

Dec. 9, 1969

H. G. MIRBETH

3,483,492

REED SWITCH

Filed Feb. 16, 1968

4 Sheets-Sheet 1

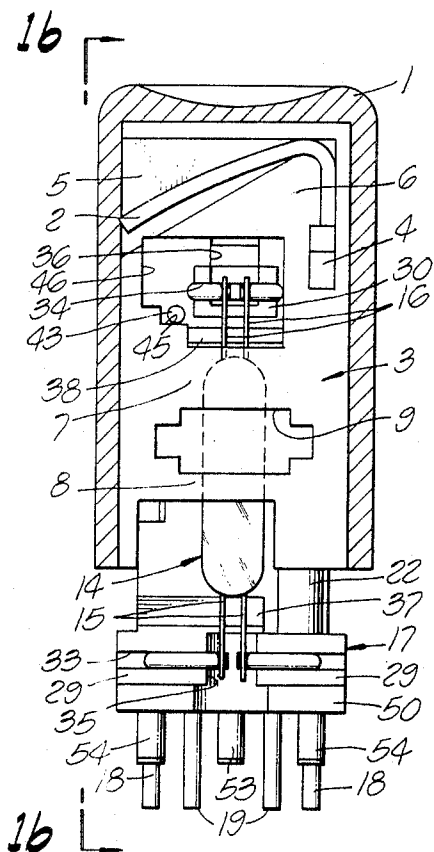


FIG. 1a.

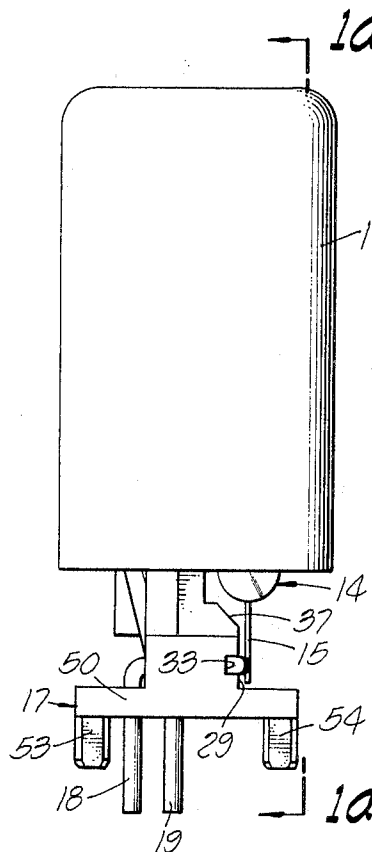


FIG. 1b.

INVENTOR
H. G. MIRBETH
BY *Donald J. [Signature]*
ATTORNEY

Dec. 9, 1969

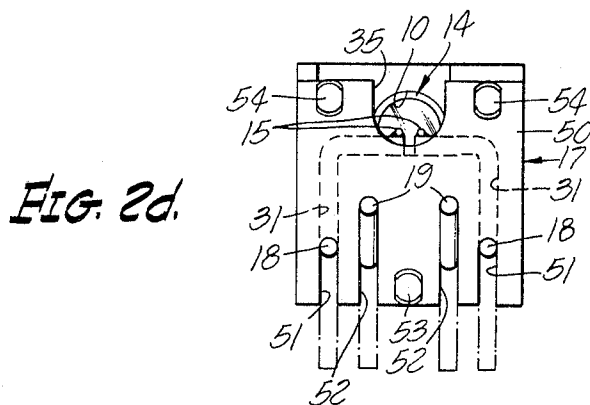
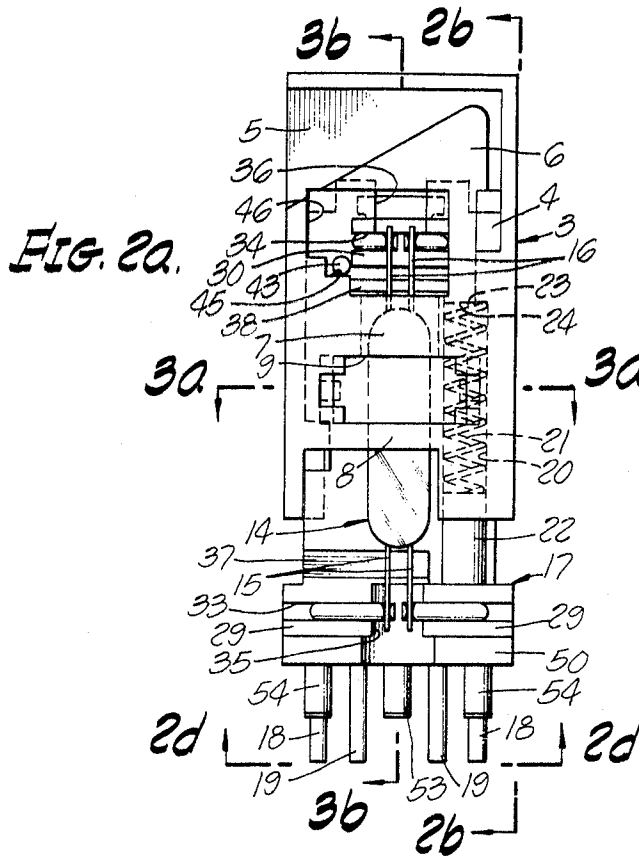
H. G. MIRBETH

3,483,492

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4 Sheets-Sheet 2



INVENTOR
H. G. MIRBETH

BY

Donald J. [Signature]

ATTORNEY

Dec. 9, 1969

H. G. MIRBETH

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4 Sheets-Sheet 3

FIG. 2c.

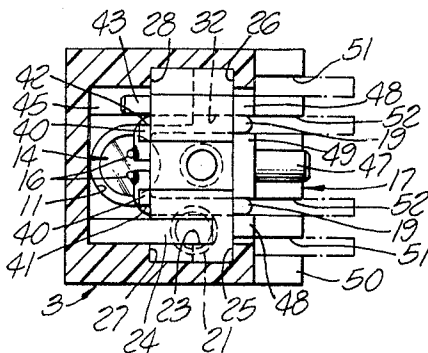
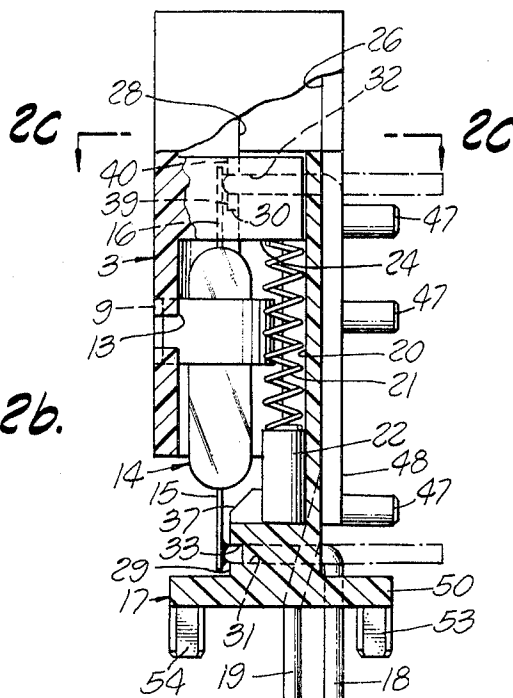


FIG. 2b.



INVENTOR
H. G. MIRBETH

BY *Donald J. [Signature]*
ATTORNEY

Dec. 9, 1969

H. G. MIRBETH

3,483,492

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4 Sheets-Sheet 4

FIG. 3a.

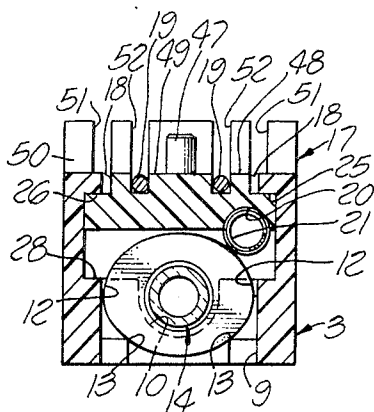
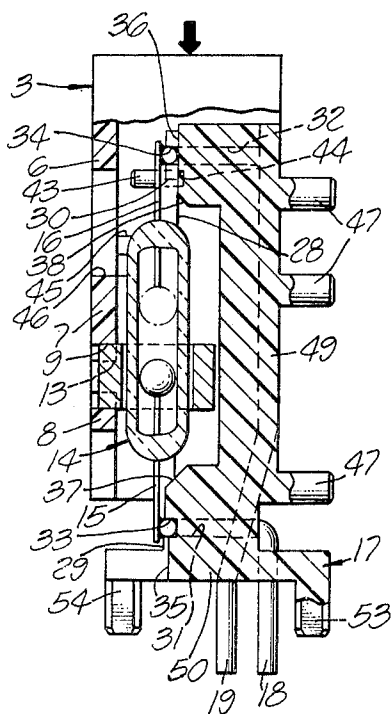


FIG. 3b.



INVENTOR
H. G. MIRBETH
BY *Harold Stitz*
ATTORNEY

1

3,483,492

REED SWITCH

Heinz Georg Mirbeth, Nuremberg, Germany, assignor to International Standard Electric Corporation, New York, N.Y., a corporation of Delaware

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Claims priority, application Germany, Feb. 21, 1967,

S 108,417

Int. Cl. H01h 9/02, 1/66

U.S. Cl. 335—205

9 Claims

ABSTRACT OF THE DISCLOSURE

A push-button or sliding key embodying a reed contact, adapted to be used as a feeding key for computing machines, typewriters and the like. The reed tube and electrical terminals therefor are mounted on the stationary part of the switch, while an annular permanent magnet is supported in encircling relationship about the reed tube in a key slide that is slidably engaged on the stationary part for longitudinal switching movement of the magnet relative to the reed tube. The key slide and stationary parts of the switch are simplified, compact unitary molded plastic members, and the key knob or push-button body is a hollow shell engageable over the key slide and providing a housing for the reed switch.

BACKGROUND OF THE INVENTION

It is known in connection with sliding or pushing key type switches to employ, instead of open contact arrangements, contacts which are provided inside a sealed capsule called a reed tube, with the contacts being actuated magnetically from the outside of the reed tube.

According to a former proposal a construction proved to be good in which a ball is used inside the reed tube as a freely movable armature which touches two adjacent contact elements in each position of the switch, these contact elements consisting of iron rods melted into the tube at the ends thereof with an air gap therebetween. The non-operative or the operative position results from the position of the permanent magnet which can be moved in the sliding direction and which has the shape of an annular magnet. Because the permanent magnet is poled in the sliding direction the ball armature always tends to take a resting position on the contact elements located next to the permanent magnet. In order to avoid this the ball-type armature is supported in an intermediate position to one contact element only, so that in practice with a slow motion of the contacting key both contact elements are not simultaneously opened or closed. In this type of device the inside drill hole of the annular magnet is made as a slotted hole.

In another former proposal the button knob and key slide form a unit and when actuated transmit the pressure into a resiliently supported plastic part in which the annular magnet is fastened. The stationary reed contact protrudes through the center opening of the annular magnet so that the movably arranged part of the armature inside the reed tube is either closed when the push-button is not pressed (break-contact) or open when the push-button is not pressed (make-contact).

The advantage of these keys is that they require no maintenance and moreover have a high life expectancy. However, a disadvantage of such prior art keys is that they require excessive space due to their length, because the reed contacts must be arranged with their longitudinal direction parallel to the sliding movement in order to obtain maximum efficiency. Further, the construction of these previously known keys embodying reed contacts are very expensive and are difficult in production.

2

SUMMARY OF THE INVENTION

It is accordingly a general object of the present invention to provide an improved push-button or sliding key switch having a reed contact which is particularly short and compact, being generally similar in size to the different types of keys having open contacts, and which can be manufactured generally as simply and economically as said open-contact keys.

A more particular object of the invention is to provide a push-button or sliding key of the character described embodying a reed contact, wherein the key knob or push-button body comprises a hollow shell that is engageable over the key slide or movable part of the switch to provide a housing for the switch.

According to the invention, the reed tube and its electrical terminals are mounted on the stationary part of the switch, while an annular permanent magnet is supported in encircling relationship about the reed tube in a key slide that is provided with guide means for slidable engagement of the key slide on the stationary part to move the magnet longitudinally relative to the reed tube, with the key slide being installed in a body or shell which serves both as the key knob and as a housing for the switch.

Details of the invention will now be explained with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1a is a vertical, longitudinal section, taken on the line 1a—1a in FIGURE 1b, illustrating the present invention on an enlarged scale and showing in particular the manner in which the key knob or housing is engaged over and locked to the key slide.

FIGURE 1b is a side elevational view of the fully assembled switch, as viewed on the line 1b—1b in FIGURE 1a.

FIGURE 2a is a front elevational view of the invention with the push-button knob removed.

FIGURE 2b is a side elevational view, partly in section, taken on the line 2b—2b in FIGURE 2a.

FIGURE 2c is a horizontal section taken on the line 2c—2c in FIGURE 2b.

FIGURE 2d is a bottom plan view of the device with the push-button knob removed, looking in the direction 2d—2d in FIGURE 2a.

FIGURE 3a is a horizontal section taken on the line 3a—3a in FIGURE 2a.

FIGURE 3b is a vertical section, partly in elevation, taken on the line 3b—3b in FIGURE 2a, with the key slide depressed or actuated.

DETAILED DESCRIPTION

The key knob 1, which also serves as the housing, is irremovably connected by means of a spring element 2 to the key slide 3. To accomplish this, a short portion of the length of spring element 2 is fixed in a locking recess 4 in the key slide 3, with the free end of the spring element extending into a funnel-shaped recess 5 so as to be movable therein. When the knob 1 is engaged and fully seated over the key slide 3, this free end of the spring element 2 is compressed in wedging engagement against the inside wall of the knob to prevent any longitudinal shifting of the key slide in the recess of said knob. Alternatively, the key slide can be fixed in the key knob in another manner if a particularly simple kind of fixing is desired, while nevertheless retaining a secure frictional engagement between the slide and the knob, even with major stresses. Such alternative fixing involves the use of a resilient element consisting of a strip of resilient material, force-lockingly connected with the key slide and supported against the wall of the recess of the

key knob. The resilient element may consist of a substantially straight strip of resilient material which is fixed with its center part in a close-fitting recess of the key slide, and with the free ends of the limbs of the strip projecting beyond the width of the key slide so that they are supported under compression against the inside wall of the knob after the knob has been slid upon the key slide.

The key slide 3 is made of a generally U-shaped spray-molding part as best illustrated in FIGURE 2c. The side walls of said key slide, i.e., the U-shaped limbs, are, however, not connected for their entire length, but only at various points by means of transverse straps 6, 7 and 8, whereby the limbs of the U-shaped part can be elastically deformed relative to each other. Two of these straps, namely the two closely adjacent ones 7 and 8, fix the permanent magnet in place, whereas the third connecting strap 6, arranged at a greater distance, bears the means to fix the key knob on the key slide as described hereinabove in detail.

The permanent magnet is arranged to the rear of the opening 9 in the key slide between straps 7 and 8, the magnet being an oval-shaped flat ring which is poled in the shifting direction and supported between two U-shaped projections or straps 10 and 11 which generally register with the internal diameter of the annular magnet and are in alignment with the openings of the magnet. The U-shaped projections or straps 10 and 11 are formed by the respective said straps 7 and 8. These U-shaped projections or straps are provided with bearing surfaces 12 which face each other, and at the limb ends projecting edges 13 are provided which serve as bearing and counter-bearing for the permanent magnet. The permanent magnet is mounted in a very simple way by merely plugging the magnet in between the U-shaped projections 10 and 11 in the direction of the longitudinal axis of the oval, and then turning the magnet around in the general plane of the magnet approximately 90° so that said longitudinal axis of the oval is generally parallel to the straps 7 and 8, or perpendicular to the plugging direction. This plugging in of the magnet is accomplished with a so-called snap-in effect, because the side walls of the key slide are resilient.

A reed contact 14 protrudes into the center opening of the permanent magnet in such a way that the armature parts, movably arranged within the reed tube, are either closed or opened. The reed tube may consist of glass into which two contact elements 15 are melted at one end and two other contact elements 16 are melted at the other end. A freely movable armature, having the shape of a ball, may be provided between the ends of said contact elements inside the glass tube, thereby bridging, depending on the position of the annular magnet relative to the reed tube, either both contact elements 15 or both contact elements 16. The position of the annular magnet results from the position of the key slide, since the annular magnet is shifted with the key slide. The free ends of the contact elements are fixed outside of the reed tube on the stationary part 17 of the switch, and are there electrically connected with the external terminals which may have the shape of pins or wires 18 and 19 for the respective contact elements 15 and 16.

The stationary part 17 of the switch is a substantially plate-shaped spray-molding provided on its inside with a forwardly facing groove 20 extending along the sliding direction, into which groove a helical resetting spring 21 is inserted. The longitudinal groove 20 is semi-cylindrical in cross-section, corresponding to the shape of the helical spring 21. In the switch-off condition, shown in FIGURE 2a, the helical spring touches the stopping surfaces of the longitudinal groove at both ends of the spring. One of these stopping surfaces is formed by a cylindrical stop member 22, fitting the diameter of the groove, which is inserted into the groove at its lower end. The upper stopping surface of the longitudinal groove is pro-

vided by projections 23 on the stationary part which protrude into the groove, but which leave sufficient space for a shoulder member 24 on the key slide to move into the groove when the switch is actuated. In the switch-on position the helical spring is thus supported at its lower end by the cylindrical stop member 22 and at its upper end by the shoulder member 24 on the key slide under a certain compression thereby producing the resilient or spring force required to restore the key slide to its switch-off position.

As a guide for the sliding movement between the key slide and stationary part, the key slide is provided on its free limb ends with guiding surfaces fitting the shape of the stationary switch part 17. One guiding surface has the shape of a semi-cylindrical groove fitting the diameter of the helical spring 21 used as a restoring spring. This guiding surface is arranged relative to the semi-cylindrical-shaped groove 20 in the stationary switch part 17 in a mirror-like arrangement so that the helical spring 21 and the cylindrical stop member 22 slide on this surface when the key is actuated. Another guide surface is formed by the web or strap portion of the key slide which terminates at the shoulder member 24. Further guiding surfaces, which are best seen in FIGURES 2c and 3a are forwardly facing surfaces 25 and 26 near the rearward of free ends of the respective sides of the key slide and rearwardly facing surfaces 27 and 28 on the respective sides of the key slide offset forwardly from the respective surfaces 25 and 26. The guiding surfaces 25, 26, 27 and 28 are all oriented generally at right angles relative to the direction of the sides of the key slide. All of the aforesaid guide surfaces in the key slide, as well as the other elements of construction of the key slide, are arranged relative to each other in such a way that the key slide can be spray-molded without using mold slides.

The reed contact 14 is supported on the stationary part 17 of the switch by means of substantially square, spaced projections 29 and 30 at the upper and lower ends of the spray molding, these projections 29 and 30 protruding forwardly a sufficient distance to locate the reed tube in the axis of the annular permanent magnet. A pair of drillholes 31 extend through the projection 29 parallel to the side walls of the key slide and have the external terminal pins or wires 18 inserted therein in closely fitting relationship, while a similar pair of drillholes 32 extend through the projection 30 parallel to the side walls of the key slide and have the external terminal pins or wires 19 inserted therein in closely fitting relationship. End portions of the terminal pins or wires 18 extend forwardly from the respective drillholes 31 and are bent toward each other so as to fit loosely into transverse grooves 33 with their free ends located in a central aperture 35 and electrically connected with the respective contacting elements 15 at the lower end of the reed tube, as by soldering. Similarly, the external terminal pins or wires 19 have end portions which extend forwardly of their respective drillholes 32 and are bent toward each other so as to fit loosely into transverse grooves 34, with their free ends disposed in a central aperture 36 and electrically connected with the respective contacting elements 16 at the upper end of the reed tube, as by soldering. The upper surface of the projection 29 adjacent the lower end of the reed tube and the lower surface of the projection 30 adjacent the upper end of the reed tube are arranged as respective oblique surfaces 37 and 38 so that the contact elements do not touch the insulating material of the stationary part, which might impair the soldering process and damage the connections. For the same reason the bent ends of the terminal pins project somewhat from their respective guiding grooves as shown in FIGURE 2b.

The grooves 34 are defined between lower and upper projections 39 and 40, respectively, arranged in a mirror-

like relationship. Spaced, protruding edges 41 and 42 are formed on the key slide by the U-shaped projection or strap 11, and these protruding edges 41 and 42 are engaged under the projections 39 in a snap-in effect when the key slide is mounted on the stationary part 17 of the switch. The mounting of the key slide, with the annular magnet already inserted therein, on the stationary part 17, in which the helical spring has already been inserted, is accomplished by a simple plugging of the key slide onto the stationary part with a simultaneous application of a small pressing and shifting force. Thereupon a stop pin 43 is inserted into a hole 44 formed in the upper projection 30 of the stationary switch part 17. This stop pin 43 cooperates with an oppositely located, upwardly facing stop shoulder 45 in the key slide to determine the uppermost limit of sliding movement of the key slide on the stationary switch part. The reed contact 14 is then affixed to the key by soldering the contact elements 15 and 16 to the associated terminal pins 18 and 19, respectively. A rectangular aperture 46 is provided in the key slide between the straps 6 and 7 to give access for soldering the contact elements 16 to the terminal pins 19, while soldering of the contact elements 15 to the terminal pins 18 can be easily accomplished from the outside.

The outside terminal pins or wires 18 and 19 may be led out in the direction of their respective drillhole axes as indicated in phantom lines in FIGURES 2b, 2c and 2d and inserted into a printed circuit board, being electrically connected to the conductors of the printed circuit board by dip-soldering. In this case the key would be installed with the longitudinal or shifting axis of the key parallel to the supporting or circuit board, and for installation of the key in this position a plurality of fixing tenons 47 project rearwardly from the plate-shaped spray molding which forms the stationary switch part 17. These tenons 47 are fitted into corresponding openings in a supporting or circuit board composed of insulating material and are riveted to such board by deformation of the tenons under heat.

If the key is to be mounted with its axis or sliding direction perpendicular to the board, the external terminal ends or wires are bent approximately parallel to the axis of the key or the shifting direction and led to the outside at the bottom surface of the stationary switch part, at the opposite end thereof from the knob. The bent parts of pins or wires 19 are secured in position by being inserted between longitudinally extending projections or ribs 48 and 49 which extend along the rear surface of the plate-shaped molding part 17. Integrally formed on the lower end of the plate-shaped molding is a generally rectangularly shaped bottom plate 50 which has a pair of spaced slots 51 therein for receiving the respective terminals 18 and a pair of somewhat longer spaced slots 52 therein for receiving the respective terminals 19. The external terminal pins are inserted into these slots 51 and 52 in such a way that they project downwardly from the bottom plate 50 in the axial or sliding direction and are arranged in patterned spacing. It is thereby possible to insert the projecting ends of the terminal pins 18 and 19 into respective openings in a circuit board also arranged in a pattern and to connect the terminal ends with the printed conductor lanes by dip-soldering. It is advantageous to have the terminals 19 not only spaced laterally from the terminals 18, but also in the front-rear direction, so as to increase the spacing between the terminals and provide electrically safe connections between the terminals and the printed circuit conductors which will not adversely influence each other.

In order to affix the stationary part 17 of the switch in this upright position on a circuit board, the bottom plate 50 thereof is provided with downwardly projecting tenons 53 and 54 which can be inserted into suitable openings of the board and riveted to the board.

It will be seen from the foregoing detailed description that the sliding or pushing key with a reed contact

according to the present invention has a number of advantages compared to former known constructions. Thus, the key is very compact and requires only a small number of components. Aside from the knob or housing, a total of only six components are used for the key, namely, the key slide, the stationary part, the pressure spring, the reed contact, the annular magnet and wire for the external soldering connections and the stopping pin. These parts can be manufactured simply and reliably. The key slide and stationary parts of the switch are so shaped that they can be spray-molded without molding slides or pitches. This results in low production costs quite comparable to the production costs for keys with open contacts. Assembly of the individual components is also simple, so that the costs therefor are very low. The annular magnet is affixed solely by inserting it into an undercut in the key slide and turning it through an angle of approximately 90°. When mounting the pressure spring the conventional threading thereof is not required. The key slide and stationary switch part are connected simply by plugging under a light pressure and shifting. The knob or housing is mounted in a most simple way by means of a self-locking resilient element. Plastic pins are used to install the key, permitting a number of different possibilities for attachment of the key. The key can be inserted into printed circuits as well as placed on a U-rail or installed into sets of keys. Moreover, it is possible to install the key in different directions, either in the shifting direction or perpendicular to it. The dimensions of the key correctly fit existing key sets. The keys according to the present invention are further suitable for computing machines and typewriters wherein the keys are used as feed-in keys. Another application may, for example, be as feed-in keys for cargo elevators.

While the instant invention has been shown and described herein in what are conceived to be the most practical and preferred embodiments, it is recognized that departures made be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

What is claimed is:

1. A reed switch which comprises a stationary switch part having a reed tube supported thereon, a key slide slidably mounted on said stationary part for movement between unactuated and actuated positions, said key slide having a permanent magnet supported therein adjacent said reed tube for operating the contacts of the reed tube, spring means engaged between said stationary part and key slide biasing said key slide towards its said unactuated position, and a key knob in the form of a hollow shell engaged over said key slide and serving as a housing for the switch, said key slide being a generally U-shaped molded plastic part having a transverse forward web portion and a pair of free limb portions extending rearwardly from opposite sides of said forward web portion, first guide surface means on said limb portions of said key slide and second guide surface means on said stationary part, said first and second guide surface means being complementary and defining the direction of sliding movement of the key slide on the stationary part.

2. A reed switch as defined in claim 1, wherein said spring means is a helical spring, and said first and second guide surface means include respective opposed, generally semicylindrical surfaces defining a generally cylindrical cavity within which said helical spring is disposed.

3. A reed switch as defined in claim 1, wherein said permanent magnet has the general shape of a flat ring oriented with the general plane thereof substantially perpendicular to the sliding direction, said ring being in encircling relationship around the reed tube.

4. A reed switch as defined in claim 3, wherein said stationary switch part is a generally plate-shaped molded part having said second guide surface means formed on

7

the sides thereof, said stationary part including a pair of forwardly projecting studs spaced apart in the sliding direction, the reed tube being supported adjacent its ends on the respective said studs with the reed tube spaced forwardly of the body of the stationary part intermediate said studs sufficiently to provide clearance for the rearward portion of the magnet ring engaged around the reed tube.

5. A reed switch as defined in claim 4, wherein the reed tube has contact means at both ends thereof, said studs each having forwardly opening passage means there-through, and terminal pin means electrically connected to said contact means at each end of the reed tube and extending through said passage means of the respective stud and projecting externally of the switch.

6. A reed switch as defined in claim 3, wherein said key slide includes a pair of generally U-shaped straps extending transversely between said limbs of the key slide adjacent to said forward web portion of the latter, said straps being spaced apart in the sliding direction and supporting said ring-shaped magnet therebetween, and opposed shoulder means projecting into the space between said opposed bearing surfaces generally at opposite sides of the key slide peripherally engaging the magnet so as to secure the magnet in place between said generally U-shaped straps.

7. A reed switch as defined in claim 6, wherein the periphery of said generally ring-shaped magnet is oval, thereby adapting the magnet to be snap-fitted between said opposed shoulder means by insertion between said generally U-shaped straps and said opposed shoulder means generally in the direction of the longitudinal axis of the oval with such axis generally parallel to the limbs of the key slide and then rotating the ring approximately 90° to snap the end portions of the oval into interlocking abutment against said opposed shoulder means.

8

8. A reed switch as defined in claim 6, wherein said forward web portion of the key slide is formed by a plurality of transverse straps spaced in the sliding direction connecting said limbs, said straps being elastically deformable to permit relative flexing between said limbs, and two of said straps comprising said U-shaped straps.

9. A reed switch which comprises a stationary switch part having a reed tube supported thereon, a key slide slidably mounted on said stationary part for movement between unactuated and actuated positions, said key slide having a permanent magnet supported therein adjacent said reed tube for operating the contacts of the reed tube, spring means engaged between said stationary part and key slide biasing said key slide towards its said unactuated position, and a key knob in the form of a hollow shell engaged over said key slide and serving as a housing for the switch, said switch including a resilient element supported on said key slide and resiliently engageable against the inside of said key knob shell, said resilient element permitting slidable engagement of the key knob into assembled position over the key slide but resisting removal of the key knob from the key slide so as to retain the key knob in its said assembled position.

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BERNARD A. GILHEANY, Primary Examiner

R. N. ENVALL, Jr., Assistant Examiner

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200-167, 168; 335-202