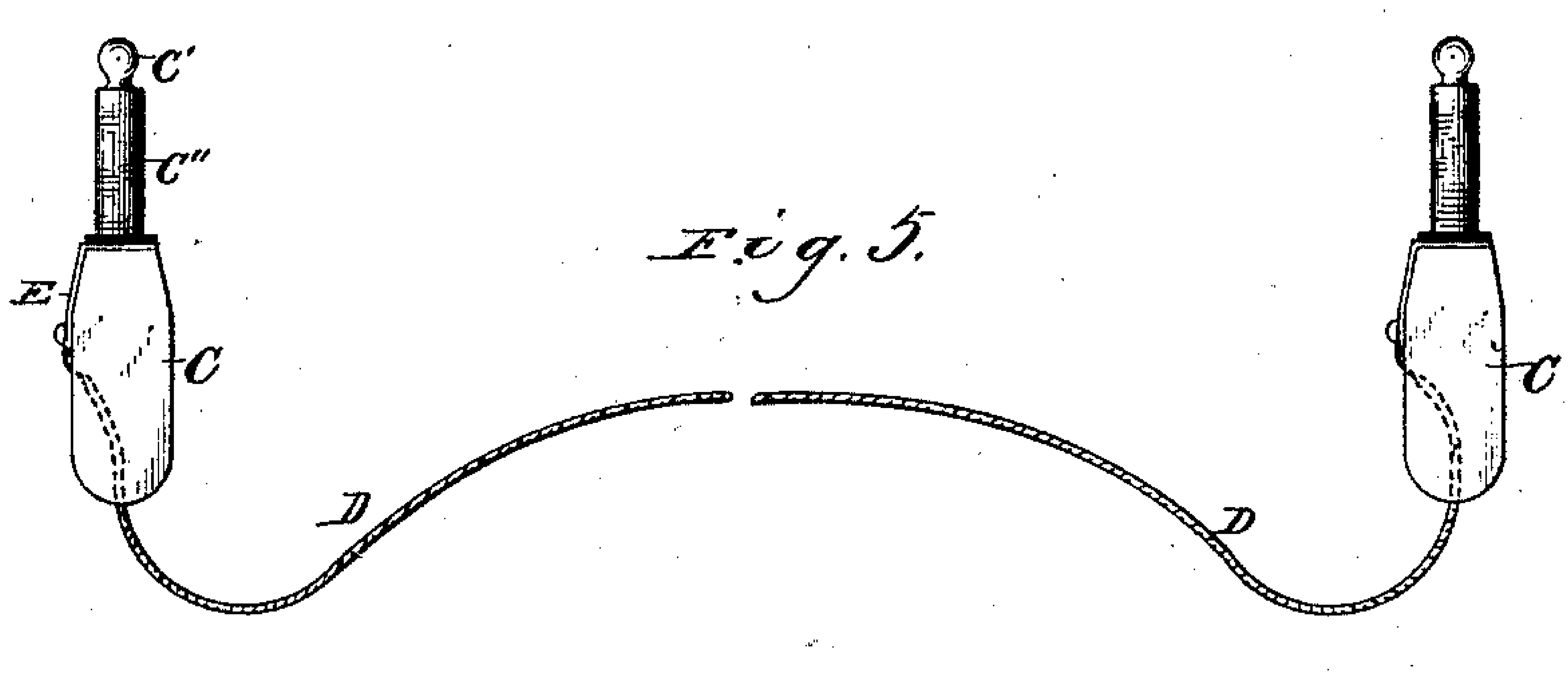


Fig. 5.



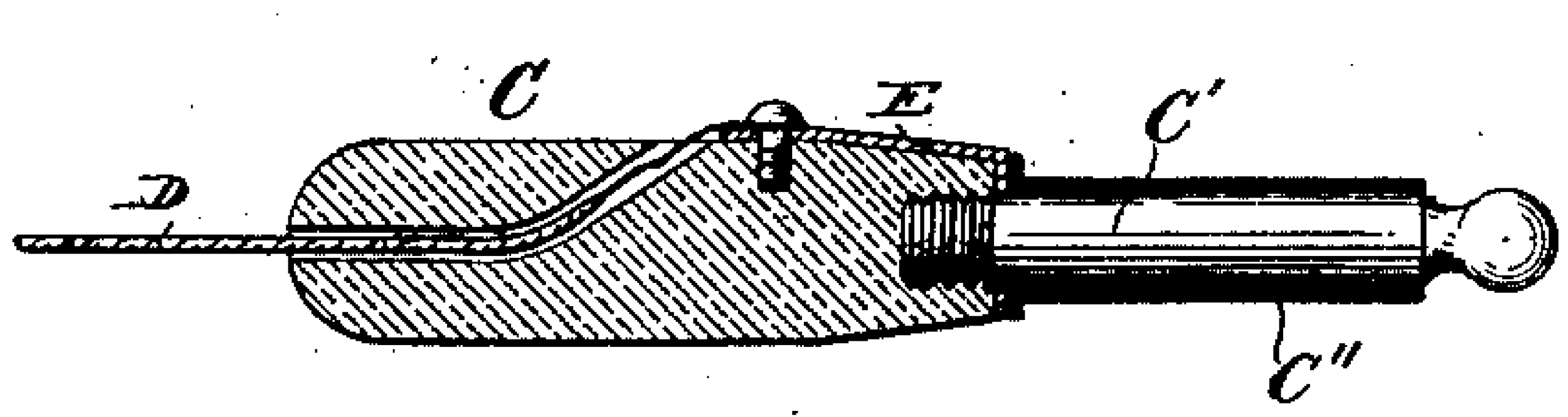


Fig. 6.

Witnesses.

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UNITED STATES PATENT OFFICE.

MILO G. KELLOGG, OF HYDE PARK, ILLINOIS.

MULTIPLE SWITCH-BOARD.

SPECIFICATION forming part of Letters Patent No. 362,217, dated May 3, 1887.

Application filed October 28, 1885. Serial No. 181,138. (No model.)

To all whom it may concern:

Be it known that I, MILO G. KELLOGG, of Hyde Park, Illinois, have discovered certain new and useful Improvements in Multiple Switch-Boards for Telephone-Exchanges, of which the following is such a full, clear, concise, and exact description as will enable those skilled in the art of telephony to practice my invention, reference being had to the accompanying drawings, forming a part of this specification.

My invention is designed to facilitate the work of switching at the central office of a telephone-exchange district system.

It consists, first, of a compound spring-jack switch—such as I shall hereinafter describe and claim in detail—designed to be used in the switch-boards of the central office of a telephone-exchange, and especially in the multiple switch-board system which I shall hereinafter describe and claim.

It consists, secondly, of the multiple switch-board system, which I shall hereinafter describe and claim in detail,

A spring-jack switch may be defined, speaking generally, as a switching device containing a movable piece, a spring acting thereon, and contact-points, said switch being adapted to receive a wedge or plug, which, on being inserted into the switch, moves the movable piece in a direction opposed to the force of the spring, whereby the relation of the contact-points to each other is changed by the insertion and withdrawal of the wedge or plug. In some forms of spring-jack switches the movable piece and the spring are one and the same. The wedge or plug has generally a metallic part, to which is attached a flexible metallic cord, and the switch is so constructed that the cord is brought into electrical connection with some part of the switch when the plug is inserted. I use the word "contact-point" in this specification, as a word of art, to indicate an insulated metal piece adapted to be brought into contact and out of contact with another metal piece insulated from it and also called a "contact-point." The two pieces thus insulated from each other and adapted to be brought into contact and out of contact with each other I call a "pair of contact-points." I designate as "simple spring-jack switches" those switches which contain but two contact-points, the relation of which is changed by the insertion and withdrawal of the plug. I designate as "compound spring-jack switches" those switches which contain more than two contact-points, the relations of which are changed by the insertion and withdrawal of the plug.

In Figure 3 of the drawings, *a* is an edge view of my compound spring-jack switch, and A′ is a broken sectional view of the frame-work of the switch-board adapted to receive the spring-jack switches.

Fig. 4 shows an edge view of the spring-jack switch, part of its metal frame-work being broken away, so as to show the position of the plug when it is inserted into the spring-jack switch, and it also shows the plug inserted.

l, Fig. 3, is the metal frame-work of the switch.

d is a metal contact-screw passing through the frame-work *l*, and insulated from it by the insulation *c*, which also passes through *l*.

e is a contact-spring, which is also insulated from the metal frame-work *l*, and is in contact with point *b* of screw *d* when the wedge or plug is not inserted into the switch. When the wedge or plug is inserted into the switch, the contact between point *b* and spring *e* is broken, as shown in Fig. 4.

b and *e* are a pair of contact-points; and as I use them in opening and closing a subscriber's telephone-line, I call them the "main-line" contact-points of my switch.

k is a connecting-piece in electric connection with screw *d*.

h is a contact-piece insulated from the metal frame-work by the insulating-piece *j*, and having a contact-point, *i*, as shown.

f is a contact-spring, which is insulated from the frame-work *l*, and also from the contact-spring *e*, and is in contact with the point *i* when the wedge or plug is not inserted into the switch. When the wedge or plug is inserted into the switch, the contact between point *i* and spring *f* is broken, as shown in Fig. 4.

i and *f* are a pair of contact-points, and as

I use them in opening and closing a local circuit in my multiple-switch-board system, I call them the "local" contact-points of my switch.

g is an insulating-piece attached to spring *e*, to maintain the insulation between *e* and *f* and to crowd the spring *f* away from the contact-point *i* when, by the insertion of the plug, the spring *e* is crowded away from the point *b*.

f' is a connecting-piece in electric connection with spring *f*.

l' is a connecting-piece in electric connection with the frame-work *l*.

m', *m''*, and *m'''* are insulating-pieces, which insulate springs *e* and *f* from each other and from the frame-work *l*. An extension of *l* passes through these pieces and has a screw-thread cut on it. *n* is a nut which fits this thread and holds the parts in place, as shown.

Fig. 6 shows a wedge or plug adapted for use with my spring-jack switch. C is the handle of the plug, and is made of some insulating material, as hard rubber. C' is a solid metal cylinder with rounded end, as shown. C'' is a rubber cylinder surrounding the metal cylinder, except at the rounded end, as shown. D is a flexible insulated conducting-cord in electric connection with the metal cylinder C' through the metal strip E.

It will be seen from Fig. 3 that when there is no plug in the switch there is electric contact between the points *b* and *e*, and also between the points *i* and *f*, and also that the frame-work is insulated from all these points. It will be seen from Fig. 4 that when a plug is in the switch the electric contact between *b* and *e* is broken, and that the contact between *i* and *f* is also broken, and that the metal cylinder C' of the plug is in contact with the spring *e*, and that the metal frame-work is insulated from all the parts *b*, *e*, *i*, *f*, and C'.

The point *b* and spring *e*, with the plug and cord, constitute the main-line switch in my system. The point *i* and spring *f*, whereby the local circuit is automatically opened by the insertion of the plug for switching the main line, constitute a local-circuit opener. The metal frame-work *l*, being always insulated from the other working parts of the switch and from the plug, except through the arrangement of circuits hereinafter shown, constitutes a test-plate in my system of multiple switch-boards.

A multiple-switch-board system may be defined, speaking generally, as a plurality of boards to each of which the telephone-lines of all the other subscribers are branched or connected, so that any two subscribers' telephone-lines may be connected together upon any one of the multiple boards. By the use of a multiple-switch-board system properly devised and constructed very many subscribers' telephone-lines may be made to center in one office and be properly answered and connected and disconnected without great confusion.

In my multiple-switch-board system I place as many switch-boards in the central office as are found necessary or desirable in order to properly answer the calls and connect and disconnect the subscribers' lines.

My invention comprises independent local circuits and electric apparatus, whereby an attendant at any board may readily determine whether the line of a subscriber called for is in use at either of the other boards. On each board I place for each telephone-line which centers at the office a compound spring-jack switch of the kind I have heretofore described. I have therefore a series of switches for each line, one switch for each series being on each board.

Fig. 2 shows three multiple switch-boards, A', A'', and A''', arranged in one office and provided with series of spring-jack switches for the different lines which center in the office, as explained above. *a'*, *a''*, and *a'''* represent the spring-jack switches of one series intended for one line. *b'*, *b''*, and *b'''* represent the spring-jack switches of another series intended for another line, and *w'*, *w''*, and *w'''* represent the spring-jack switches of still another series intended for still another line. In switch-board A''' two subscribers' lines, whose spring-jack switches on that board are *b'''* and *w'''*, are shown as connected together by means of two plugs and a flexible conducting-cord connecting them.

Fig. 5 shows the two plugs and the cord more in detail.

Fig. 1 is a detail diagram of the connections of the spring-jack switches with the others of their series and with their lines and with the local test circuits and apparatus. A', A'', and A''' represent sections of the switch-boards A', A'', and A'''. (Shown in Fig. 2.) *a'*, *a''*, and *a'''* represent the spring-jack switches of one series and belonging to one subscriber's telephone-line, which I shall designate as "line No. 1." *b'*, *b''*, and *b'''* represent the spring-jack switches of another series and belonging to another subscriber's telephone-line, which I shall designate as "line No. 2."

B', B'', and B''' in Figs. 1 and 2 represent the test bells or signals, and T', T'', and T''' in the same figures represent the test-plugs and cords which belong to the respective boards, as shown.

Line No. 1 passes direct to spring *e* of switch *a'''* on switch-board A''', and thence through point *b* and connecting-piece *k* of that switch and wire *e''* to spring *e* of switch *a''* on switch-board A'', and thence through point *b* and connecting-piece *k* of that switch and wire *e''* to spring *e* of switch *a'* on switch-board A', and thence through point *b* and connecting-piece *k* of that switch and wires *e''* and *e'''* to ground G.

Line No. 2 passes direct to spring *e* of switch *b'''* on switch-board A''', and thence through point *b* and connecting-piece *k* of that switch and wire *e'* to spring *e* of switch *b''* on switch-board A'', and thence through point *b* and

connecting-piece *k* of that switch and wire *e'* to spring *e* of switch *b'* on switch-board A', and thence through point *b* and connecting-piece *k* of that switch and wires *e'* and *e'''* to ground G. Every other subscriber's telephone-wire in the system should be connected in like manner to the switches of its series and to ground.

The local test-circuit system is as follows: Wire *f''''*, containing the battery B, is a return-wire common to all the other wires of the system. *t'*, *t''*, and *t'''* are test-wires, which branch off from the return-wire *f''''* at the boards A', A'', and A''', and passing through the test-bells B', B'', and B''' terminate in the test-plugs T', T'', and T'''. The wire *f'''* branches off from the return-wire *f''''* and passes to spring *f* of switch *a'* on switch-board A', and thence through point *i* and piece *h* of that switch to spring *f* of switch *a''* on switch-board A'', and thence through point *i* and piece *h* of that switch to spring *f* of switch *a'''* on switch-board A''', and thence through point *i* and piece *h* of that switch to wire *l'''*. This wire *l'''* is also connected by connecting-pieces *l'* and branch wires with the metal frame-works *l* of switches *a'*, *a''*, and *a'''*. The wire *f''* branches off from the return-wire *f''''* and passes to spring *f* of switch *b'* on switch-board A', and thence through point *i* and piece *h* of that switch to spring *f* of switch *b''* on switch-board A'', and thence through point *i* and piece *h* of that switch to spring *f* of switch *b'''* on switch-board A''', and thence through point *i* and piece *h* of that switch to wire *l''*. This wire *l''* is also connected by connecting-pieces *l'* and branch wires with the metal frame-works *l* of switches *b'*, *b''*, and *b'''*. In like manner for each series of switches a wire should branch off from the return-wire, pass through the local contact-points of the switches of the series, and thence be connected by branch wires with all the metal frame-works *l* of the series.

I have not shown or described any system for receiving signals and answering calls of subscribers' lines, as any well-known system of doing so is applicable to my system of multiple switch-boards. I have shown the metal frame-works of my switches as insulated from all other working parts of the switch, and I use them as test-plates in a manner which will hereinafter appear. I do not limit myself to the use of the metal frame-work as a test-plate, as it is evident that any other insulated metal piece placed near the spring-jack and made accessible to the test-plug will answer as test-plates, if connected as I have described the metal frame-works.

It will be seen from the description of the apparatus and the connections of the subscribers' lines, as shown in Fig. 1, that when there is no plug in any switch of a series belonging to a given line the circuit of the line through the boards and to ground is unbroken, and that when there is a plug in any switch of the series the circuit of the line to ground is broken and the line is in electric connection with the cord which belongs to the plug. It is evident that when a plug is inserted into a switch at any board and its corresponding plug, connected with it by a flexible conducting-cord, is inserted into another switch at that board, the two lines connected to these two switches are disconnected from the ground and are connected to each other.

The local test-circuit system is operated as follows: If, for instance, the attendant at switch-board A' wishes to determine whether line No. 1 is in use at either of the other boards, he places the test-plug T' on the end of the metal frame-work *l* of switch *a'*, (which is used as a test-plate.) If there is no plug in either of the switches *a''* and *a'''* of the series there is a continuous circuit from the test-plug T' through the test-wire *l'*, the test-bell B', the return-wire *f''''*, the battery B, the wire *f'''* through the local contact-points of switches *a'*, *a''*, and *a'''*, and thence through wire *l'''* and its branch to the metal frame-work or test-plate at switch *a'*, and the test-bell B' will ring, indicating that the line is not in use at either of the other boards. If, on the other hand, a plug is in either of the switches *a''* and *a'''* of the series—as, for instance, in *a'''*—the circuit is interrupted between the local contact-points of that switch and the test-bell B' will not ring, thereby indicating that the line is in use at one of the other boards. In like manner, by placing the test plug on the end of the metal frame-work of any other switch, the attendant may at once know its line is in use on another board. The method of operation of this multiple-switch-board system is therefore such that on the operators making the test for a line the test-bell rings only when the line is not in use, and he can safely connect to the line only when, on making the test, his test-bill rings. In the multiple-switch-board system described in my Patent No. 308,315 the method of operation is, on the contrary, such that the operator can safely connect to a line only when, on making the test, the test-bell does not ring, as in that system the test-bell rings only when the line is in use.

Instead of using a test-plug for each board I might use test-keys, one for each spring-jack switch and each placed so as to be made to bear against the test-plate of its spring-jack switch at the will of the attendant, the test-keys being all connected by branch wires with the test-wire of their respective boards, in which are placed the test-bells.

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

1. In a telephone exchange, multiple switch-boards in a multiple-switch-board system provided with series of switches, one series for each telephone-line, and one switch for each series arranged on each board, local-circuit openers arranged one for each switch and each opened automatically by the insertion of a plug into its switch, test-plates arranged one for

each switch, test-signals arranged one for each board, and test plugs or devices arranged one for each board, in combination with a system of local circuits, consisting, substantially, of a return-wire common to the system, test-wires, one for each board and branching off from the return-wire through the signaling-instrument, and thence to the testing device of its board, and branch wires, one for each series of switches, each wire branching off from the common return-wire and passing through local-circuit openers, and thence connected to the test-plates of the switches of its series, substantially as and for the purposes set forth.

2. In a telephone-exchange system, multiple switch-boards to which the same telephone-lines are connected, in combination with local circuits, one local circuit for each telephone-line and normally open at one place only on each board, each local circuit composed of a return-wire common to all and of a wire branching off therefrom and passing through the local-circuit openers in succession, local-circuit openers, arranged one on each board for each local circuit and constructed to automatically open its local circuit when connection is made with any switch of the line, signal devices at each board and local-circuit closing apparatus for closing the local circuits at the place where they are normally open, substantially as and for the purposes set forth.

3. Two or more multiple switch-boards, each provided with a switch for each subscriber's line, in combination with local-circuit openers, one opener for each line on each board, local circuits arranged substantially as specified and passing successively through their local-circuit openers, local battery, test-plates, testing plugs or devices, and signal-instruments, all arranged and operating substantially as and for the purposes set forth.

4. Two or more multiple switch-boards with telephone-lines connected therewith and provided with switching apparatus on each board for each telephone-line, in combination with local try-circuits, one for each telephone-line and independent therefrom, local-circuit openers arranged one on each board for each local circuit and constructed to automatically open its local circuit when the telephone-line to which it belongs is in use at its board, test-plates arranged one for each local circuit on each board and insulated from the rest of the apparatus, except by circuit-wires, as described, testing apparatus, and signal-instruments at each board, local battery, and local circuits, arranged as specified, all substantially as and for the purposes set forth.

5. A spring-jack switch adapted to receive a wedge or plug and provided with two pairs of contact points or pieces, each pair insulated from the other and both opened by the insertion and closed by the withdrawal of the plug, all constructed and arranged substantially as specified, whereby the wedge or plug, when inserted into the switch, will break the contact between the points or pieces of both pairs, and when withdrawn the contact between the points of both pairs will be automatically established.

6. A spring-jack switch adapted to receive a wedge or plug, and composed of two pairs of contact points or pieces, each insulated from the other and from the frame-work and both opened by the insertion and closed by the withdrawal of the plug, in combination with a metal frame-work which supports the parts and receives the plug, whereby when the plug is inserted into the switch the contact between both pairs is broken, and when the plug is withdrawn the contact between both is automatically established.

7. A spring-jack switch provided with two pairs of contact points or pieces, each pair insulated from the other and both opened by the insertion and closed by the withdrawal of the plug, in combination with a wedge or plug adapted to be inserted into the switch, constructed and arranged substantially as described, whereby the wedge or plug, when inserted into the switch, will break the contact between the points or pieces of both pairs, and the metal part of the plug will be in contact with one of the points or pieces, and when the plug is withdrawn the contact of each pair will be automatically established.

8. A spring-jack switch provided with two pairs of contact points or pieces, each pair insulated from the other and from the frame-work and both opened by the insertion and closed by the withdrawal of the plug, in combination with a metal frame adapted to support the parts of the switch and receive the plug and a wedge or plug adapted to be inserted into the switch, constructed, arranged, and insulated substantially as described, whereby when the wedge or plug is inserted into the switch the contact between both pairs of points is broken, and the metal part of the plug is in contact with one of the points or pieces, but is insulated from the frame-work, and when the plug is withdrawn the contact between both pairs of points is automatically established.

9. The combination, with a main-line spring-jack switch, of an insulated movable piece operated thereby to open a pair of local contact-points on the insertion of the plug, whereby a local-circuit contact may be broken by the insertion of a plug into the main-line switch, substantially as shown and described.

10. The combination, with a main-line spring-jack switch and its plug, of a circuit-opener provided with contact-points and controlled by the movable piece of the switch to open the contact-points on the insertion of the plug, whereby the contacts between the points of the switch and between the points of the key are both opened when the plug is inserted into the switch and are both closed when the plug is withdrawn from the switch.

11. In a spring-jack switch, a metal piece

or socket adapted to receive the plug or wedge, in combination with a contact-point insulated from said piece or socket, a movable contact-piece arranged in contact with said point normally, or when the plug is not inserted, and a plug or wedge, constructed substantially as shown and described, whereby when the plug is inserted its metal part is in electrical connection with the movable piece, but is insulated from the contact-point and the metal socket, substantially as and for the purposes set forth.

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Witnesses:
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CALVIN DE WOLF.