United States Patent [19]

Muller

[11] **3,777,090**

[45] **Dec. 4, 1973**

[54] **LINEAR CAM ACTUATED DIAPHRAGM SWITCH WITH LOST MOTION ACTUATOR**

[75] Inventor: **Michael Muller,** Newport Beach, Calif.

[73] Assignee: **Datanetics Corporation,** Fountain Valley, Calif.

[22] Filed: **July 26, 1972**

[21] Appl. No.: **275,209**

[52] **U.S. Cl.... 200/159 B,** 200/153 LA, 200/153 V, 200/172 A

[51] **Int. Cl.....** **H01h 13/50,** H01h 3/48, H01h 3/12

[58] **Field of Search**..... 200/153 LA, 159 B, 200/159 R, 153 V, 153 L, 38 E, 172 A

[56] **References Cited**

UNITED STATES PATENTS

2,978,555	4/1961	Jones	200/159 R X
3,694,606	9/1972	Harris et al.	200/159 B X
3,657,460	4/1972	Cutler	200/159 B X
2,938,985	5/1960	Brantingson	200/159 R
3,258,549	6/1966	Stoi	200/153 V UX
3,622,934	11/1971	Yano et al.	200/153 LA X

FOREIGN PATENTS OR APPLICATIONS

962,745	7/1964	Great Britain	200/153 T

Primary Examiner—Robert K. Schaefer
Assistant Examiner—Robert A. Vanderhye
Attorney—Robert L. Parker et al.

[57] **ABSTRACT**

A data key assembly having a keystem which is movably mounted in a housing. The housing also supports a flat diaphragm switch with an actuating surface which is oriented parallel to the direction of motion of the keystem. An actuating spring is coupled to the side of the keystem by a lot-motion connection which provides hysteresis in the key action, and the spring slides over the actuating surface to close the switch when the keystem is depressed.

14 Claims, 19 Drawing Figures

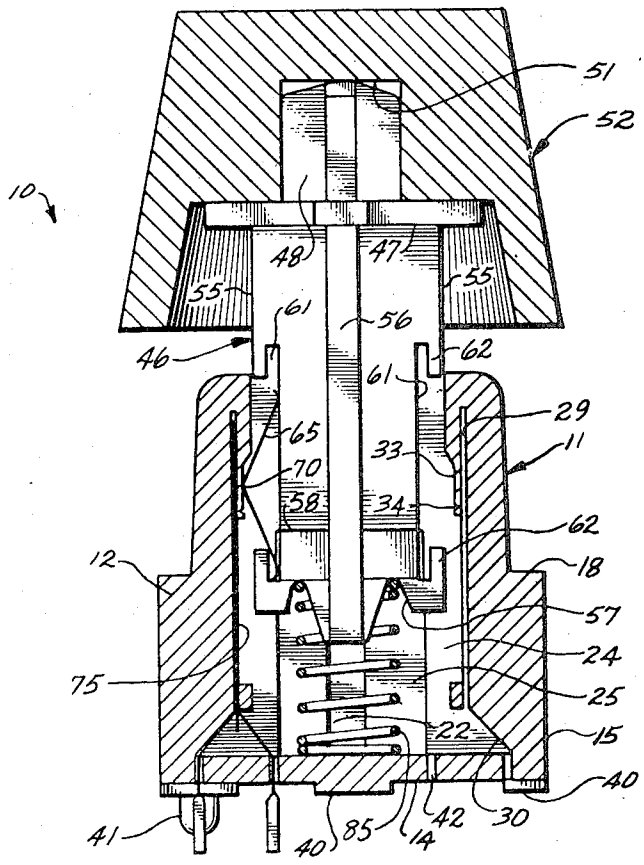


Fig. 1

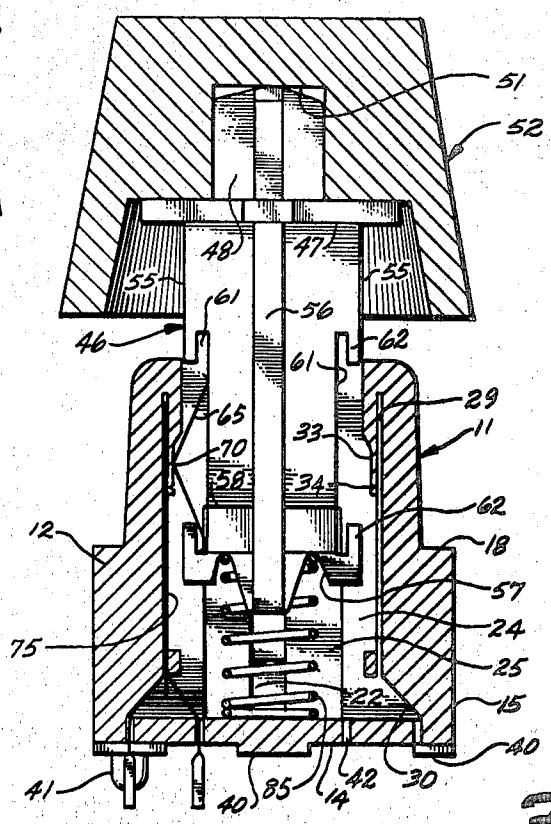


Fig. 14

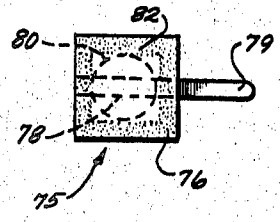


Fig. 15

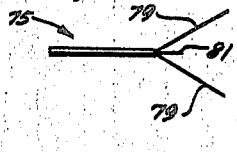


Fig. 16

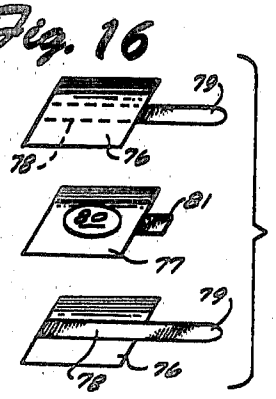


Fig. 2

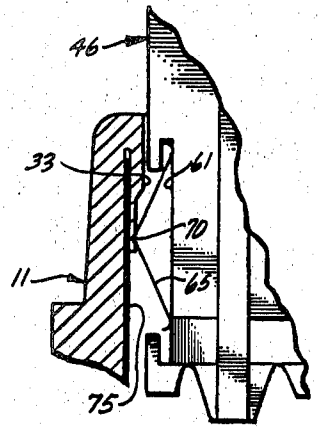


Fig. 3

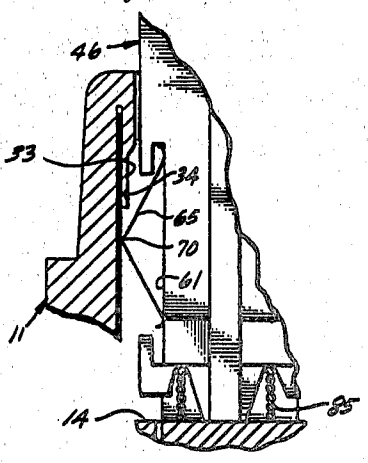


Fig. 4

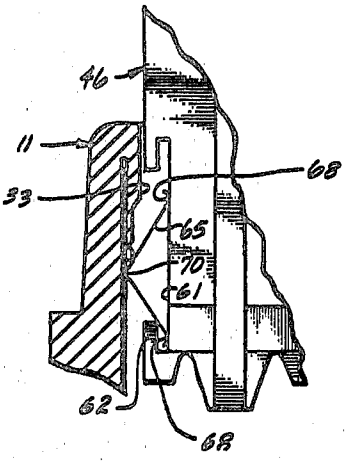


Fig. 5

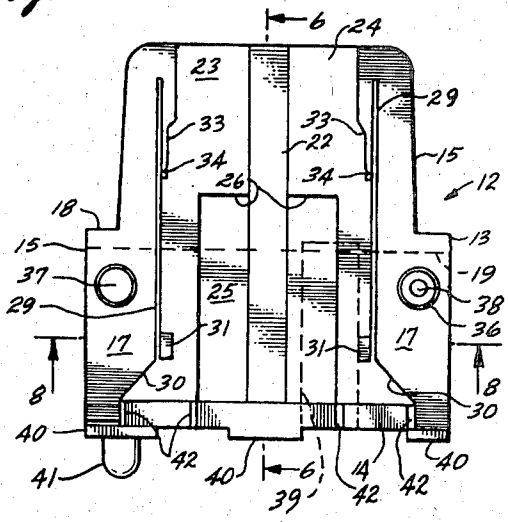


Fig. 6

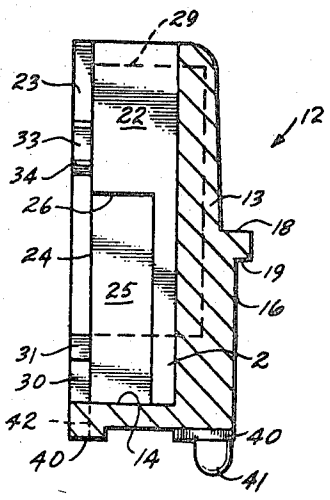


Fig. 7

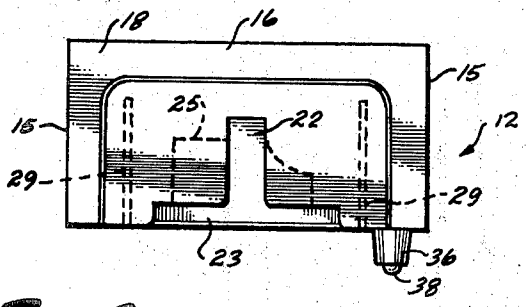


Fig. 8

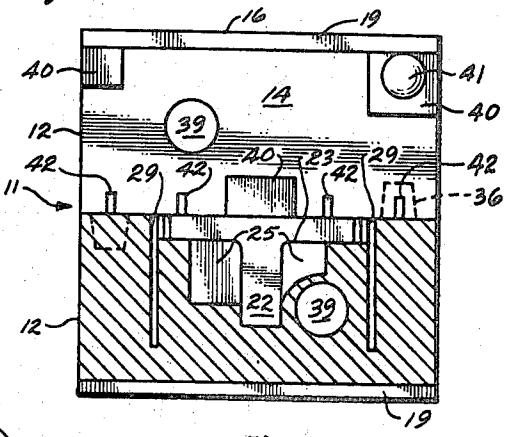


Fig. 9

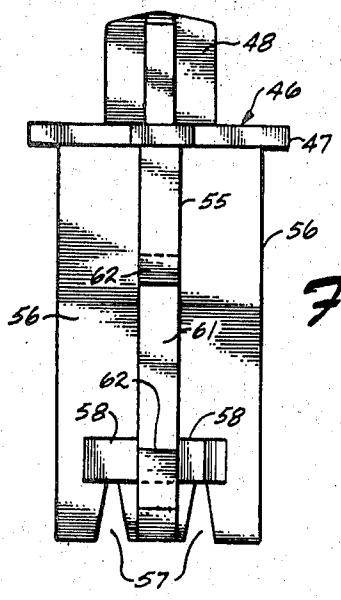


Fig. 10

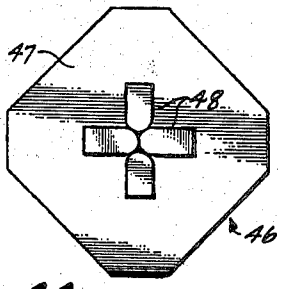


Fig. 11

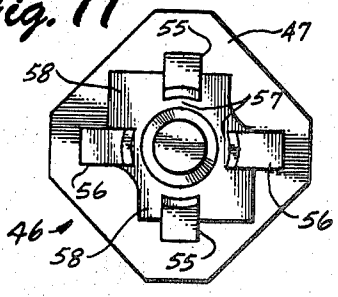


Fig. 12

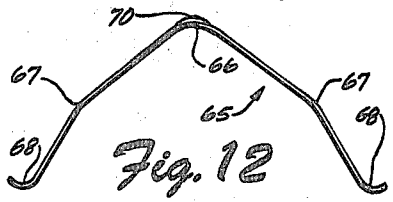


Fig. 13

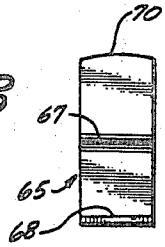


Fig. 17

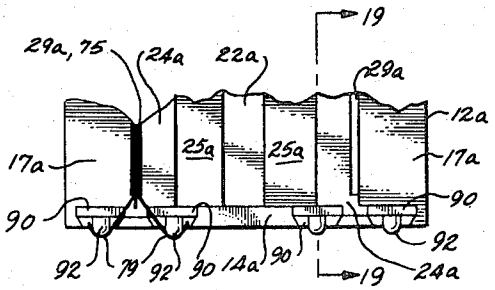


Fig. 18

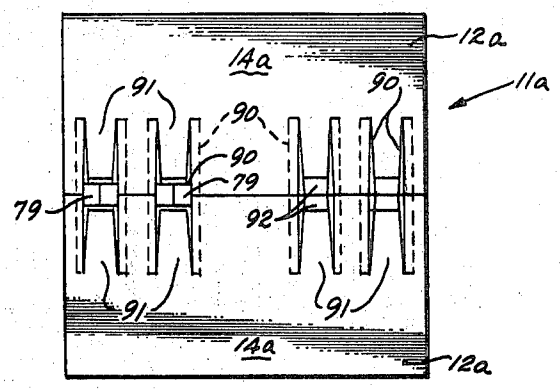
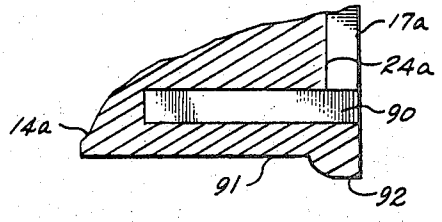


Fig. 19



LINEAR CAM ACTUATED DIAPHRAGM SWITCH WITH LOST MOTION ACTUATOR

BACKGROUND OF THE INVENTION

Data key switches are used for manual entry of information or instructions in a variety of business machines such as typewriters, teletypes, calculators, and computer data-entry terminals. A number of data keys are typically grouped together to form a keyboard for entry of alphanumeric information and functional instructions.

Older styles of keyboards typically use reed switches or simple open contacts which are mechanically linked to an actuating key. A more recent development involves the use of diaphragm switches in keyboards, and these switches are noteworthy for their low cost and high reliability.

A diaphragm switch includes a pair of contacts which are normally spaced apart by a dielectric separator having an opening in alignment with the contacts. At least one of the contacts is supported on a resilient or flexible diaphragm which is deflected to bring the contacts together to close an electrical circuit. This style of switch normally has a very short actuating stroke, and is readily sealed to protect the contacts against entry of dust particles, moisture, or corrosive atmospheres which can interfere with proper switch operation.

Although keyboard diaphragm switches can be actuated directly by an operator's fingertips, most users prefer a key action which provides a relatively long travel, and which gives the operator a tactile signal upon closure of the switch. Diaphragm switches are accordingly combined with actuating keys which are compatible with the short actuating stroke of the switch while still providing the desired long-stroke actuation characteristic for the operator.

The data key of this invention is a unitized assembly having a housing which supports an internally mounted diaphragm switch, and a movable keystem which is shaped to receive a conventional key cap. A pair of leads or connecting tabs extend from the bottom of the housing, and the unitized assembly is designed for direct mounting on a circuit board having conductors with which the tabs make electrical contact. A plurality of the unitized assemblies are easily grouped together to form a keyboard of any desired format. Individual units are also readily removed or replaced if the keyboard format is to be changed, or if an individual key station becomes defective and requires replacement.

An important feature of the invention is to take advantage of the reliability and low cost of a diaphragm switch, while still providing a data key which is convenient and comfortable for the operator to use, and which is easily and inexpensively incorporated in a larger keyboard assembly.

SUMMARY OF THE INVENTION

Briefly stated, the data key assembly of this invention includes a housing preferably formed from a pair of identical housing halves which are secured together during assembly of the device. An elongated keystem is movably mounted on the housing to be actuable through a linear stroke movement between a normally extended position and a depressed position. A diaphragm switch is mounted on the housing, and has a planar actuating surface oriented parallel to the direction of movement of the keystem.

A resilient actuator spring is carried by the keystem to contact the actuating surface of the switch as the keystem is moved from the extended position through a downstroke toward the depressed position. A resilient return means such as a coil spring is provided between the keystem and the housing to urge the keystem toward the normally extended position.

Preferably, the keystem and actuator are coupled by a lost-motion connection which permits the actuator to move within a limited range with respect to the keystem in a direction parallel to keystem stroke movement. The lost-motion means is preferably a channel formed in the side of the keystem, and the actuator is slidably engaged in the channel. The lost-motion connection provides a positional hysteresis which prevents switch jitter if the operator inadvertently holds the keystem at a position very close to the position of initial switch closure.

Preferably, the actuator is a V-shaped spring having a tip or button at its apex, and the tip rides along an actuator track formed in the interior of the housing. As the keystem is moved through the actuating downstroke, the actuator tip passes off the track and snaps against the actuating surface of the switch. Further downstroke movement of the keystem drives the actuator tip along the switch actuating surface, maintaining a rolling contact between flexible electrodes in the switch. Connecting tabs from the diaphragm switch are brought out through the base of the housing, and are adapted for either solder connection to an underlying circuit board, or a solderless arrangement in which the connecting tabs are wrapped around integrally formed leaf springs in the base of the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation of a data key assembly according to the invention, with the key shown in a normally extended position;

FIG. 2 is a portion of the assembly shown in FIG. 1, showing the position of the moving components during an early part of the key downstroke just before switch actuation;

FIG. 3 is a view similar to FIG. 2, but showing the key components in a fully depressed position with the switch actuated;

FIG. 4 is a view similar to FIG. 2, but showing the components as they are positioned during an intermediate portion of the key return stroke just before the switch is opened;

FIG. 5 is a front elevation of a housing half;

FIG. 6 is a view on line 6—6 of FIG. 5;

FIG. 7 is a top view of the housing half;

FIG. 8 is a bottom view of a pair of assembled housing halves, the lower portion of which is a section on line 8-8 of FIG. 5;

FIG. 9 is a front elevation of a keystem;

FIG. 10 is a top view of the keystem;

FIG. 11 is a bottom view of the keystem;

FIG. 12 is a front elevation of an actuator spring;

FIG. 13 is a side elevation of the actuator spring;

FIG. 14 is a plan view of a diaphragm switch;

FIG. 15 is a side view of the diaphragm switch;

FIG. 16 is an exploded perspective view of the several components of the diaphragm switch;

FIG. 17 is a partial front elevation of another embodiment of a housing half useful in the invention;

FIG. 18 is a bottom view of a pair of assembled housing halves as shown in FIG. 17; and

FIG. 19 is a view on line 19—19 of FIG. 17.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A data key assembly 10 according to the invention is shown in FIG. 1. The components of the assembly are mounted on a housing 11 made of two identical housing halves 12 which are bonded together during manufacture of the assembly.

Referring to FIGS. 5–8, each housing half 12 is an integrally molded component formed as an upright body 13 having a base 14. Body 13 has outer side surfaces 15, a rear surface 16, and flat, coplanar front surfaces 17 which fit against corresponding surfaces in the other housing half when the housing is assembled.

Body 13 is inwardly stepped midway along its height to define a peripheral ledge 18 against which a clamping bar (not shown) can be secured to fasten the data key assembly against a circuit board or other mounting panel. Rear surface 16 is also stepped inwardly beneath ledge 18 to form a flange 19 (FIGS. 6 and 8) which may be fitted against a stiffening bar (not shown) used when a plurality of data key assemblies are grouped together in a keyboard.

A first guide slot 22 extends vertically from base 14 to the top of body 13 of the housing half. A second partial guide slot 23 (forming a full guide slot when two housing halves are secured together) is defined by an inner wall 24 which extends vertically from base 14 to the top of body 13, and is stepped back from front surfaces 17. A lower central portion of inner wall 24 above base 14 is recessed toward rear surface 16 to define a return-spring clearance space 25 having an upper surface which forms a keystem stop 26 extending parallel to base 14.

A pair of thin but deep switch slots 29 extend vertically on opposite sides of first guide slot 22, and extend almost to rear surface 16 from the inner edges of front surfaces 17 and the outer edges of inner wall 24. An outwardly sloping recess 30 extends rearwardly from each front surface 17 back to inner wall 24 below each switch slot 29 to provide clearance for electrical connecting tabs when the diaphragm switch is installed. A short post 31 extends forwardly from inner wall 24 adjacent the lower edge of each switch slot 29.

The narrow end walls of partial guide slot 23 are outwardly stepped somewhat below the top of body 13 to define an actuator track 33 adjacent the upper portion of each switch slot 29. That is, each track 33 extends forwardly (toward the viewer in FIG. 5) from inner wall 24, and the front edge of each track is coplanar with front surfaces 17. An actuator detent recess 34 is formed adjacent the lower end of each actuator track.

A tapered post 36 extends forwardly from one of front surfaces 17 below ledge 18, and a tapered socket 37 is formed in a corresponding position in the other front surface 17. When two housing halves 12 are assembled to form housing 11, posts 36 and sockets 37 are mated to align the respective halves which are then secured together by ultrasonic welding. An energy-directing button 38 is formed at the end of post 36 to insure a secure bond of the two halves.

A mounting hole 39 extends upwardly midway into body 13 from base 14. As shown in FIGS. 7 and 8, a portion of the vertical wall forming clearance space 25 is curved to clear the mounting hole.

Three mounting bosses 40 extend downwardly from base 14, and the undersurface of these bosses abuts the circuit board or panel (not shown) on which the data key assembly is mounted. One of bosses 40 has a keying post 41 extending downwardly therefrom, and the post mates with a hole in the circuit board or mounting panel to insure that the data key assembly is properly oriented.

Two shallow slots 42 are cut through base 14 from front surface 17 back to inner wall 24 below each switch slot 29. These slots provide openings through which electrical connecting tabs from the diaphragm switch can extend downwardly into connection with other components on a circuit board or panel on which the data key assembly is mounted.

An integrally molded keystem 46 (FIGS. 9–11) has a laterally extending upper flange 47. A cruciform post 48 extends upwardly from flange 47, and the post is configured to mate with a socket 51 in a conventional key cap 52 (FIG. 1). The main body of the keystem below upper flange 47 is also cruciform in cross section, defining a pair of perpendicularly related guide ribs 55 and 56.

An upwardly extending spring recess 57 is formed in the bottom of the keystem by V-shaped cuts at the lower end of each guide rib. A laterally extending keystem retaining flange 58 is integrally formed between guide ribs 55 and 56 at the lower end of the keystem just above spring recess 57. As shown in FIG. 11, two corners of retaining flange 58 are concavely formed to mate with the convex curvature of inner wall 24 (FIG. 8) of housing half 12.

A pair of actuator-retaining channels 61 (FIGS. 1 and 9) are formed in the opposing longitudinal edges of guide rib 55. Each end of each retaining channel 61 is partially covered by a short longitudinally extending arm 62.

A V-shaped actuator spring 65 (FIGS. 12-13) is bent from a generally rectangular blank of spring metal to define a central bend 66 and a pair of intermediate bends 67 on opposite sides of the central bend. Reverse bends 68 are formed in the opposite ends of the spring. The spring is generally flat in cross section, with the exception of the center of the spring at central bend 66 which is dished to form an outwardly extending actuating tip or button 70.

A diaphragm switch 75 suitable for use in data key assembly 10 is shown in FIGS. 14–16. Switch 75 is a thin square laminated assembly of a pair of plastic outer panels 76 which are separated by a dielectric separator panel 77. A metal conductive strip 78 is bonded to the inner face of each panel 76, and each strip extends substantially beyond the edge of the associated panel to form a connecting tab 79. Dielectric separator panel 77 has a central opening 80, and a laterally extending insulating tab 81 positioned between connecting tabs 79.

Conductive strips 78 are secured by a heat-activated adhesive to outer panels 76. The dielectric separator panel and two outer panels are then also secured together by a heat-activated adhesive applied along the margin of the panels as suggested by stippled area 82 in FIG. 14. The two conductive strips are then in face-to-face alignment, but separated by the thickness of dielectric separator panel 77. Depression of either outer

panel 76 in a direction perpendicular to the panel will close the switch by moving the associated conductive strip 78 through central opening 80 into electrical contact with the other conductive strip. Switch 75 may be quite small, and typically has side lengths of slightly less than one-half inch.

Outer panels 76 are preferably made from a sheet of polyimide plastic as sold under the trademark Kapton. A sheet thickness of about 0.002–0.003 inch provides adequate flexibility for proper switch operation. Dielectric separator panel 77 is preferably formed from a sheet of polyester plastic (as sold under the trademark Mylar) of about 0.003 inch thickness. Conductive strips 78 are preferably copper ribbons of about 0.002 inch thickness, and the facing surfaces of the conductive strips are nickel plated and then gold plated to insure good electrical contact.

Housing halves 12 are preferably molded from polysulfone plastic, and keystem 46 is preferably from an acetyl-resin plastic as sold under the trademark "Delrin." ABS plastic is a suitable material for key cap 52, and actuator spring 65 is formed from a spring material such as heat-treated beryllium copper.

Data key assembly 10 is assembled from the parts described above by first inserting diaphragm switch 75 fully into close-fitting switch slot 29 in a housing half 12. Connecting tabs 79 on the switch are angled apart below supporting post 31 as shown in FIG. 1, and are passed through slots 42 in base 14. The ends of the connecting tabs extending beneath the base may be folded on themselves as shown in FIG. 1 to stiffen the tabs for insertion through a circuit board on which the data key assembly is to be mounted.

After the diaphragm switch is installed, keystem 46 is inserted in housing half 12 with guide rib 55 fitted in guide slot 23, and one of guide ribs 56 fitted in guide slot 22. A keystem return spring 85 (preferably a conventional helical wire spring) is fitted between the top of base 14 and the undersurface of keystem 46 to seat in spring recess 57 as shown in FIG. 1.

Actuator spring 65 is then slightly flattened and is inserted in spring recess 57 of the keystem. A second housing half 12 is next carefully fitted over the extending portions of the diaphragm switch, connecting tabs, and keystem guide ribs, and the two housing halves are drawn together to seat posts 36 in socket 37. The housing halves are then ultrasonically bonded or otherwise secured together. Assembly of the unit is completed by pressing key cap 52 over post 48 on the keystem.

While the data key assembly may be used in a variety of applications, it will typically be used in conjunction with a circuit board having openings to mate with keying posts 41, and having through holes to receive connecting tabs 79 for connection to metallic circuit lines on the board. The data key assembly can be clamped against the circuit board by a clamp member bearing on ledge 18, or alternatively can be fastened into place by self-tapping screws inserted through the board and threaded into mounting holes 39.

In operation, keystem 46 is normally maintained in a fully extended position by the restoring force of return spring 85 as shown in FIG. 1. Upward travel of the keystem is limited by retaining flange 58 which abuts keystem stops 26 on the housing halves. In the fully extended position, button 70 of actuator spring 65 bears against actuator track 33 above detent recess 34.

As shown in FIGS. 1–4, the installed actuator spring is shorter than retaining channel 61 in which the spring is fitted. The retaining channel is preferably about 0.060 inch longer than the installed spring, and the retaining channel thus forms a lost-motion connection between the spring and keystem. That is, with the spring fully seated at one end of the channel, the keystem can move 0.060 inch while sliding beneath the actuator spring before the opposite end of the spring abuts the other end of the channel and forces the spring to travel with the keystem. The housing and keystem materials are selected to have coefficients of friction such that the actuator spring slides more easily on the keystem retaining channel than on the actuator track or diaphragm switch.

The purpose of actuator detent recess 34 in actuator track 33 is to insure that the actuator spring is in the uppermost position in channel 61 before button 70 of the spring drops off actuator track 33 to contact the diaphragm switch. This action is illustrated in FIG. 2 which shows the position of the components approximately two-thirds of the way through the total downstroke travel of the keystem. Button 70 is seated in detent recess 34, and the actuator spring is thereby temporarily restrained against downward movement with the keystem until the upper end of the spring is seated against the upper end of retaining channel 61 as shown in FIG. 2.

Further downward motion of the keystem causes the actuator spring 65 to snap downwardly off the lower end of actuator track 33, and button 70 of the spring is urged against the outer surface of diaphragm switch 75 slightly below the bottom of the track to force conductive strips 78 together to close the switch. The keystem can then be further depressed by about 0.060 to 0.070 inch until the lower end of the keystem bottoms against the top surface of base 14 as shown in FIG. 3. During this further motion or overtravel of the keystem, button 70 9f actuator spring 65 continues to ride along the actuating surface of diaphragm switch 75, and keeps conductive strips 78 in rolling contact to maintain the switch in a closed position.

When finger pressure from the operator is decreased, keystem 46 commences upward travel through a return stroke under the influence of the restoring force exerted by return spring 85. The switch remains closed during a substantial portion of the total upstroke travel, consisting of the 0.060–0.070 inch overtravel of the keystem plus about two-thirds of the 0.060 inch freedom which the actuator spring has to move within retaining channel 61. The actuating button leaves the switch surface at a point about 0.020 inch beneath the lower end of the actuator track due to the shape of the spring, so the entire lost-motion displacement is not traversed before the switch opens during the key upstroke.

Even if the actuator spring tends to move with the keystem during the early part of the upstroke, button 70 will remain on the switch when a portion of the spring above the button abuts the lower edge of actuator track 33 as shown in FIG. 4, and the actuator spring will remain stationary with respect to the housing until the upward travel of the keystem has almost bottomed the spring in its channel. At this point, the inner edge of lower arm 62 contacts the lower one of intermediate bends 67 in the actuator spring, and the spring is thereby slightly deflected toward the base of channel

61 to reduce the amount of force (from return spring 85) required to pass button 70 over the lower edge of the actuator track.

As the spring is deflected inwardly to raise the button over the lower edge of the track, the spring then bottoms in channel 61, and is forced to travel upwardly along the actuator track with the keystem. Upstroke travel of the keystem is terminated when retaining flange 58 abuts keystem stop 26, and the switch is then again in the position shown in FIG. 1.

The distance from the "at rest" position of button 70 (as shown in FIG. 1) to the bottom of actuator track 33 is about 0.060 inch. As mentioned above, the actuator spring also has about 0.060 inch freedom or lost-motion space in channel 61. A downstroke of 0.120 inch is accordingly required to shift the actuator spring upwardly in channel 61, and then to move the spring off the lower end of track 33 against the diaphragm switch to close the switch contacts.

Any slight "teasing" relaxation of finger pressure on the key immediately after switch closure will not retract the actuator spring off of the diaphragm switch, because an upward travel of the keystem of about two-thirds of the lost-motion space of channel 61 or about 0.040 inch is required before the spring is positively driven upwardly off the switch by the keystem. The switch action is thus characterized by a positional hysteresis which prevents the operator from teasing or holding the keystem at a position where the switch contacts can jitter on and off. That is, once the switch contacts are initially closed, a substantial upward motion of the keystem is required to break the contacts.

The overtravel motion of 0.060–0.070 inch is desirable so the operator can complete a key downstroke which passes through the point of switch closure. A tactile sensing of switch closure is also provided by the actuator spring as it snaps over the lower end of the actuator track to contact the diaphragm switch. The magnitude of this closure-indicating tactile feedback can be varied by adjusting the restoring force exerted by the actuator spring. If a strong tactile signal is desired, actuator springs can be used in both channels 61 to increase the snapping action as buttons 70 toggle over the ends of the actuator tracks.

Return spring 85 is selected to provide a finger load of about 80 grams before switch closure is obtained during the keystem downstroke. The actuator spring is selected to provide a contact-closure load against the diaphragm switch of about 20 to 30 grams, and 10 grams is normally adequate to insure closure of the contacts of this style of switch.

Another factor which increases the reliability of the data key assembly is the relatively long-line rolling contact which occurs between conductive strips 78 as the actuator spring moves downwardly along the surface of the switch. Even if the conductive strips become eroded (due to excessive electrical current, or to long usage) at their break point immediately below actuator track 33, a reliable electrical connection will be maintained beneath the break point as the actuator moves downwardly with the keystem during the overtravel portion of the total stroke.

Although the data key assembly has been described in terms of a single-pole switch, a second diaphragm switch can be added to the unit in second switch slot 29 (at the right side of FIG. 1). Addition of a second actuator spring to operate the additional switch converts the assembly to one capable of making two entirely independent switch closures in a single data key. The leads of the second switch are brought out through slots 42 in the base of the housing beneath the switch.

A modification of the data key assembly described above is shown in FIGS. 17–19. The modification relates to the use of leaf-spring contacts on the base of the data-key housing, eliminating the need for soldered connections to a printed circuit board. Only the lower-most portion of the data-key housing is shown in FIGS. 17–19 as the other components of the assembly are as described above.

The modified assembly includes a housing 11*a* formed of two identical housing halves 12*a* secured together during assembly of the data key as described above. As shown in FIG. 17, each housing half 12*a* includes a base 14*a*, front surfaces 17*a*, first guide slot 22*a*, inner wall 24*a*, clearance space 25*a*, and switch slots 29*a*. Four deep recesses 90 are formed in base 14a to define four tapered leaf springs 91 arranged in pairs below each switch slot 29*a*. A downwardly extending button 92 is formed at the free end of each leaf spring 91, and these buttons extend below the flat undersurface of housing half 12*a*.

Connecting tabs 79 from diaphragm switch 75 are passed through the thin clearance slots on the opposite sides of leaf springs 91 as shown in FIGS. 17 and 18. The connecting tabs pass over buttons 92, and are then directed back up into the base as best seen in FIG. 17.

This modified data key assembly is clamped against a printed circuit board (not shown) with connecting tabs 79 in alignment with conductive members on the board. When housing 11*a* is clamped against the board, leaf springs 91 deflect upwardly into recesses 90 so the undersurface of the housing is flush against the board. The leaf springs, however, exert a substantial force which urges connecting tabs 79 into electrical connection with the conductive members on the board. Contact is thus made automatically when the data key assembly is installed on the board, and the need for soldered connections is eliminated.

There has been described an economical data key assembly which is useful in a variety of data-entry applications. The assembly takes advantage of the reliability and long life which characterize sealed diaphragm switches, and at the same time provides a low-profile data key with the desirable features of overtravel, anti-teasing, and tactile sensing of the switch-closure point. Switch closure always occurs at the same position during the key downstroke as this characteristic is determined by the fixed dimensions of the molded components, and is hence accurately repeatable in a large number of units. The use of identical housing halves and a modular diaphragm switch simplifies the manufacturing and assembly processes, and permits production of a relaible, low-cost switch useful in many keyboard applications.

What is claimed is:

1. A key assembly, comprising:

a housing;

a keystem movably mounted on the housing to be actuable through a linear stroke movement between a normally extended position and a depressed position;

a sealed diaphragm switch mounted on the housing and having an actuating surface oriented parallel to the stroke movement of the keystem;

a resilient actuator carried by the keystem to contact and move along the actuating surface of the switch as the keystem is moved from the extended position toward the depressed position, the actuator being electrically isolated from current-carrying portions of the diaphragm switch; and

resilient return means for urging the keystem toward the normally extended position.

2. The assembly defined in claim **1** in which the actuator and keystem are coupled by a lost-motion means which permits the actuator to move within a limited range with respect to the keystem in a direction parallel to the keystem stroke movement, whereby the switch is closed at a first keystem position and opened at a second keystem position, the two positions being spaced apart and the first position being closer than the second position to the depressed position of the keystem.

3. The assembly defined in claim **2** in which the lost-motion means is a channel formed in a side surface of the keystem, the actuator being shorter than the channel and being captively retained in the channel between the housing and keystem.

4. The assembly defined in claim **3** in which the actuator is a spring member having an actuator tip, and in which the housing includes an actuator track along which the actuator tip rides during a portion of the keystem stroke, the actuating surface of the switch being positioned adjacent an end of the track whereby the actuator tip is driven off the track and urged against the actuating surface as the keystem is moved toward the depressed position.

5. The assembly defined in claim **4** in which the actuator track has a detent depression adjacent said end and receiving the actuator tip to maintain the actuator temporarily stationary with respect to the housing during a portion of the keystem travel toward the depressed position until the actuator contacts an end of the keystem channel.

6. A key assembly, comprising:

a hollow housing having a base, the housing having an opening therein extending from the base to an upper end of the housing;

a keystem extending into the housing opening and slidably engaged with the housing to be movable through a linear stroke between a normally extended position and a fully depressed position;

a return spring disposed between the housing base and keystem to urge the keystem toward the extended position;

a sealed diaphragm switch supported in the housing adjacent the keystem and having a depressible elongated actuating surface for operating the switch, the actuating surface being generally parallel to the direction of keystem motion as the keystem is moved through its stroke; and

a resilient actuator carried by the keystem and having an actuator tip which bears on an inner surface of the housing when the keystem is extended, and which moves off the housing to bear against and move along the actuating surface of the switch as the keystem is moved toward the depressed position, the actuator being electrically isolated from current-carrying portions of the diaphragm switch.

7. The assembly defined in claim **6** in which the keystem has a side surface defining an elongated longitudinal channel, and in which the actuator is an elongated spring fitted in the channel and formed to urge the actuator tip away from the keystem toward a plane which includes the switch actuating surface, the actuator spring being shorter than the channel so the keystem and actuator spring are relatively movable within a limited range and in a direction parallel to the direction of keystem motion.

8. The assembly defined in claim **7** in which the housing base has openings therethrough, and in which the sealed diaphragm switch is a substantially flat, assembly with connecting tabs extending therefrom through the base openings for external connection.

9. The assembly defined in claim **8** in which the housing inner surface defines an elongated actuator track extending generally parallel to the direction of keystem motion and facing the keystem channel, the housing further defining a slot for receiving the diaphragm switch with the actuating surface facing the keystem channel and extending from a lower end of the actuator track toward the base, the actuator tip riding on the track during an initial portion of keystem movement toward the depressed position and then passing off the end of the track to press against and ride along the switch actuating surface during further keystem movement toward the depressed position.

10. The assembly defined in claim **9** in which the actuator track includes a detent adjacent its lower end for restraining actuator movement with respect to the keystem until an end of the keystem channel abuts an end of the actuator spring.

11. The assembly defined in claim **10** in which the actuator spring is a V-shaped member having the actuator tip at its apex, the keystem having an arm extending away from the base over a lower end of the channel to contact the spring and urge the actuator tip away from the switch actuating surface and over the lower end of the actuator track as the keystem is returned toward the extended position.

12. The assembly defined in claim **11** in which the housing comprises a pair of identical housing halves which are secured together, the housing having a second slot for receiving a second diaphragm switch, the two switch slots being on opposite sides of the keystem, and in which the keystem includes a second actuator channel to receive a second actuator for operating the second switch.

13. The assembly defined in claim **6** in which the switch is a diaphragm switch having a pair of connecting tabs extending therefrom through the housing base, and in which the base includes resilient means carrying the connecting tabs and urging the tabs away from the base for connection to an external device against which the base is positionable.

14. The assembly defined in claim **13** in which the resilient means is a pair of integrally formed leaf springs on the base.

* * * * *