

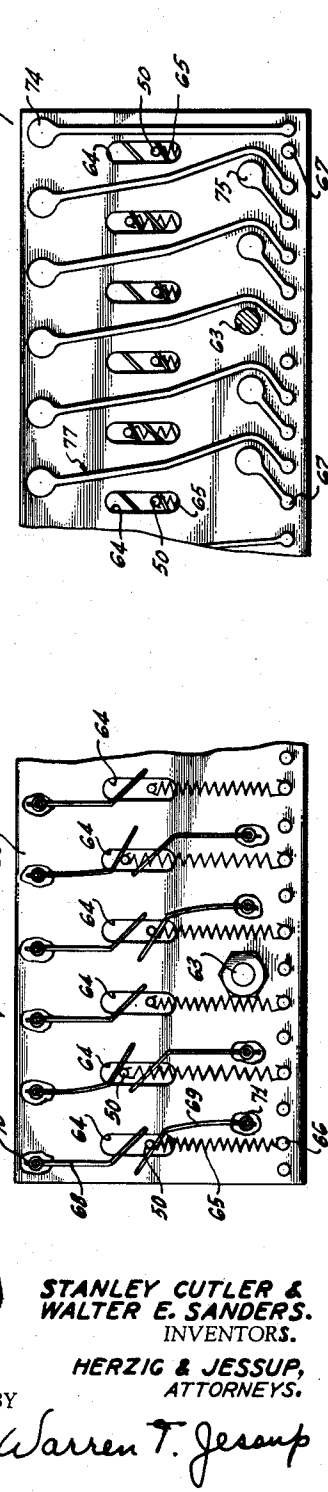
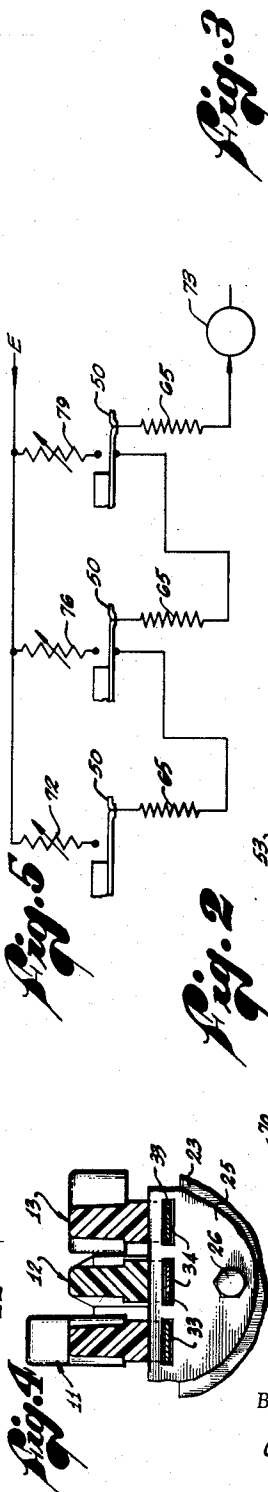
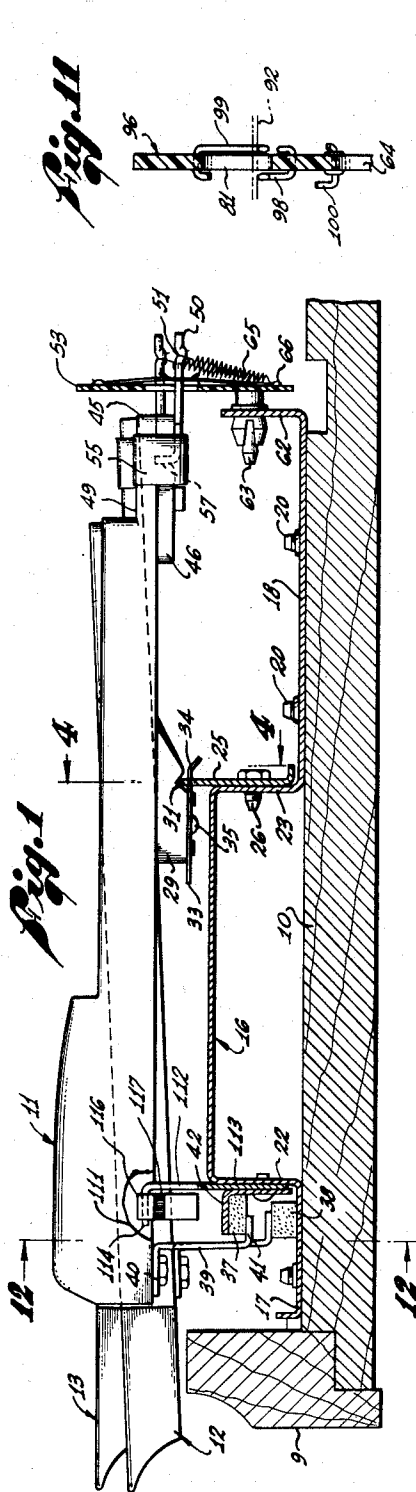
Dec. 6, 1960

S. CUTLER ET AL
KEYBOARD SWITCH

2,963,564

Filed Nov. 14, 1957

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 6

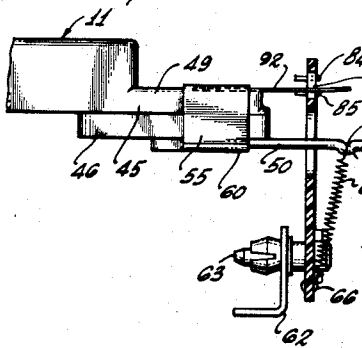


Fig. 7

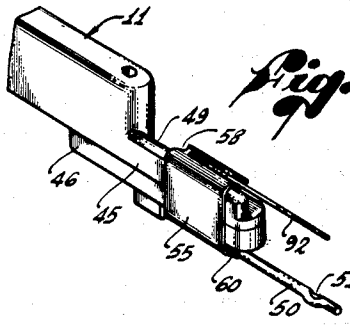


Fig. 8

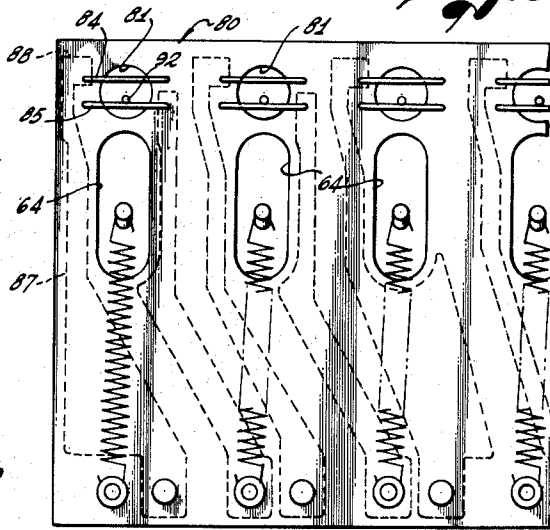


Fig. 9

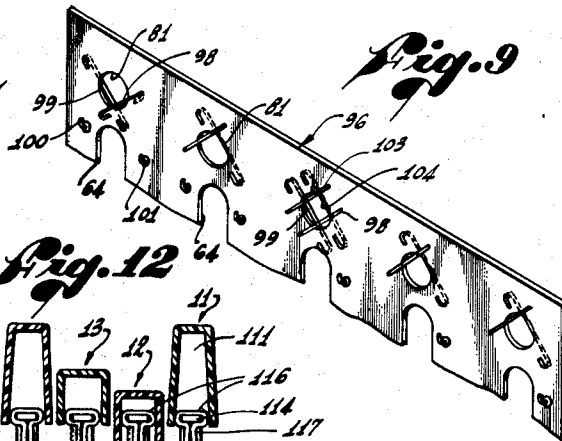


Fig. 10

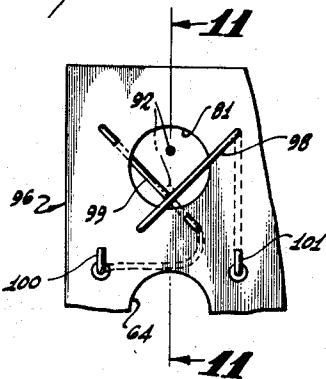
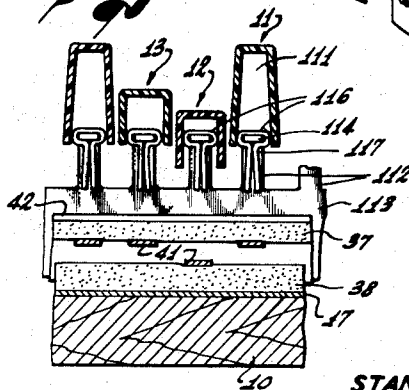


Fig. 12



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2,963,564

KEYBOARD SWITCH

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15 Claims. (Cl. 200—153)

This invention relates to improvements in electrical switches, and particularly to keyboard switches adapted for use with keyboard musical instruments. The invention is particularly adapted as an electric organ key switch.

In electric keyboard musical instruments of the type wherein the invention finds primary utility, there is ordinarily provided one or more audio-frequency generators selectively controllable from the keyboard of the instrument.

The switch of this invention is one having individual compactness and adapted for assembly in a compact organization of a group of similar switches, such as would be operated by a group of keyboard keys.

A primary object of the invention is to provide an improved keyboard switch characterized by simplicity of construction having few parts and possessing the features of durability and uniformity in performance.

A further object of the invention is the provision of an improved keyboard switch characterized by a keyboard key having a stiff projection extending directly therefrom forming a contact member operable between flexible contact members in the form of resiliently mounted wires extending across a recess or opening through which the stiff projection extends.

Another object of the invention is to provide an improved keyboard switch characterized by a key having a resilient contacting or conducting member extending directly therefrom operable adjacent to or between contacting members in the form of stiff wires extending across a recess or opening.

Another object of the invention is to provide an improved keyboard key switch characterized in having a knife edge pivotal mounting formed by an upstanding fulcrum plate engaged in a notch formed in the underside of the keyboard key, the key having a resilient mounting member extending through a slot in the fulcrum plate.

Another object of the invention is to provide an assembly comprising switches as in the foregoing objects wherein the keys are biased by a spring attached directly to the stiff projection extending from an individual key, the spring forming a part of the electrical circuit extending through the switch.

Another object of the invention is to provide an improved single pole double-throw switch characterized as in the foregoing objects.

Another object of the invention is to provide an improved keyboard switch characterized by a key having a flexible contact member extending directly therefrom, the member being in the form of a resilient wire operable between contacting members in the form of stiff wires extending across a recess or opening.

Further objects and numerous advantages of the invention will become apparent from the following detailed description and annexed drawings wherein:

Fig. 1 is a side view of a part of a keyboard embodying improved switches of this invention;

Fig. 2 is a partial end view of the supporting wall or

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insulating panel on which the contact members and terminals are mounted;

Fig. 3 is a view of the opposite side of the insulating wall or supporting member of Fig. 2 showing the printed circuits and terminals on that side of the member;

Fig. 4 is a detail sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a schematic circuit diagram illustrating representatively the tone generator circuit in a musical instrument in which the switches of the invention are adapted for use;

Fig. 6 is a detail view of a modified form of the invention wherein the conducting member or contactor at the end of the keyboard is slightly different;

Fig. 7 is a detail perspective view of the modified construction shown in Fig. 6;

Fig. 8 is a partial view of one side of an insulating wall or supporting member for contact members in a modified form of the invention;

Fig. 9 is a perspective view of an insulating wall or supporting member for contact members in a further modified form of the invention;

Fig. 10 is a detail view of a part of the insulating wall of Fig. 9 showing one pair of contacting members;

Fig. 11 is a detail sectional view taken along the line 11—11 of Fig. 10; and

Fig. 12 is a cross-section on line 12—12 in Fig. 1.

Referring now more in detail to Figs. 1, 2, 3 and 4 of the drawings, numeral 10 designates diagrammatically a base or platform forming a part of the cabinet upon which the keyboard of a musical instrument is mounted. At the front of the platform 10 is an upstanding panel member 9 which is rabbeted to the front of the platform 10 as shown. Mounted on the keyboard are a group or assembly of keys of which three are shown in cross-section in Fig. 4 numbered 11, 12 and 13. The keys have the cross-sectional shape shown in Figs. 4 and 12 and may be made of a suitable plastic composition.

The keyboard may be used in any type of electric organ.

The keys are pivotally or rockably mounted for up and down movement on a mounting plate designated at 16 having portions as shown at 17 and 18 attached to the platform 10 by means of screws, for example as shown at 20. The intermediate portion of the plate 16 is raised up from the platform 10 by vertical portions 22 and 23.

Attached to the vertical portion 23 is a fulcrum plate 25 which is attached by a screw 26, as shown. The key 11, representative of the other keys, has below it, at an intermediate point a fulcrum member or portion 29 which may be integral with the key or formed as a separate part and attached to the key. Formed in the member or portion 29 is a notch 31 which engages with the upper edge of the fulcrum plate 25. Attached to the lower surface of the member or portion 29 is a mounting member 33 having certain resilience or springiness and which extends through a slot 34 near the upper edge of the fulcrum plate 25. The mounting plate 33 may be attached in any suitable manner such as by a screw 35. The extending end of the mounting plate 33 is bent downwardly as shown at 36. The slot 34 is spaced from the upper end of the fulcrum plate 25 so that the upper end of the plate engages in the notch 31 to provide for the key being fulcrumed on the fulcrum plate with the parts being attached by way of the mounting member 33 extending through the slot in the fulcrum plate.

The tilting or up and down movement of the key 11 is limited by stop members in the form of stationary pliant stop means shown for example as the resilient stop members in the form of felt strips 37 and 38. Extending downwardly from the key 11 is an angle bracket 39 attached to the key by a screw as shown at 40. At the

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lower end of the bracket 39 is an angle portion 41 which operates between the stationary pliant stops 37 and 38. The stop 38 is attached as by being glued to the plate 16 and the upper stop 37 is attached to an angle bracket 42 secured as by a screw as shown to a vertical portion 22 of the plate 16. The stop members 37 and 38 may be formed of felt, rubber, or any suitable pliant, soft material.

To restrain each key against lateral movement, the keys are made in the form of U-cross-section (Fig. 12), thereby providing an underside recess 111. Projecting upward into the recess 111 is a post 112 formed from a plate 113 held between members 42 and 22. The upper end of 112 is bent forward to form a tab 114 over which is slipped a felt guide member 116, which forms a soft lining on each side of the tab against which the walls of the recess 111 may rub. The felt 116 is formed of a short felt strip sewed into a loop at 117. The tab 114 thus forms a guide member restraining the key against lateral deflection in its normal up and down movement.

The improved switch or switches of the invention are mounted at the right end of the keys and are actuated directly by members extending from the ends of the keys.

Referring to key 11 as shown in Fig. 1, at its right end it has a portion 45 having a smaller vertical dimension and the key has an integral portion 46 beneath the extending portion 45. The portion 45 also has an upstanding rib 49 as may be seen in the view of Fig. 7. The extending portion 45 of the elongate key 11 has attached thereto a conducting member or contacting member in the form of a stiff projection as shown at 50 which by way of example is a stiff or rigid wire having a crimp near its end portion as shown at 51.

The conducting member 50 operates between contacting members as will be described carried by a supporting member in the form of an insulating wall as shown at 53 which will be described presently.

The stiff projection 50 is attached to the extending portion 45 of the key 11 by way of a spring clip 55 which is shown in greater detail in the view of Fig. 7. (The contacting means of Fig. 7 is otherwise slightly different and will be described presently.)

The inner end of the stiff projection 50 has an angle portion 57 which extends upwardly into an opening in the underside of the projecting portion 45. The upper part of the spring clip 55 is crimped as may be seen at 58 in Fig. 7 so as to clip over the rib 49 on the upper side of the projection 45. The lower part of the spring clip 55 is crimped or grooved as may be seen at 60, to receive the stiff projection 50; the clip 55 being thus clipped over the extending portion 45 of the key so as to hold the stiff projection 50 in position.

The supporting member or insulating wall 53 is made of suitable insulating material and it is mounted from the plate 16 by way of being attached to a vertical portion 62 of plate 16 by a bolt or similar attaching element 63 having a split head as shown in Fig. 1. The insulating wall 53 has a group or series of similar elongate recesses in the form of openings 64 therein as shown in Figs. 2 and 3. The stiff projection extending from the key 11 extends through one of the recesses 64 opposite the end of the key. The construction is the same for individual keys so it will be described in detail for only one key. Numeral 65 designates a biasing spring which is attached at one end to the stiff projection 50 by means of the end of the spring engaging in the crimp 51 in the projection. The other end of the biasing spring 65 is attached to a pin 66, as shown in Fig. 2, which extends through the insulating wall 53 from an electrical terminal on the opposite side as shown at 67 in Fig. 3.

The stiff projection 50 itself forms a contact member and it cooperates with contact members which are resiliently mounted on one side of the insulating wall 53. The resiliently mounted contact members are shown as the relatively fine wires indicated at 68 and 69 in Fig. 2.

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The adjacent ends of these contact members are bent at an angle as shown and extend obliquely across the recess 64 as shown with the stiff projection 50 disposed between them. The ends of the contact members 68 and 69 are connected or attached to pins as shown at 70 and 71 extending through the insulating wall 53 and connecting to terminals formed on the other side of the wall as shown at 74 and 75 in Fig. 3. The contacting members 68 and 69 may be relatively fine wires possessing sufficient resiliency such that when they are engaged by the stiff projection 50 good electrical contact is made and there is a wiping contact between the parts. As will be observed, the assembly described forms a single pole double-throw electrical switch.

Fig. 5 illustrates diagrammatically a circuit in a musical instrument in which the piano key switches of this invention may be utilized. Numeral 73 designates a tone generator whose operation and/or operating frequency is controlled by the switches 50, which selectively insert elements 72, 76, 79 into the generator circuit to control the oscillation frequency.

The terminals on one side of the insulating wall 53 or terminal panel as shown in Fig. 3 may be formed by printed circuits as indicated at 77, the terminals themselves such as 74 and 75 being slightly raised from the surface of the insulating wall to facilitate electrical connections to the panel.

In the operation of one of the switches of this invention, when a key such as key 11 is depressed, the projection 50 moves upwardly in recess 64 and will engage with and make contact with the resilient contacting member 68. A circuit is thus completed through the biasing spring 65. Similarly when the key is released, it will rock in the opposite direction with the projection 50 making contact with the contacting member 59. The spring 65 biases the key and also forms a part of the circuit through the single pole double-throw switch.

From the foregoing, those skilled in the art will observe that there has been provided a simple but effective contacting means formed by the stiff projection extending directly from the end of the keyboard key and operating directly between the resilient contacting members formed by the wires 68 and 69.

Referring now to Figs. 6, 7 and 8 of the drawings, a modified form of the invention is shown wherein a resilient contacting or conducting projection extends from the key and cooperates with relatively stiff contacting members mounted on the insulating wall. In Fig. 8, the insulating wall or supporting member is shown at 80 having similar elongated recesses 64 as in the previous embodiment of the invention. The insulating wall of Fig. 8 has a group of circular recesses in the form of apertures 81 above the recess 64 as shown. Extending across the recess 81, the construction being similar for each one, are a pair of stiff contacting members formed by the relatively fine wires 84 and 85, the ends of which are bent at a right angle and extend through the insulating wall 80, as shown in Fig. 6. The circuits on the other side of the insulating wall are printed circuits as shown in the previous embodiment and are indicated in outline as at 87. Raised electrical terminals are formed at the ends of the printed circuits at their ends as indicated by the numeral 88.

In this form of the invention, there is provided a resilient conducting or contacting member 92 formed as a wire, the end of which lies in the crimped portion 58 at the upper part of the clip 55 and the end of the wire 92 may preferably be soldered to the clip. The stiff projection 50 extends through the recess 64 as in the previous embodiment and is biased by the spring 65. The resilient conducting member 92 extends through the recess 81 between the contacting members 84 and 85, as shown in Figs. 6 and 8.

The operation is similar to that of the previous embodiment. When the key 11 is tilted or rocked up and down,

the resilient contacting member 92 moves up and down and engages one or the other of the contacting members 84 and 85 and due to its resiliency a good electrical contact is made. Thus, the assembly forms a single pole double-throw switch as in the previous embodiment. The circuit in the present embodiment is through the spring 65, the stiff projection 50, the clip 55, the resilient conducting or contacting member 92, and one or the other of the contact members 84 and 85.

Referring to Figs. 9, 10 and 11 of the drawings, these figures show a modified form of the invention wherein the contacting members of the insulating wall are slightly different. In Fig. 9, the insulating wall is shown at 96 having recesses as shown at 81 as in the previous embodiment and elongated recesses as shown at 64. The contacting members are formed of relatively stiff wires as indicated at 98 and 99 extending substantially at right angles to each other on opposite sides of the wall 96 and crossing each other at a point near the lower or upper part of the recess 81 and the point of crossing being shown as near the upper part of the recess 81 in connection with some of the recesses in Fig. 9. The ends of the crossed contacting members, that is, the wires 98 and 99, extend through the insulating wall 96 as shown, and one end of each extends back through the insulating wall through apertures on opposite sides of the elongated recess 64 as shown at 100 and 101 in Fig. 10.

In Fig. 9, the central recess 81 has two pairs of crossed contacting wires associated with it. In addition to the crossed wires 98 and 99, there are an additional pair of crossed wires 103 and 104 which are similar except that their point of crossing is near the upper part of the recess 81 so that the contacting or conducting member 92 contacts and bridges a pair of wires both upon downward movement and upward movement.

The contacting or conducting means at the end of the key 11 in the present embodiment of the invention is the same as that of the previous embodiment, that is, that construction shown in Figs. 6 and 7. The stiff projection 50 extends through the elongated recesses or slots 64 and the contacting member 92 extends through the recess 81. As may be seen in Fig. 10, when the key is tilted downwardly the contacting member 92 will contact with the wires 98 and 99, bridging them to complete a circuit between them, they being on opposite sides of the insulating wall 96. Thus, depending on the manner of wiring, the conducting member 92 can bridge and complete a circuit between members 98 or 99, or on the other hand the member 92 can complete two circuits, one through member 98 and the other through member 99 in the manner of a double contact relay. Where two pairs of crossed wires forming contacting members are used, the contacting takes place both on the upward and downward movement of the contacting member 92.

From the foregoing, those skilled in the art will observe that the invention provides a keyboard switch having simplicity, few parts and durability of construction and also providing for ease of fabrication and assembly. The contacting action is direct as between the extension from the keyboard key and the contacts mounted on the insulating wall adjacent the ends of the keys. The pivotal mounting of the keys is simple but effective and contacting is made dependable and uniform by the limitation of motion of the keys between the pliant stop members.

While these switches have been described in connection with keyboard keys, it will be readily apparent that many of the switch features have general application not necessarily associated with such keys.

Thus, while the instant invention has been shown and described herein in which is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention which is therefore not to be limited to the details described herein but is to be accorded the full scope of the claims.

We claim:

1. Pivotal mounting means for a keyboard key comprising, an elongate key, a fulcrum plate extending transversely beneath said key, means forming a notch in an undersurface of said key parallel to said fulcrum plate, a slot in said fulcrum plate adjacent and paralleling the upper edge thereof, and a resilient mounting member mounted beneath said key and extending into said slot, the distance from said edge to said slot being substantially the same as the distance from said notch to said mounting member, said mounting member residing in said slot and said notch resting over said edge, thereby pivoting said key to the upper edge of said plate for back and forth pivoting motion.

2. Mounting means for a keyboard key comprising: an elongate key, means for pivotally mounting said key intermediate its ends, a stop member secured to the underside of said key near the forward end thereof and having a projecting portion spaced vertically from said underside and extending parallel to said key, stationary pliant stop means secured above and below said projecting portion to constitute stop limiting pivoting of said key, and resilient means for biasing the forward end of said key upward.

3. Switch comprising an insulating wall having an opening therethrough, a first conductor mounted on one side of said wall and at least partially spanning said opening, a second conductor mounted on the opposite side of said wall and at least partially spanning said opening in crossed relation to said first conductor, and a conducting member disposed in said opening and mounted for movement into and out of engagement with said conductor.

4. Switch operated by a keyboard key comprising: an elongated key, means for pivotally mounting said key intermediate its end for up and down movement, an insulating wall mounted transversely of said key adjacent one end of said key and having an opening therein, a contact member resiliently mounted to said wall on one side thereof over the face of said opening, a conducting member extending from said key and into said opening in position to be selectively engaged and disengaged by said contact member upon pivotal movement of said key, a tension spring engaged with said conducting member and biasing the rearward end of said key downward, printed conducting circuits on the side of said wall opposite to that of said contact member, and electric terminals extending through said wall and electrically connected on one side to said contact member and spring respectively, and on the other side to said printed conducting circuits.

5. Switch means operated by a keyboard key comprising: an elongate key, means for pivotally mounting said key intermediate its ends for up and down movement, an insulating wall mounted transversely of said key adjacent one end of said key and having an opening therein, a contact member spanning said opening, a conducting member extending from said key and into said opening in position to selectively engage and disengage said contact member upon up and down movement of said key, said wall being provided with a second opening therein positioned vertically with respect to said first-mentioned opening, said key having a relatively stiff projection extending through said second opening, a spring engaging said projection for biasing the rear end of said key downward, and a resilient clip snapped over the end of said key and aiding in the securement of said projection and said conducting member to said key and also providing a conducting path between said conducting member and said projection.

6. Switch means operated by a keyboard key comprising: an elongate key, means for pivotally mounting said key intermediate its ends for up and down movement, an insulating wall mounted transversely of said key adjacent one end of said key and having an opening therein passing through said wall, a first contact wire spanning said opening, a conducting member extending from said

key and into said recess in position to selectively engage and disengage said contact member upon up and down movement of said key, said wall being provided with a second opening therein positioned vertically with respect to said first mentioned opening, said key having a relatively stiff projection extending through said second opening, a spring engaging said projection for biasing the rear end of said key downward, and a resilient clip snapped over the end of said key and aiding in the securement of said projection and said conducting member to said key and also providing a conducting path between said conducting member and said projection, and a second contact wire spanning said first mentioned opening and engageable by said conducting member.

7. Switch means operated by a keyboard key comprising: an elongate key, means for pivotally mounting said key intermediate its end for up and down movement, an insulating wall mounted transversely of said key adjacent one end thereof and having an opening passing therethrough, a pair of crossed wires disposed on opposite sides of said wall and spanning said opening, a conducting member extending from said key and through said opening in position to selectively engage and disengage said wires, the crossing line of said wires lying in the path of up and down movement of said conducting member, a projection extending from said key, a biasing spring engaging said projection for biasing the rear end of said key downward, and a resilient clip snapped over the end of said key and aiding in the securement of said projection and said conducting member to said key and also providing a conducting path between said conducting member and said projection.

8. Mounting means for a keyboard key comprising: an elongate key, means for pivotally mounting said key intermediate its ends, a stop member secured to the under side of said key near the forward end thereof and having a projecting portion spaced vertically from said under side and extending parallel to said key, stationary pliant stop means secured above and below said projecting portion to constitute stops limiting pivoting of said key, resilient means for biasing the forward end of said key upward, means forming a recess in the under surface of said key spaced from said pivotal mounting, and a guide member disposed in said recess and covered at its sides by soft material serving as a lateral guide for said key during up and down movement thereof.

9. Pivotal mounting means for a keyboard key comprising: an elongate key, a fulcrum plate extending transversely of said key, means forming a transverse notch in said key parallel to said fulcrum plate, a slot in said fulcrum plate adjacent and paralleling the edge thereof, and a resilient mounting member mounted to said key and extending into said slot, said mounting member residing in said slot and said notch resting against said edge, thereby pivoting said key to the edge of said plate for back and forth pivoting motion.

10. Pivotal mounting means for a keyboard key comprising: a first member in the form of an elongate key, a second member in the form of a base, a fulcrum plate secured to one of said members and extending transversely of said key, means forming a notch in a surface of the other of said members and facing said one member, said notch paralleling said fulcrum plate, a slot in said fulcrum plate adjacent and paralleling the edge of

said fulcrum plate, and a resilient mounting member secured to said other of said members and extending into said slot, said mounting member residing in said slot and said notch resting against said edge, thereby mounting said key for back and forth pivoting about the edge of said plate.

11. Switch means operated by a keyboard and comprising an elongate key, means for mounting said key intermediate its ends for oscillating movement, a support member mounted adjacent one end of said key and having a recess therein, a contact member mounted over a face of said recess, a conducting member extending from said key and into said recess in position to selectively engage and disengage said contact member upon oscillation of said key, and means for biasing said key in a given direction.

12. Switch means operated by a keyboard key comprising: an elongate key, means for mounting said key intermediate its ends for oscillating movement, an insulating wall mounted adjacent one end of said key and having an opening passing therethrough, a contact member mounted over a face of said opening, a conducting member extending from said key and through said opening in position to selectively engage and disengage said contact member upon oscillation of said key, and means for biasing said key in a given direction.

13. Switch means operated by a keyboard key comprising: an elongate key, means for mounting said key intermediate its ends for oscillating movement, support means mounted adjacent one end of said key and having a recess therein, a contact member mounted over a face of said recess, a conducting member extending from said key and into said recess in position to selectively engage and disengage said contact member upon pivoting of said key, one of said members being resilient, and means for biasing said key in a given direction.

14. Switch means operated by a keyboard key comprising an elongate key, means for mounting said key intermediate its ends for oscillating movement, support means mounted adjacent one end of said key and having a recess therein, a contact member mounted over a face of said recess, a conducting member extending from said key and into said recess in position to selectively engage and disengage said contact member upon oscillation of said key, and a resilient clip snapped over the end of said key and serving to at least partially secure said conducting member to said key.

15. Switch operated by a keyboard key comprising an elongate key, means for pivotally mounting said key intermediate its ends for up and down movement, an insulating wall mounted transversely of said key adjacent one end of said key and having an opening therein, a wire mounted over a face of said opening, a conducting member extending from said key and into said opening in position to be selectively engaged and disengaged by said wire upon pivotal movement of said key, and a tension spring engaged to said conducting member and biasing the rearward end of said key downward.

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