

(No Model.)

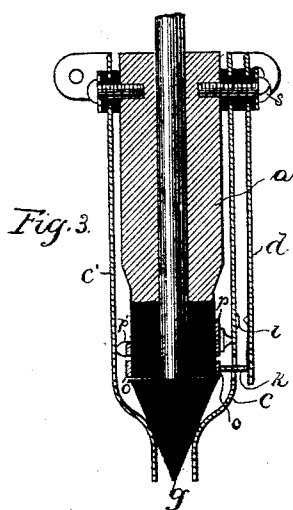
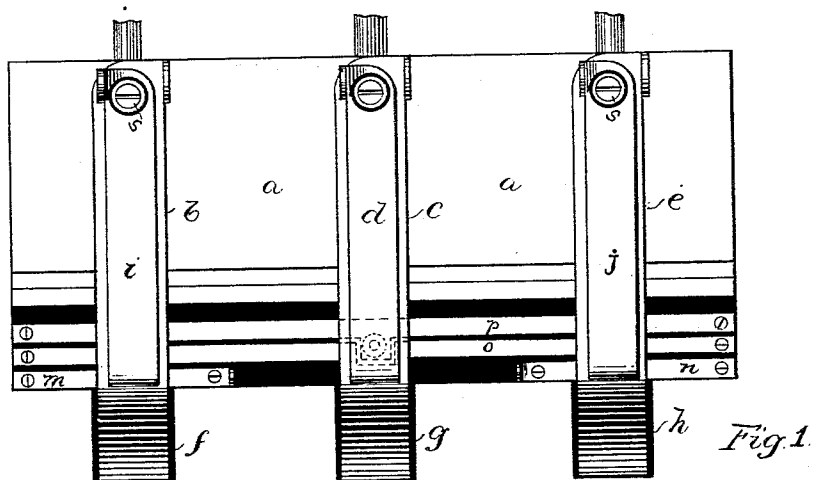
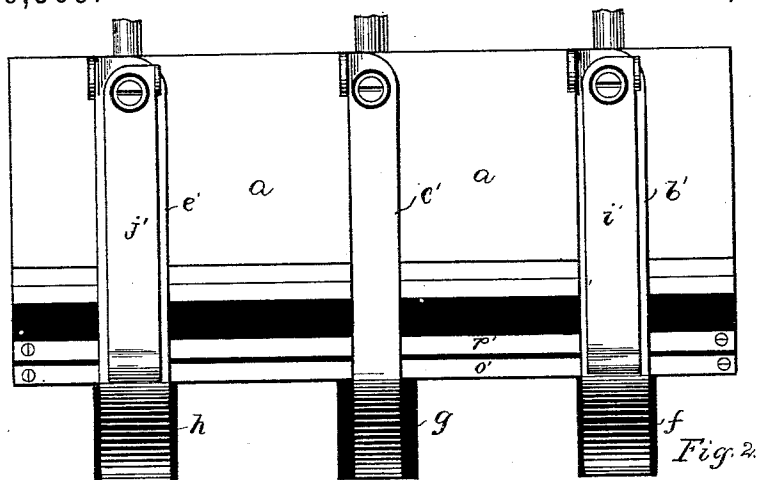
2 Sheets—Sheet 1.

O. A. BELL.

KEYBOARD CIRCUIT FOR MULTIPLE SWITCHBOARDS.

No. 476,509.

Patented June 7, 1892.



Witnesses
George C. Cragg.
Ella Eder.

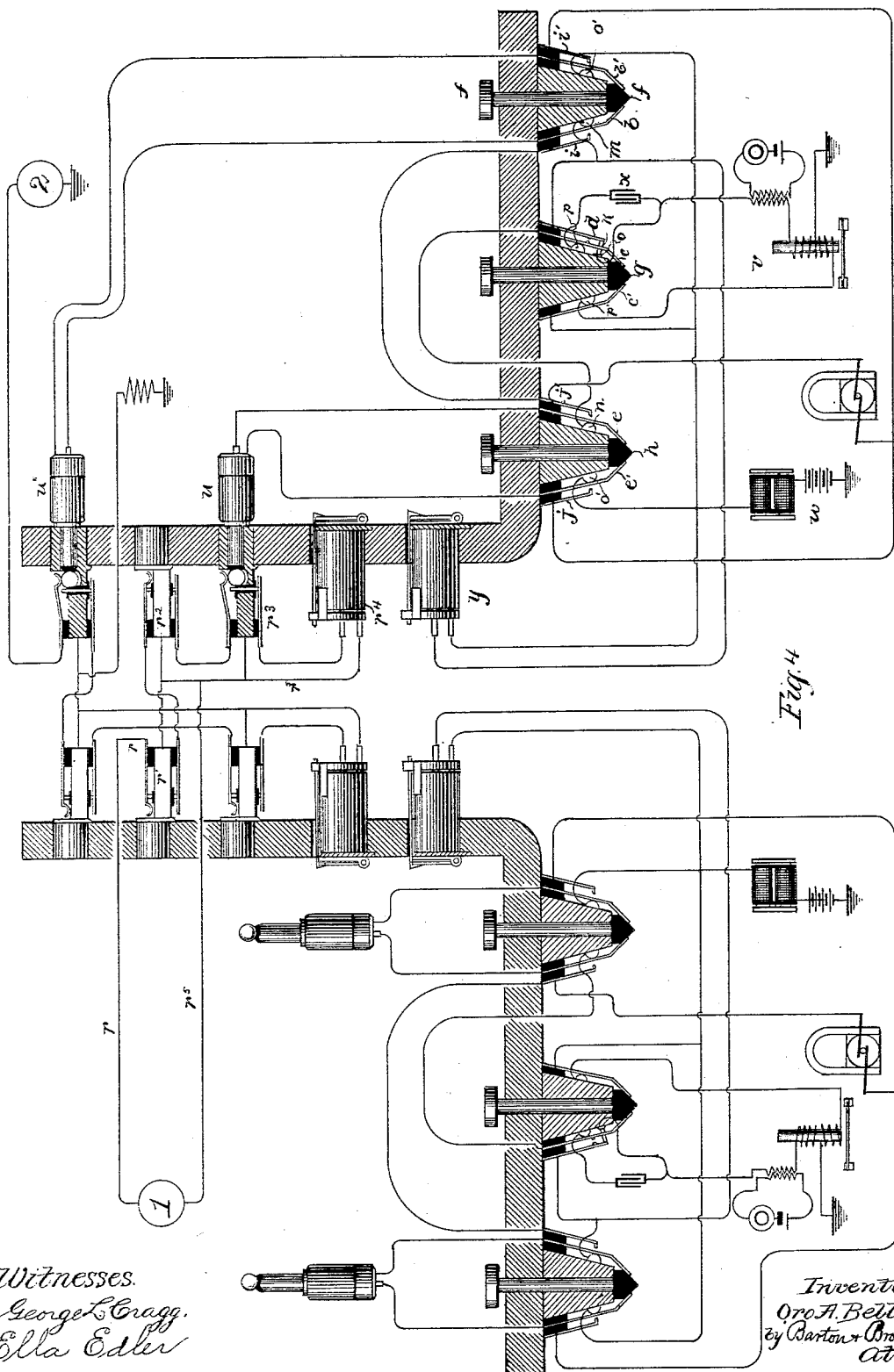
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UNITED STATES PATENT OFFICE.

ORO A. BELL, OF NEW YORK, N. Y., ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF ILLINOIS.

KEYBOARD-CIRCUIT FOR MULTIPLE SWITCHBOARDS.

SPECIFICATION forming part of Letters Patent No. 476,509, dated June 7, 1892.

Application filed September 30, 1891. Serial No. 407,261. (No model.)

To all whom it may concern:

Be it known that I, ORO A. BELL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented a certain new and useful Improvement in Keyboard-Circuits for Multiple Switchboards, (Case No. 3,) 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 keyboard-circuits for multiple switchboards of telephone-exchanges. Its object is to simplify the circuit connections and the mechanism of the operator's apparatus.

My invention is especially adapted for use with a metallic circuit system, and comprises a novel form of listening and calling key and keyboard-circuit connections adapted to the same.

Heretofore it has been usual to provide calling-keys and a listening-key having two springs with their contact-anvils adapted to disconnect both sides of the condenser and one terminal of the operator's telephone from the circuit, a third spring and its contact-anvil to disconnect the other terminal of the telephone, and a contact-spring adapted to complete a direct circuit between the tips of the connecting-plugs.

With my improved form of listening-key and circuit connections I am enabled to dispense with one spring and its contact-anvil, thereby simplifying the mechanism and the circuit.

The spring and contacts which constitute the calling-keys in my improved key are of the usual construction and are mounted upon a block of some insulating material. The listening-key is preferably mounted upon the same block, and consists of a single spring upon one side of the block, with its contact-anvil and two springs upon the opposite side of the block, each furnished with a contact-anvil and adapted to close together when they are separated from their contact-anvils. A connection from the tip of one connecting-plug extends through the usual contacts of one calling-key to one of the two springs at

one side of the block. A connection from the tip of the other plug extends similarly through the contact of the other calling-key to the other of the two springs described. The single spring upon the opposite side of the block is connected with the sleeves of both plugs. One terminal of the operator's telephone set is connected to the contact-anvil of said single spring and the other terminal to the contact-anvil of that spring which is connected to the testing-plug. The contact-anvils of the two springs are connected together through a condenser. Thus the springs of my improved key perform all the functions of the usual key by simpler means.

My invention will be more readily understood by reference to the accompanying drawings.

Figure 1 of the drawings shows an elevation of one side of my improved combination-key. Fig. 2 is an elevation of the other side thereof. Fig. 3 is a cross-section through the center of the listening-key. Fig. 4 is a diagram showing a multiple-switchboard system comprising two multiple switchboards equipped with my improved keyboard apparatus and circuits and two sub-stations connected together for conversation.

Like parts in the several figures are designated by similar letters and figures of reference.

I will now describe the construction of my improved key in greater detail.

Referring to the Fig. 1, *a* is preferably a block of insulating material, as hard rubber. Upon this block are mounted springs *b*, *c*, *d*, and *e*. These are secured to the block at their upper ends by suitable means, as by screws. The lower ends of the springs *b*, *c*, and *e* are bent inward, so as to rest against the inclined surfaces of the wedge-shaped rubber blocks *f g h*. The forms of the spring *c* and of the block *g* are shown in Fig. 3. In front of the springs *b* and *e*, but insulated therefrom, are mounted spring-contacts *i* and *j*. These are so adjusted that when the springs *b* and *e* are pressed outward by a movement of the wedges *f h* the springs are forced into contact with the contact-springs *i* and *j*, respectively. In front of the central spring *c*,

and also insulated from it, is another spring *d*, having attached to it a stud *k*, which projects freely through a hole in the spring *c*. Spring *c* is furnished with a contact-point *l*, which rests upon the spring *d* after the former has been slightly raised, as by thrusting down wedge *g*. Beneath springs *b* and *e* are insulated contact-strips *m* *n*, against which the said springs normally rest. Beneath all the springs and normally insulated from all are two contact-strips *o* *p*. The strip *o* is so shaped that a portion of it lies under the contact *k* and serves as a contact-anvil when the wedge *g* is in the position shown. The other strip *p* also has a projection under the spring *c*, upon which a contact-point upon the latter rests when the key is in the position shown. Upon the opposite side of the block *a*, as shown in Fig. 2, are mounted corresponding springs *b'* *c'* *e'*, bearing against the oppositely-inclined faces of the wedges *f* *g* *h*, respectively. In front of the springs *b'* *e'* are placed contact-springs *i'* *j'*, against which the springs *b'* *e'* are forced when the corresponding wedges are depressed. Beneath the springs upon the surface of the block *a* are contact-strips *o'* *p'*. The spring *o'* is provided with contact-points, against which the springs *b'* *e'* rest normally. The strip *p'* is provided with a contact-point, against which the spring *c'* rests when the wedge *g* is in the position shown. The wedges *f* *g* *h* are secured to lower ends of plungers moving through holes in the block *a*, and are thus capable of a limited vertical movement. These plungers may carry upon their upper ends heads, whereby they may be pressed down, or they may be acted upon by the usual cam-lever.

I will now proceed to describe the circuit connections adapted to this form of key, referring to circuit diagram, Fig. 4. I will first describe the connections to the sub-stations, however.

In Fig. 4 the normal circuit from a sub-station (station 1, for example) may be traced over its line-wire *r* through the line-spring and contact-anvil of its line-jack *r'* at the first board, thence similarly through line-jack *r''*, answering-jack *r'''*, and annunciator *r''''* at the second board, thence returning by line *r''''* to station 1. Line *r''''* is connected to the frame or test-rings of all the spring-jacks *r'*, *r''*, and *r'''*. The operator's outfit comprises the two double connecting-plugs *u* *u'*, the calling and listening key, telephone-set *v*, test-battery *w*, and clearing-out drop *y*. Like contacts of the two plugs are connected as usual. When the operator's set is not connected—that is, when the springs *c* and *d* are separated from their respective contact-anvils and are not connected together—the circuits are as follows: From tip of plug *u* to spring *e*, anvil *n*, spring *c*, spring *d*, anvil *m*, spring *b* to tip of plug *u'*, and from sleeve of plug *u* through spring *e'*, contact *o* to spring *b'*, (since the anvils *o'* *o''* are in the key upon one strip *o'*), thence to sleeve of plug *u'*. When the plunger of the

listening-key is not forced down, however, the circuit is, as before, to spring *c*, thence through anvil *p*, condenser *x*, anvil *o*, contact-stud *k*, spring *d*, and thence to tip of plug *u'*, as before, and the operator's telephone-set *v* is placed in a bridge or shunt connection between the sleeves and tips of the plugs thus: from anvil *o'* through spring *c'*, anvil *p'*, telephone-set *v*, anvil *o*, thence through condenser *x* to tip of plug *u* or stud *k*, and spring *d* to tip of plug *u'*. The contact-springs *i'* and *j'* are connected to the opposite poles, respectively, of a calling-generator. When the plunger of either of these keys is depressed, the two springs of the key which are connected to the tip and sleeve of the corresponding plug are raised from their anvils and closed upon the poles of the calling-generator. A clearing-out annunciator *y* of large resistance and self-induction is permanently "bridged in" between the tips and sleeves of the plugs. To the conductor joining the sleeves of the plugs the usual test-battery *w* is connected through a retardation-coil, and to complete the test-circuit a connection is extended from the middle of the operator's telephone-coil to earth.

I will now trace very briefly the operation of the system shown. The subscriber at, say, station 1 calls in the usual manner. The shutter of annunciator *r''''* falls, notifying the operator that a connection is desired. The operator thrusts answering-plug *u* into answering-jack *r'''* of the line for station 1, raises the plunger of her listening-key, and thus through condenser *x* loops her telephone into circuit with subscriber at station 1. Having learned his order—say, for a connection with station 2—she proceeds to test the jack of that line at her board. If now a connecting-plug is already thrust into any spring-jack of line *s*, then a difference of potential exists between the test-rings of the spring-jacks of that line and the earth, due to a test-battery similar to *w*, connected to the sleeve of the plug, and as the operator applies the tip of that plug *u'* to the testing of jack *s'* a current will traverse spring *b*, anvil *m*, spring *d*, stud *k*, anvil *o*, one-half of operator's telephone-coil *v*, thence to earth, and a click will be produced in the telephone *v*, which will be recognized by the operator as an indication that the line tested is already in use; but assume that she finds the line to station 1 not in use she then inserts plug *u'* into jack *s'* and depresses plunger *f* of the calling-key at the right, sending a call-signal to station 2. The subscriber having responded, the operator is in communication with both, since her telephone-set is in a bridge connection between the two sides of the circuit joining the two subscribers. Having assured herself that they are in communication, the operator depresses plunger *g* of her listening-key, thereby disconnecting her telephone *v* and condenser *x*, leaving the two subscribers connected directly, as already traced. When conversation is finished, either subscriber by operating his generator causes the

shutter of clearing-out annunciator *y* to fall, thereby notifying the operator that they may be disconnected.

My improved key admits of various modifications, which will readily suggest themselves to those skilled in the art to which the invention pertains. Hence I do not limit myself to the precise form shown.

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

1. As an element in a keyboard-circuit, the combination of contact-anvils *p p'*, springs *c c'*, adapted to make contact with *p p'*, respectively, a spring *d*, adapted to come into contact with and be raised by spring *c* when said spring *c* is separated from its anvil *p*, a contact-anvil *o*, adapted to make contact with spring *d* when the said spring is not raised by spring *c*, and a wedge and plunger or other suitable means for raising springs *c c'* from their contacts, substantially as and for the purpose described.

2. In combination, contact-anvils *p p'*, springs *c c'*, adapted to rest upon said contacts *p p'*, respectively, a spring *d*, adapted to make contact with and be raised by spring *c* when said spring *c* is raised, a contact-anvil *o*, adapted to make contact with spring *d* when said spring is not raised, a condenser *x*, connected between contact-anvils *p* and *o*, a telephone connected between contacts *o* and *p'*, and suitable means for separating the springs *c c'* from their respective contacts, substantially in the manner described.

3. In combination, the block *a* of suitable material, the contact-strips *o, o', p, p', m*, and *n*, mounted thereon and adapted to make contact with the springs *d, b', and e', c, c', b*, and *e*, respectively, the springs *c* and *d* being furnished with contact-points, whereby they are crossed together when the spring *c* is raised from its contact-anvil, the contact-springs *i i' j j'*, adapted to make contact with the springs *b b' e e'*, respectively, and wedges *f g h*, attached to plungers moving in perforations through the block, substantially as described.

4. In combination, the block *a*, contact-strips *o, o', p, p', m*, and *n*, adapted to make contact with springs *d, b', and e', c, c', b*, and *e*, respectively, conductors extending from the tip and sleeve of a connecting-plug to the springs *e* and *e'*, respectively, other conductors extending from the tip and sleeve of another connecting-plug to spring *b* and *b'*, respectively, a conductor joining strip *m* with spring *d*, a conductor joining spring *c* with

strip *n*, a telephone having its terminals connected to strips *o* and *p'*, a condenser having its sides connected to strips *o* and *p*, respectively, conductors joining springs *i i'* and *j* and connected to one pole of a source of electric current, another conductor joining springs *i* and *j'* and connected to the other pole of the source of current, and an annunciator included in a conductor joining the contact-strip *o'* with the conductor joining the strip *m* and spring *d*, substantially as set forth.

5. The combination, in a listening-key, of a spring connected to one contact-piece of a connecting-plug, a contact-anvil therefor, connected to one terminal of a telephone and to one side of a condenser, means for forcing said spring away from its contact-anvil, a second spring connected to one contact-piece of another connecting-plug, and a contact-anvil therefor, connected to the other side of the said condenser, said second spring being so disposed with relation to the first spring as to make electrical contact therewith and to be raised from its anvil simultaneously with the separation of the first spring from its anvil, whereby the telephone and condenser are disconnected from the connecting-plugs and the said plugs are connected directly, substantially as described.

6. The combination, with loop-plugs, each having two contact-pieces, of a spring connected to two corresponding contact-pieces of the plugs, contact-anvil thereof, connected to one terminal of a telephone, a second spring connected to one of the remaining contact-pieces of the plugs, an anvil therefor, connected to the other terminal of said telephone and to one side of a condenser, a third spring connected to the remaining contact-piece of the plugs, a contact-anvil therefor, connected to the other side of said condenser, and means for separating all the springs from their contact-anvils and closing said third spring upon said second spring, whereby said condenser normally included between two corresponding contact-pieces of said plugs and said telephone normally in a bridge connection between the different contact-pieces of said plugs may be disconnected from the plugs and connection made directly between like contact-pieces of the two plugs, substantially as described.

In witness whereof I hereunto subscribe my name this 21st day of July, A. D. 1891.

ORO A. BELL.

Witnesses:

FRANK R. MCBERTY,
JOHN O. PARSONS.