(No Model.)

C. E. SCRIBNER & F. R. McBERTY.

OPERATOR'S KEYBOARD APPARATUS AND CIRCUIT THEREFOR.

No. 564,456. Patented July 21, 1896.

Fig. 1

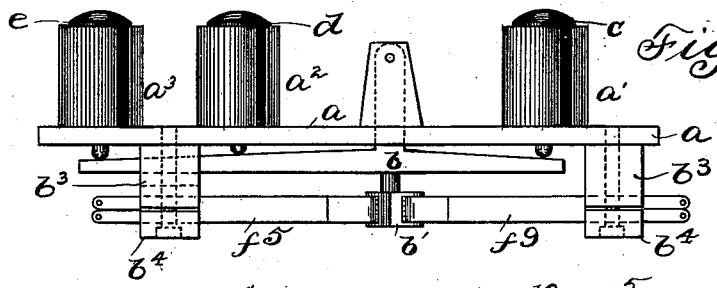
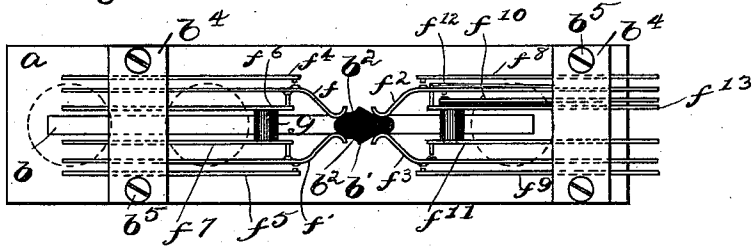


Fig 2.



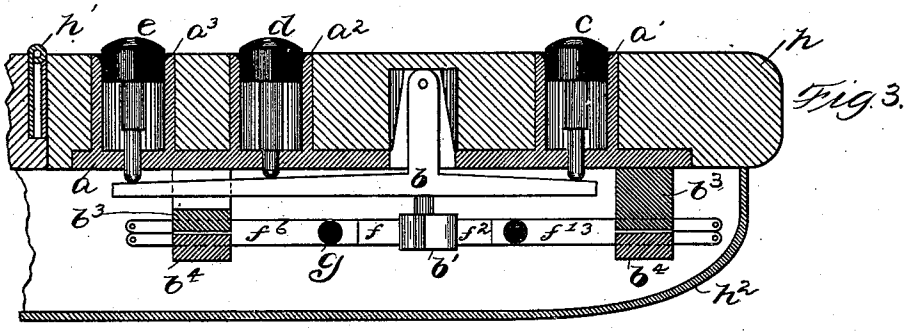


Fig. 3.

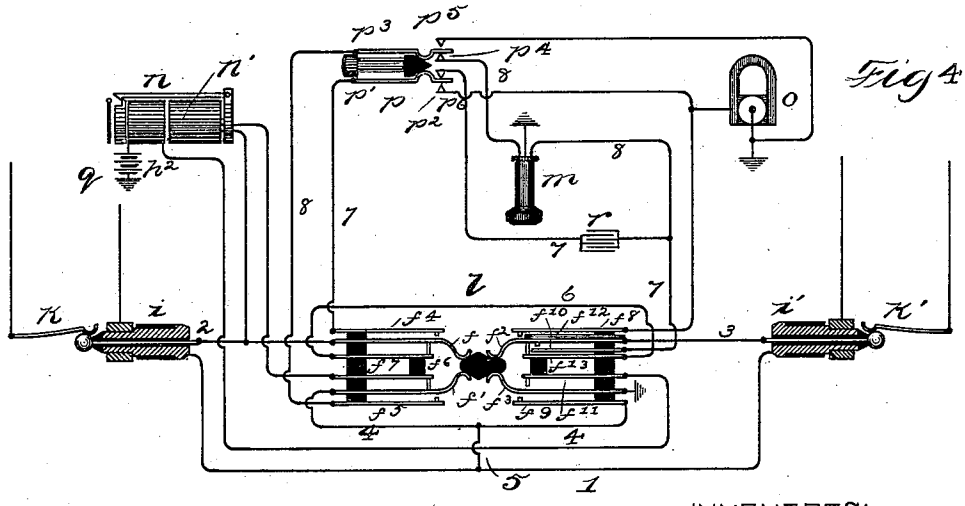


Fig 4

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UNITED STATES PATENT OFFICE.

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OPERATOR'S KEYBOARD APPARATUS AND CIRCUIT THEREFOR.

SPECIFICATION forming part of Letters Patent No. 564,456, dated July 21, 1896.

Application filed September 28, 1893. Serial No. 486,730. (No model.)

To all whom it may concern:

Be it known that we, CHARLES E. SCRIBNER, residing at Chicago, in the county of Cook, and FRANK R. McBERTY, residing at Downer's Grove, in the county of Du Page, State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Operators' Keyboard Apparatus and Circuits Therefor, 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.

Our invention relates to mechanism of telephone-switchboards, more particularly to the keys or switching mechanism and circuit connections appropriate thereto furnished the operator for connecting her telephone with the plug-circuit and for calling subscribers, its objects being to reduce the number of manipulations of keys required in making connection between subscribers and to construct a compact and easily accessible form of key.

Hitherto it has been common to provide each operator with a number of keys, each controlling the connection of her telephone with a single plug-circuit, and another independent set of keys for calling a subscriber after connection was made with his line, these different keys being independently manipulated, and thus requiring a number of distinct operations in completing connection between subscribers. These keys have been commonly arranged upon the under side of a shelf or "keyboard" upon the front of the switchboard, the springs of the keys projecting downward and being with difficulty reached for inspection or adjustment.

Our invention herein relates to a combination listening and ringing key constructed to be operated by three buttons, the mechanism and circuits thereof being so arranged that the depression of one button connects the operator's telephone with the plug-circuit, the depression of another button disconnects the operator's telephone and connects in place thereof a clearing-out annunciator of usual construction, while the operation of the third button alone disconnects the operator's telephone.

Each plug-circuit, or pair of connecting-plugs, is equipped with one such combination-key. In practice the operator leaves her keys in position to connect her telephone with all of the pairs of plugs which are out of use, so that upon inserting any plug into a subscriber's spring-jack she is in position to communicate with the subscriber of that line, the clearing-out annunciators being in that position of the keys disconnected from their respective plug-circuits, so as to avoid their shunting telephonic current. Having completed the connection, the operator depresses the last-mentioned key, thus sending a calling-signal to the subscriber called for, and at the same time automatically disconnecting her telephone from the plug-circuit employed and substituting for the telephone a clearing-out annunciator. An additional function of the key, when self-restoring clearing-out annunciators are employed, is to restore or reset this annunciator by closing a local circuit through its restoring-magnet, this being accomplished by means of contact-points which are brought into operation when the telephone is connected with the plug-circuit. The calling-key is arranged to open one side or conductor of the plug-circuit to prevent the calling-current from finding circuit back to the subscriber who initiated the connection. A single independent key is provided in the branch including the operator's telephone, connected with the source of signaling-current, by which the operator may close this source of signaling-current to the circuit in a manner to ring out to the substation of the call-initiating subscriber.

Our improved key is constructed with its various contact-springs and anvils arranged in the same plane, parallel with the base upon which the key is mounted, so that when in place upon the keyboard the latter, which is hinged at one edge, may be turned over, disclosing all the contact points and surfaces and the entire mechanism of the key, so that the circuits may be readily traced and the switch-contacts inspected or adjusted. The springs are arranged at only a slight elevation from the base of the key, so as to occupy a very small space beneath the keyboard, thus

permitting the close approach of the operator to the switchboard, a disadvantage of the former keys, occupying a larger space beneath the keyboard, being that they necessitated the elevation of the keyboard to permit the operators to sit at the board, thus encroaching upon the space assigned to the spring-jacks upon the switchboard.

Our invention is illustrated in the accompanying drawings and may be described in greater detail in connection therewith.

Of the drawings, Figure 1 is a side elevation of a form of our combination-key. Fig. 2 is a plan thereof from beneath. Fig. 3 is a central longitudinal section of the key, the latter being shown mounted upon a hinged keyboard, as described. Fig. 4 is a diagrammatic representation of an arrangement of circuits appropriate to our improved key.

The key comprises, essentially, a base-plate a, to which is pivoted, near its center, a lever b. Upon this lever the stems of three push-buttons c, d, and e bear, the buttons being adapted to move vertically in tubular projections a' a^2 a^3, respectively, of the base-plate, and being limited in their downward motion by shoulders cut upon the stems. Opposite its pivot the lever b carries an irregular-shaped block or wedge b', of insulating material, at the extremity of a short stem. This block is adapted to move nearly horizontally between the extremities of a set of switch-springs arranged upon each side of it, secured at their distant extremities in blocks b^3 b^3, of insulating material, mounted upon the frame. These switch-springs comprise four main springs f, f', f^2, and f^3, two upon each side of the double wedge b'. These springs are curved inward at their free extremities to press upon the block b' and are so adjusted as to hold the block normally in its central position, the lever b being then nearly horizontal. When the plunger or button c is pressed downward, the block b' is thrust inward between the springs f and f', forcing these outward. The block comes to rest when the shoulder upon its stem comes against the base-plate a, the curved extremities of the springs f and f' then resting in a stable position in shallow recesses or depressions b^2 in opposite sides of the block b', whereby the lever is retained in this position. If now the button d be depressed, it will descend far enough to return the block b' to its normal central position between the springs. By the depression of the button e, however, the block b' may be thrust still farther over until it enters between the springs f^2 f^3, forcing these apart. The block b' is, however, shaped with a regular incline upon the face which enters between the springs f^2 f^3, so that upon the release of the button e it is returned to its normal central position by the pressure of the springs f^2 f^3. The extremities of the springs f, f', f^2, and f^3 are so adjusted in their position with relation to the curved faces of the block b' that the pressure of either pair of springs upon the rounded edge of the wedge b' assists to force the wedge between the opposite pair of springs, so that the wedge may be more easily moved.

The springs f, f', f^2, and f^3 constitute the switch springs or levers of the key, and are provided with suitable contact-anvils to alter the circuit connections as desired. In the form shown the springs f and f' are provided with contact-anvils f^4 f^5, carried at the extremities of flat springs, against which they are thrust when moved outward, and other anvils f^6 f^7, against which they close and come to rest in the normal position of the double wedge or block b', as shown. The springs f^6 f^7 are held in position and prevented from closing together by a block g of insulating material. On the other side of the key the springs f^2 and f^3 are provided with similar anvils f^8 and f^9, against which they close when thrust outward, and anvils f^{10} f^{11}, upon which they may come to rest. The spring f^2 carries a light spring or rider f^{12} fastened to it, provided with a contact-point projecting through an aperture in the spring f^2 and adjusted to close upon an additional anvil f^{13} when the wedge b' stands in its central position. The spring f^3 is, however, in that position of the wedge held out of contact with either of its anvils f^9 or f^{11}.

The different springs are set on edge in saw-cuts in the blocks b^3 b^3, which may be of rubber, and are held in place by cap-blocks b^4, screwed down upon them by means of screws b^5, passing through the blocks b^3 b^3 and entering the base-plate a. The springs of the key are provided with the usual perforated extensions beyond their supporting-blocks, by means of which circuit-wires may be soldered to them.

The different positions of the key are as follows: The wedge b' stands normally in its middle position, the switch-spring f is closed upon its anvil f^6, and the spring f' upon its anvil f^7. The spring f^2 stands free from its anvil f^{10}, but the rider f^{12} upon it is closed upon its anvil f^{13}. The spring f^3 is free from contact with anything. When the button c is depressed, the key assumes a stable position, the extremities of the springs f f' resting in the depressions b^2. The springs f and f' are then separated from their respective anvils f^6 f^7 and closed against their anvils f^4 and f^5. The springs f^2 f^3 are permitted to approach each other, the contact-point of the spring f^2 resting upon its anvil f^{10} and the spring f^3 upon its anvil f^{11}. When, however, the button e is depressed, the springs f and f' are permitted to close upon their anvils f^6 and f^7, respectively, the spring f^2 is closed against its anvil f^8, the rider f^{12} is separated from its anvil f^{13}, and the spring f^3 is closed upon its anvil f^9.

The key is mounted as usual upon the under side of a keyboard h, which keyboard is hinged at h' to the frame of the switchboard, which carries also the apron or shield h^2, upon

which the keyboard h closes. When the keyboard h is turned up into a vertical position, all the springs and contact-points of the key are exposed for inspection or adjustment, together with the wire connections to them.

In Fig. 4, which represents the circuit to which this particular form of key is specially adapted, a pair of connecting-plugs i i' are shown inserted into spring-jacks k k', respectively, supposed to be connected with subscribers' lines, as in the act of making connection between lines. Generally the like parts of the plugs, that is, the tips and sleeves, respectively, are connected together, the sleeves being permanently united by a conductor 1, and the tips by means of a conductor including varying portions of the circuit. The usual telephonic and signaling appliances are shown connected with the conductors uniting the plugs, the key l being employed to alter the circuit connections as desired. These appliances comprise a telephone m, which may be connected to or withdrawn from connection with the plugs, a clearing-out annunciator n of the self-restoring type, which is alternated with the telephone in its connection with the plug-circuits, and a generator o of signaling-current for sending call-signals.

An auxiliary key p is connected in circuit with the telephone, by which signaling-currents may be sent out through the answering-plug, or that which is employed to connect with a calling line. The tip of plug i is united by a conductor 2 with the spring f, and the tip of plug i' by a conductor 3 with the spring f^2. The spring f' and the contact-anvil f^8 are united by conductors 4 and 5, respectively, with the conductor 1 joining the sleeves of the plugs. The spring f^3 is grounded. One terminal of the main or operating magnet n' of the clearing-out annunciator n is connected directly with the conductor 2, while the other extends to the contact-anvil f^7. The restoring-magnet n^2 is grounded at one terminal through a battery q and is connected at its other terminal with the contact-anvil f^{11}. The anvils f^6 and f^{13} are united directly by a conductor 6, while the anvils f^4 and f^{10} are connected together by a conductor 7, including a condenser r and the contact-spring p' and anvil p^2 of the key p. The telephone m is included in a conductor 8, extending from the anvil f^5 to the anvil f^{10}, and including the spring p^3 and anvil p^4 of key p. The telephone m is grounded at the center of its coil in the usual manner for testing purposes. The contact-anvil f^9 constitutes one terminal of the generator o, whose other terminal is grounded. The anvils p^5 p^6 of the key p are connected with the terminals of the same generator o.

To illustrate the employment of this plug-circuit with its combined apparatus, suppose a call to have been made to connect the line of spring-jack k with the line of spring-jack k'. The operator, seeing the individual calling-annunciator operated, inserts plug i into spring-jack k. The line-circuit is thus continued through the tip of the plug to conductor 2 and through the sleeve to conductor 1, and thence, the key l being already in position to connect the telephone m with the circuit, the telephonic current of the subscriber finds a path from conductor 2 through the spring f to anvil f^4, thence through the conductors 7 and 8, including the telephone m, to the anvil f^5, thence through conductor 4 to conductor 1. The operator is thus enabled to receive the oral order of the calling subscriber for the connection desired. She thereupon tests the spring-jack k' by means of plug i' to determine whether the corresponding line is already in use or not, the testing-current finding circuit through conductor 3 to spring f^2, thence to anvil f^{10}, and thence through the telephone m to earth in the usual manner. Having found the line tested not in use, she inserts the plug i' into the spring-jack k' and depresses the button e, throwing the wedge b' to its farthest position between the springs f^2 f^3. The generator o is now provided with a circuit from earth through the anvil f^8 to spring f^2, and thence, this spring being momentarily insulated from the remainder of the plug-circuit, over the conductor 3 to the tip of the plug, and thence out to line. At the same moment the grounded spring f^3 is closed against the anvil f^9, grounding the conductor 1 and providing a return-circuit over the corresponding side of the line in case the latter should be a metallic circuit free from grounds or earth connections throughout. Upon the release of button e the wedge b' returns to its normal intermediate position between the springs, permitting the springs f f' to separate from the telephone-terminals and to close upon their anvils f^6 f^7. The plug-circuit is now complete from the tip of plug i through conductor 2, to spring f, thence to anvil f^6, thence through conductor 6 to anvil f^{13}, thence to the rider f^{12}, and to the tip of plug i'. The clearing-out annunciator is also connected with the plug-circuit by means of the anvil f^7, spring f' and conductor 4 being bridged between the sides of the plug-circuit. If the operator should desire to send a call-signal to the substation of the calling line k, she would connect her telephone with the plug-circuit by depressing the button d and would then depress the plunger of the key p. By this means the springs p' p^3 are closed to the anvils p^5 p^6, which constitute terminals of the generator o, whereby signaling-current is transmitted over a portion of the conductor 7 and the conductor 2 to the tip of the plug i, and over the conductors 8 and 4 to the sleeve thereof. At the same time the remainder of the plug-circuit extending to the plug i' and connected with the telephone m and condenser r is disconnected, so as not to receive any of the signaling-current.

It is obvious that our improved key is ca-

pable of many modifications in detail to adapt it to different circuits, and to effect other and different permutations; but

We claim as new and desire to secure by Letters Patent—

1. The combination with a centrally-pivoted rocking lever, of a button pressing upon each end thereof, and a wedge or block b' carried by the lever adapted to move between switch-springs to alter their contacts with anvils provided for them, substantially as described.

2. The combination with a centrally-pivoted rocking lever, of a button adapted to act upon each end thereof, a double wedge b' carried by the lever, symmetrically-placed switch-springs upon opposite sides of the double wedge, each face of the wedge being adapted to enter between one pair of switch-springs, and contact-anvils and circuit connections for the switch-springs, substantially as described.

3. The combination in a listening and ringing key, of an oscillating or rocking lever, a button acting upon one end of the lever to move it in one direction, two buttons adapted to act upon its other extremity to move it to different distances in the opposite direction, switch-contacts adapted to be operated by the movement of the lever in either direction, and other switch-contacts operated by its movement through different ranges, substantially as described.

4. The combination with an oscillating or rocking lever, of a button acting upon one end to move the lever in one direction, and two buttons acting upon its other extremity to move it to different extents in the opposite direction, the switch-block or double wedge b' carried by the lever, symmetrically-disposed switch-springs upon opposite sides of the double wedge adapted to be moved thereby, and different sets of contact-points whose connections with their respective springs are altered in accordance with the movement of the lever in different directions and to different extents, substantially as described.

5. The combination with a hinged keyboard or shelf, of keys mounted thereon having their switch-springs placed on edge and arranged in a plane parallel with the keyboard, whereby the keys may be readily inspected, as described.

6. In combination, the oscillating lever b carrying the double wedge b', the keys c and d acting upon the lever on opposite sides of its fulcrum, the switch-springs f f' f^2 and f^3 arranged symmetrically in pairs on opposite sides of the double wedge b', and switch contacts or anvils for the springs, as described.

7. The combination with the oscillating lever b carrying the wedge b', of the buttons c d and e acting upon the lever, the switch-springs f f' f^2 and f^3 arranged symmetrically in pairs upon opposite sides of the wedge b', the parts being so adjusted that pressure upon button c forces the wedge between the springs f f', and pressure upon button e forces it between springs f^2 f^3, while pressure upon button d returns it to its normal central position, as described.

8. The combination with the listening and ringing key, of the grounded switch-spring f^3 oscillating between contact-anvils f^9 f^{11} to ground the plug-circuit in ringing, or to close the local circuit of the restoring-coil of the clearing-out annunciator when the telephone is connected with the plug-circuit, as described.

9. In combination, two connecting-plugs, a combination listening and ringing key having its switch-springs connected with the different contact-pieces of the connecting-plugs, the key being provided with an oscillating lever and with buttons pressing upon opposite ends of the lever, said lever being adapted to move the switch-springs to connect the telephone with the plug-circuit when in one position, and to disconnect the same when in another position, as described.

10. In combination, a plug-circuit, a key included therein, said key being provided with an oscillating lever acted upon by three buttons, said lever controlling switch-contacts to connect a telephone with the plug-circuit when one key is depressed, to disconnect said telephone when another button is depressed, and to both disconnect the telephone and close the circuit of a local generator of signaling-current to the circuit when a third button is depressed, substantially as described.

11. The combination with a two-part plug adapted for use with metallic circuits, a plug-circuit and a key connected therewith, said key being adapted when operated to disconnect one contact-piece of the plug from the remainder of the plug-circuit and to connect it with one terminal of a grounded generator, and to ground the other side of the plug-circuit, as described.

12. In combination, a lever and means for moving it about its pivot, a double wedge carried on the lever, two sets of switch-springs and their contact-points on opposite sides of the wedge in a plane substantially that in which the wedge is adapted to move, said wedge being adapted to lie between the presented extremities of all the switch-springs in a normal position, means for applying spring-pressure to the lever to return it to said normal position from between one pair of switch-springs, the wedge being adapted to remain fixed when thrust between said other switch-springs, substantially as described.

13. The combination with two pairs of symmetrically-disposed switch-springs, of a double wedge between the presented ends of the springs, mounted upon a rocking lever, a press-button acting upon each end of the lever, the range of movement of the lever and

the press-buttons being so adjusted that one button may move the wedge from its normal intermediate position to a position between one pair of springs, and the other button may move the wedge from this position to its normal position and thence between the other pair of springs, substantially as described.

In witness whereof we hereunto subscribe our names this 19th day of July, A. D. 1893.

CHARLES E. SCRIBNER.
FRANK R. McBERTY.

Witnesses:
CHARLES A. BROWN,
GEORGE L. CRAGG.