(No Model.) 2 Sheets—Sheet 1.

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

OPERATOR'S KEYBOARD APPARATUS AND CIRCUIT THEREFOR.

No. 564,457. Patented July 21, 1896.

Fig. 1

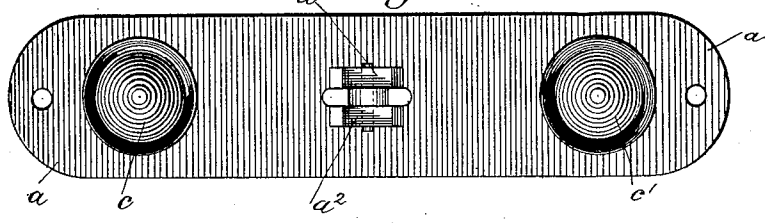


Fig. 2

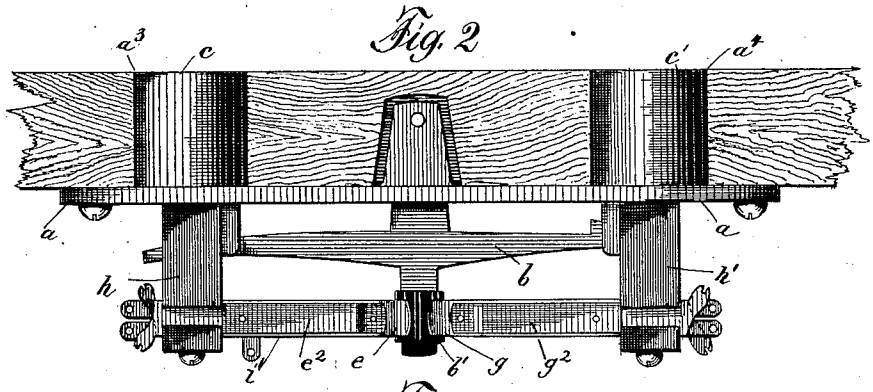


Fig. 3

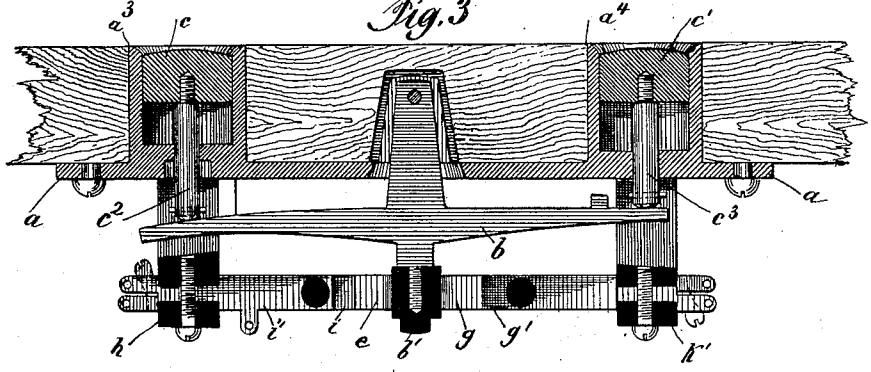
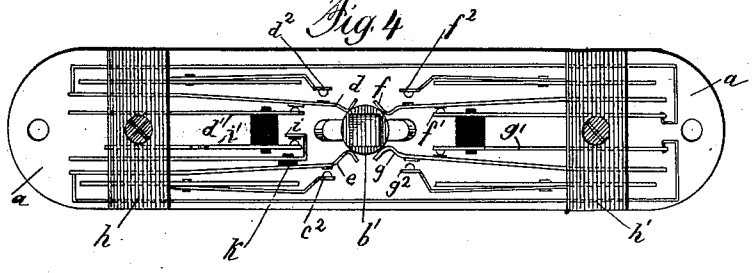


Fig. 4



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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OPERATOR'S KEYBOARD APPARATUS AND CIRCUIT THEREFOR.

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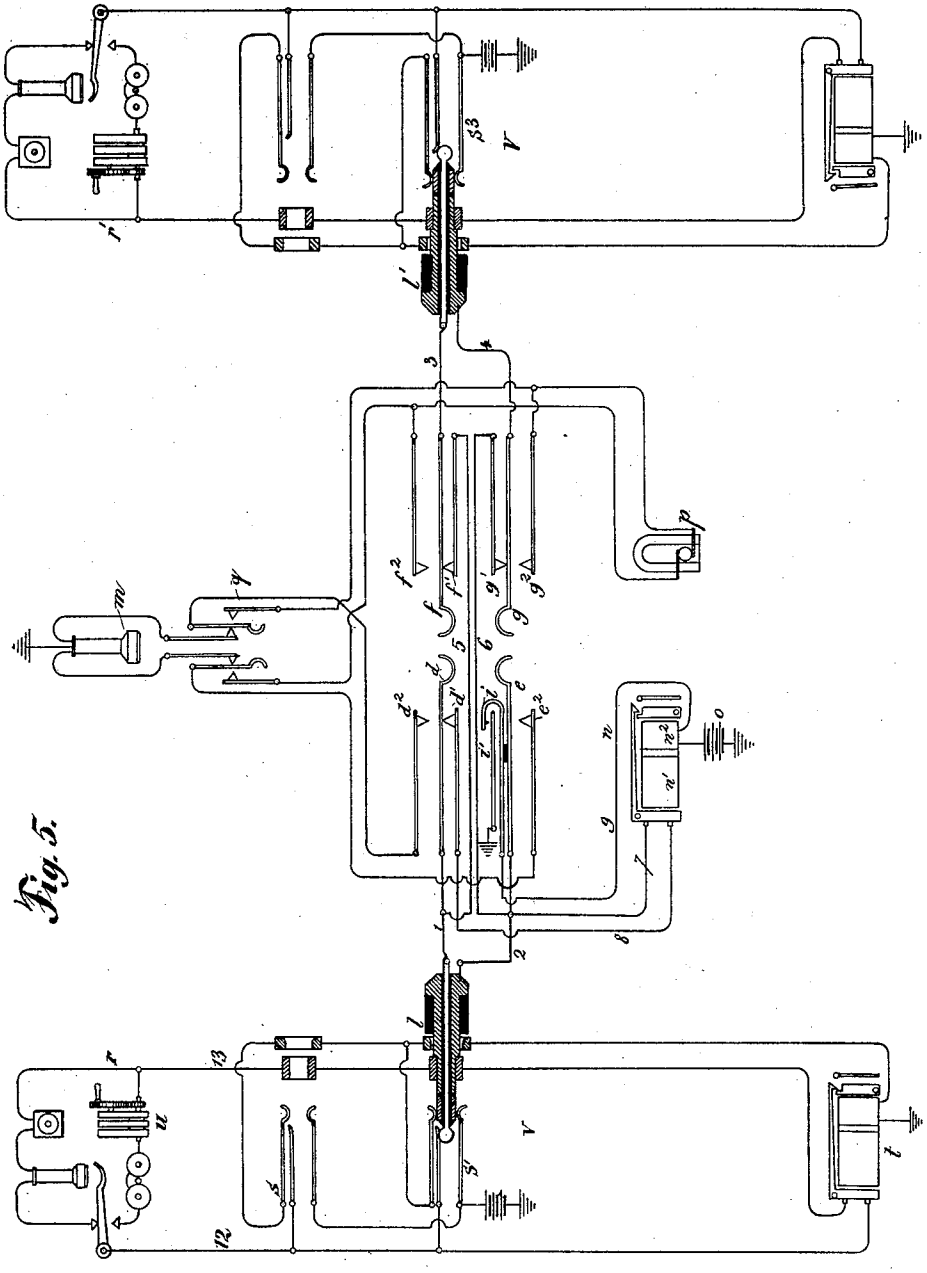

Fig. 5.

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UNITED STATES PATENT OFFICE.

CHARLES E. SCRIBNER, OF CHICAGO, AND FRANK R. McBERTY, OF DOWNER'S GROVE, ILLINOIS, ASSIGNORS TO THE WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

OPERATOR'S KEYBOARD APPARATUS AND CIRCUIT THEREFOR.

SPECIFICATION forming part of Letters Patent No. 564,457, dated July 21, 1896.

Application filed January 10, 1894. Serial No. 496,443. (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, (Case No. 346,) 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 apparatus for establishing connections between telephone-lines at a telephone-switchboard, more particularly to the mechanism provided for the operator to control the circuit connections of the telephonic and signaling appliances with which she is equipped. Its object is to enable the operator to perform the various operations of connecting and disconnecting her telephone from the plug-circuit, and of signaling to one or both of the subscribers, with fewer movements than heretofore possible, thus increasing the rapidity and facility with which she may establish connection between different lines.

Our invention consists in a new form of key for connecting and disconnecting the operator's telephone, for signaling over the line with which connection is made, and for controlling the connections of and automatically restoring or resetting the clearing-out annunciator, together with suitable circuit connections for this type of key.

In a former joint application, Serial No. 486,730, filed September 28, 1893, we have described and claimed, broadly, a key having the same general purpose and arrangement, but differing in various details of construction, which will be set forth and specifically claimed in the present application.

Our improved key consists, essentially, of a centrally-pivoted lever carrying a double wedge, push-buttons adapted to act upon the different extremities of the lever to move the wedge in opposite directions, and switch springs and levers controlled by the wedge in its different movements. One pair of switch-levers is arranged upon each side of the wedge. The members of each pair are provided with suitably-disposed contact-pieces for controlling the various circuits. The wedge tends to remain in a central or intermediate position between the pairs of switch-springs. In this position the operator's telephone is disconnected from the plug-circuit, while the clearing-out annunciator is connected in a bridge between the different conductors of the plug-circuit. When one button is depressed, moving the wedge between one pair of switch-springs, the operator's telephone is connected in a bridge between the sides of the plug-circuit, the branch containing the clearing-out annunciator is opened, and a local circuit including the restoring or resetting magnet of the self-restoring annunciator commonly employed is closed, replacing this instrument in position to respond to a subsequent signal. The operator is thus in position to communicate with a subscriber desiring connection. After the required connection is established, the depression of the remaining button of the key forces the wedge between the opposite switch-springs, disconnecting all of the cord-circuit excepting the plug through which it is desired to signal and connecting the latter with the terminals of a generator of signaling-current. When this latter button is released, the wedge is returned automatically to its central or normal position, the telephone and signaling-generator being disconnected and the clearing-out annunciator being placed in condition to respond to the signal for disconnection.

Our invention is illustrated in the accompanying drawings, of which—

Figure 1 represents a plan view of our improved key. Fig. 2 is a side elevation of the same, together with a portion of the frame of the switchboard upon which the key is mounted. Fig. 3 is a longitudinal section of the key, showing the construction of the various parts. Fig. 4 is a view from beneath, showing the disposition of the switch-springs. Fig. 5 is a diagram representing the key with its circuit connections in a plug-circuit, the latter being in position of connecting two telephone-lines upon a switchboard.

The key consists of a frame a, upon which a lever b is pivoted near the middle of its length in lugs a' a^2. Opposite the extremities of the lever b push-buttons c and c' are provided, moving in cylinders a^3 a^4 and bearing upon the corresponding extremities of the lever through stems c^2 c^3. Near the middle of its length the lever b carries a double wedge b'. Two pairs of switch springs or levers d e and f g are arranged, one pair upon either side of the double wedge b', with their curved free extremities presented to the wedge. These switch-springs are fixed at their rear extremities in blocks h and h', respectively, of insulating material, secured to the frame a. The switch-spring d has a normal resting-contact d' and an alternate contact d^2, with which it is adapted to make contact when the spring is forced outward. These contact-points are carried at the extremities of stiff springs, also secured in the block h. The switch-spring e has no normal resting-contact, but is provided with an alternate contact-point e^2, carried in the same manner. Parallel with the spring e an auxiliary spring i is arranged, insulated from spring e, but mechanically connected with it by a stud k of insulating material. The free extremity of the spring i is bent round in the form of a hook, and a contact-point i' is provided to register with the inwardly-projecting extremity. The tension or resiliency of the spring i is so adjusted with relation to that of spring e that it is normally pressed inward and away from the contact-point i'; but when relieved of the pressure of spring e it is adapted to move outward and thus to bear upon the contact i'. The switch-springs f and g are each provided with resting-contacts f' and g', and with alternate contact-points f^2 and g^2, respectively, similarly secured to the extremities of the stiff springs.

On account of the pressure of the springs d e f g, the wedge b' will be held normally in a central or intermediate position between the springs. When the button c' is depressed, the wedge is forced between the switch-springs d e, throwing these apart. The spring d is thus separated from its resting-contact d' and closed upon its anvil d^2, the spring e is closed upon its anvil e^2, while the spring i is permitted to bear upon its contact i'. The range of movement or throw of the lever b is so adjusted that the curved extremities of springs d and e pass beyond the thickest portion of the wedge and are permitted to close on its other faces, thus preventing its return, whereby the circuit connections thus established are permitted to remain until the position of the key is forcibly altered. When now the button c is depressed, the wedge is first returned to its normal central position, permitting the switch-springs d and e to regain their normal positions. Then, in the further movement of the wedge, it enters between switch-springs f and g, separating these from their respective resting-contacts and forcing them outward against their alternate contact-points. The wedge is not, however, permitted to enter sufficiently far between these springs to be held by them, but is returned by their pressure upon its inclined surfaces to the central position.

Referring now to the diagram showing the circuit connections of the key, its various functions in connection with the plug-circuit may be traced. In this diagram, l and l' represent double connecting-plugs of the usual type, each having a tip adapted to register with the line-spring of a spring-jack, and a sleeve to make connection with the thimble or ring of the same.

The plug l is designed to be used in answering a call or signal for connection, and the plug l' for completing the connection with the line called for, the former being ordinarily designated the "answering-plug" and the latter the "testing-plug." The tip of the plug l is connected by conductor 1 with the switch-spring d; the sleeve of the same plug, by conductor 2, with the switch-spring e. The tip and sleeve of the plug l' are united with the switch-springs f and g, respectively, through conductors 3 and 4. The conductor 1 is connected with the resting-contact f', and conductor 2 with resting-contact g', through wires 5 and 6, respectively. The contact-anvils d^2 e^2 constitute the terminals of the operator's telephone m. A self-restoring clearing-out annunciator n, having a main or operating magnet n' and a restoring-magnet n^2, is connected in a bridge between the conductors 1 and 2, one side of the magnet n' being connected directly through wire 7 with conductor 2, and the other terminal being connected through wire 8 with the resting-contact d', and thus with the switch-spring d. The restoring-magnet n^2 is in a normally open local circuit with a grounded battery o, one terminal of the magnet being connected by conductor 9 with switch-spring i, whose contact-anvil i' is grounded. The contact-pieces f^2 and g^2 constitute terminals of a generator p of signaling-current. A ringing-key q is connected in the conductors extending to the telephone m, the circuit being normally continuous through the key. When the plunger of the key is depressed, forcing its switch-springs q' q^2 outward, the circuit to the telephone is disconnected, and the generator p of signaling-current is connected in place thereof, thus transmitting a signaling-current to both of the connected lines.

Two telephone-lines are shown extending from substations r r' and connected with the usual spring-jacks upon a multiple switchboard at the telephone central station. Thus the station r is connected through line-wires 12 and 13 with spring-jacks s and s' and with an individual annunciator t. A subscriber, as for example at station r, desiring to have his line connected with another, signals the central office by rotating his calling-generator u, whose generated current operates the an-

nunciator t, causing it to display its signal. The attendant operator at the switchboard v, at which the line-annunciator t and the spring-jack s' are located, seeing this indication, inserts the plug l into the spring-jack.

It is preferable that the key should be left with the button c' in its depressed position, the operator's telephone being thus already connected with the conductors 1 and 2. In this position of the key the bridge containing the clearing-out annunciator n is open at the contact-point d'. It will be understood that the necessity for this arrangement arises from the fact that each operator has a considerable number of pairs of plugs $l\ l'$ under her charge, with several or all of which her telephone may be connected at the same time, in which case, if each clearing-out annunciator were left permanently connected with its plug-circuit, the telephone would be shunted by such a number of annunciators in parallel that its efficiency would be materially impaired. At the same time the local circuit including the restoring-magnet n^2 of the clearing-out annunciator is closed at the contacts $i\ i'$, whereby this annunciator, if it has been previously operated and left with its indicator exposed, would be reset to its normal position ready for a disconnection-signal. Hence, having inserted the plug l into the spring-jack of the subscriber calling, the operator finds herself already in position to communicate with the subscriber to receive his order. This being done, she proceeds to test the line called for, in the usual way, by applying the tip of plug l' to the test ring or thimble w of the nearest spring-jack of the line. If the line be free, no effect is produced in the telephone by this test; but if the line were in use, a plug would be already inserted in a spring-jack of the line, whereby the test-ring w would be connected through a battery to earth at the spring-jack where such connection was made. Then a current would be created through the path to the test-ring w, thence to the tip of plug l', through conductor 3, switch-spring f, resting-contact f' through wire 5 to spring d, thence to anvil d^2, thence to the operator's telephone, and through one-half of its magnet-coil to earth. A click would thus be produced in the operator's telephone which would indicate to her that the line was in use.

Having found the line to the station called for, as station r', to be free, the operator inserts the plug l' fully into the spring-jack s^3. She then depresses the button c of the key, whereby the wedge b' is forced between switch-springs $f\ g$, disconnecting the conductors 5 and 6 and the remainder of the plug-circuit, and looping the calling-generator p into circuit with the plug l'. A signaling-current is thus transmitted to the station r'. As soon as the operator releases the button c the wedge b' is returned to its central position by the pressure of the springs $f\ g$. The connections are thus restored to their former condition, excepting that the telephone is disconnected from the circuit of the plugs, the bridge containing the clearing-out annunciator n is completed, and the local or restoring circuit is again opened.

When the subscribers have finished their conversation, either or both may send a clearing-out signal, which will operate the clearing-out annunciator n. It is customary for the operator having received a clearing-out signal to bring her telephone again into the circuit in order to discover whether another connection is desired by either party. The operator does this by depressing the button c', thus returning the entire apparatus to its first condition. If she desires to again disconnect her telephone, she accomplishes this by depressing the button c until the wedge b has reached the central or normal position between the switch-springs, but not sufficiently far to enter between the switch-springs $f\ g$. This is easily done, since a greatly-increased resistance to the pressure upon button c is experienced at the moment the wedge enters between springs $f\ g$. If, however, it be not necessary to disconnect the telephone, the operator may leave the key in the former position and may remove the connecting-plugs $l\ l'$ from the spring-jacks into which they are inserted. The entire plug-circuit and the key are now in position for immediate use in answering another call.

If it be necessary at any time for the operator to signal to other than the subscriber called for, this would be done by depressing the button of key q, by which signaling-current would be sent to both substations.

Thus with our improved key the operator is enabled to control the circuit connections of all her different appliances for speaking and signaling, in the performance of ordinary work, in two motions for each connection, the first being to depress button c in order to signal to the answering subscriber and at the same time to disconnect the telephone and the other being to depress the button c' after receiving the clearing-out signal.

Having thus described our invention, we desire to claim as new and secure by Letters Patent—

1. The combination with two pairs of symmetrically-disposed switch-springs, of a double wedge carried upon a centrally-pivoted rocking lever, placed between their presented ends, and normally free from both pairs of springs, switch-contacts for each spring, and a press-button acting upon each end of the said lever to force the wedge between the opposite pair of springs, substantially as described.

2. The combination with two pairs of symmetrically-disposed switch-springs, of a double wedge mounted upon a centrally-pivoted rocking lever, between the presented ends of the switch-springs, the wedge being normally free from both sets of springs, and means for forcing the wedge between either

pair of springs, the range of movement of the wedge in one direction being so adjusted that it is held by the corresponding pair of springs and prevented from returning to its normal central position, and a press-button acting upon the lever to return the wedge to its central position, substantially as described.

3. In an operator's key, the combination with two pairs of symmetrically-disposed switch-springs, of a double wedge adapted to be forced between either pair of springs, double plugs each having its two parts connected with the different members of one pair of switch-springs, the resting-contacts of one pair of springs being connected with the two parts of the other plug, and the alternate contacts of the same switch-springs being connected with the terminals of a calling-generator, the alternate contacts of the other pair of switch-springs constituting the terminals of an operator's telephone, whereby when the wedge is moved in one direction one plug is disconnected from the other and connected with a calling-generator, and when the wedge is moved in the other direction the telephone is connected in a bridge between the different conductors uniting the plugs, substantially as described.

4. The combination with two pairs of symmetrically-disposed switch-springs, of a double wedge between the presented extremities of the two pairs of springs, normally free from both pairs, two press-buttons, one adapted to move the wedge in each direction, a double connecting-plug having its parts connected with the members of each pair of switch-springs, alternate contact-points constituting the terminals of a telephone, for one pair of switch-springs, the wedge being adapted to be held between this pair of springs when thrust between them to press them outward, alternate contacts for the other pair of switch-springs constituting the terminals of a calling-generator, the wedge being adapted to be returned to its central position by the pressure of the corresponding springs upon it when it is thrust between them, substantially as described.

5. In combination, a pair of switch-springs each connected with one contact-piece of a plug, a resting-contact for one switch-spring included with the main magnet of a self-restoring annunciator in a bridge across the plug-circuit, an auxiliary spring controlled by one of the switch-springs to close upon a contact-anvil when the spring is pressed outward, the auxiliary spring and its anvil being included in the restoring-circuit of the said annunciator, and a pair of alternate contact-points for the switch-springs constituting the terminals of a telephone, another pair of switch-springs each of which is connected with one contact-piece of another plug, normal resting-contacts for these springs, each connected directly with one contact-piece of the first-mentioned plug, alternate contact-anvils forming the terminals of a calling-generator, and a double wedge adapted to be thrust alternately between the presented ends of the pairs of switch-springs, whereby the telephone may be connected with the plug-circuit, and the local circuit of the annunciator closed, the annunciator may be connected in a bridge of the plug-circuit, or the plug-circuit may be opened and a generator of signaling-current may be looped into circuit with one plug, as described.

In witness whereof we hereunto subscribe our names this 23d day of December, A. D. 1893.

CHARLES E. SCRIBNER.
FRANK R. McBERTY.

Witnesses:
ELLA EDLER,
LUCILE RUSSELL.