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KEY SWITCH WITH AXIALLY MISALIGNED SHUTTLE BRIDGING MEMBER

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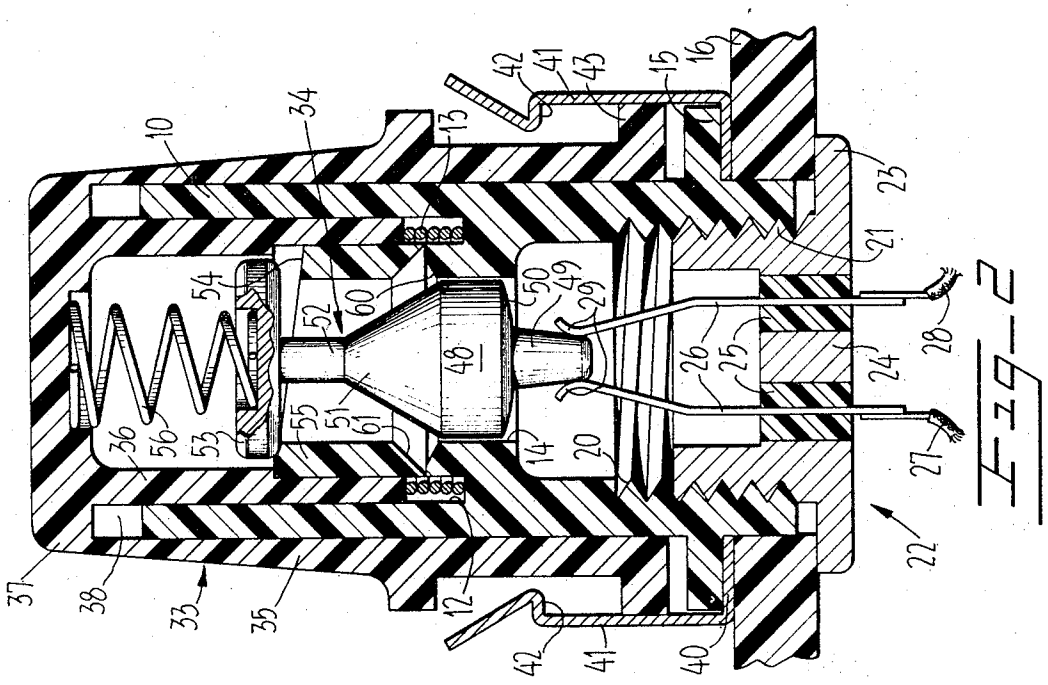

Fig. 2

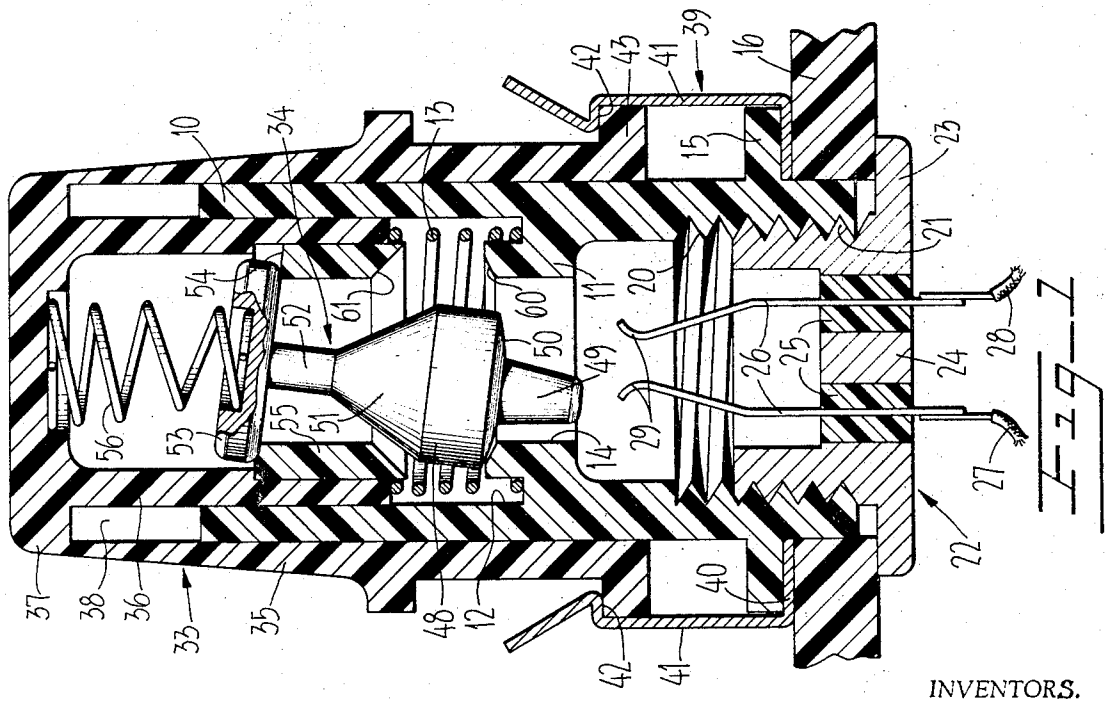

Fig. 1

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KEY SWITCH WITH AXIALLY MISALIGNED SHUTTLE BRIDGING MEMBER

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ABSTRACT OF THE DISCLOSURE

A keyboard key module adaptable for use in any keyboard configuration on electronic or electrical devices. Upon depression of a key, a relatively light pressure is required to effect operation of a spring-actuated shuttle. The normally axially misaligned shuttle is snappedly cammed into axial alignment to bridge two spring contacts and complete a circuit.

BACKGROUND OF THE INVENTION

The trend today is toward high-speed printers and more compact computer systems. In such devices, the keyboard is an important functional unit, the keys of the keyboard must be adaptable to high speed operation for the rapid selection of values or other characters to be printed or otherwise utilized in the system. In the past, a series of switches, such as leaf switches or microswitches, have been installed in the keyboard unit for control by the respective keys. A compact spacing and/or arrangement of the keys being determined by the suitable placement of the switches. Because of the depth requirement for keys and switches and the necessarily wide spacing between keys, the spatial requirements for the keyboard unit becomes restrictive.

In Pat. No. 3,366,808, for Steward, issued Jan. 30, 1968, and assigned to the assignee of the present application, there is described a keyboard key having a unitized construction, i.e., the key and switch are combined in a housing. However, the structure is relatively complex and expensive to manufacture. Because of its complexity, a casing, or housing of considerable size must be employed and, due to this fact, the key does not readily lead itself to a compact grouping or arrangement of a plurality of such keys. The Steward key structure does have an advantage over prior devices for creating a voltage pulse by the impact of a hammer with a cantilevered crystal section. All of the parts, except for the key, being totally enclosed.

SUMMARY OF THE INVENTION

The present invention constitutes an improvement over the Steward key structure as disclosed in Pat. No. 3,366,808 and relates particularly to a self-contained key-switch combination of simple and inexpensive construction.

The present invention provides a compact key module affording considerable flexibility in various keyboard arrangements for operator convenience. By virtue of a shortened stroke and lighter pressure requirement, the key is readily adaptable to easier and faster control by an operator with the closure of the switch contacts being independent of operator touch.

DESCRIPTION OF DRAWINGS

FIG. 1 is a cross-sectional elevational view of the key module, and

FIG. 2 is a view similar to FIG. 1, showing the key fully depressed.

Referring to FIG. 1, a key guide member **10** is cylindrical in shape and is hollow, preferably molded, or formed, of a thermoplastic material. Integrally formed, internally of the guide member **10**, and intermediate its

ends, is a transverse wall **11** having an annular groove **12** formed in the top surface thereof. The larger diameter of the groove **12** is identical to the inside diameter of the upper portion of the cylindrical guide **10**, while the smaller diameter is such that the width of the groove **12** is sufficient to accommodate a compression spring **13** seating on the bottom surface of the groove. Concentric with the upper portion of the cylindrical guide **10** is a bore **14** formed in the internal wall **11** for a purpose to be hereinafter described.

Adjacent its lower end, the guide member **10** is provided with an annular collar **15**, integrally formed therewith and effective to support the cylindrical guide on a keyboard mounting plate **16**. The mounting plate **16** may serve to support a plurality of such guide members **10**. In the lower end portion of the guide member **10** a series of female threads **20** are formed and are adapted for threaded engagement by the male thread portion **21** of a base member **22**. Upon inserting the lower end portion of the guide member **10** in a suitable aperture in mounting plate **16** and threading the base member **22** into the guide **10**, an annular flange **23** of the base **22** serves to secure the guide **10** in place on plate **16**.

Base member **22** is counterbored to a depth approximately one-half its thickness with the remaining solid portion **24** thereof having a pair of identical diametrically-opposed holes **25** drilled or otherwise formed therein. Each of a pair of spring contacts **26** of a suitable electrically conductive material, such as beryllium copper, is suitably supported within the respective holes, or apertures, **25** by means of an insulating material preferably neoprene rubber, which is bonded or otherwise secured to the contacts **26** and to the walls of the respective holes **25**. While the lower end portion of each of the contacts **26** extends below the base **22** sufficiently to permit the coupling of the electrical conducting leads **27** and **28**, the upper end portion is formed angularly inwardly, each toward the other. At its upper extremity, each of the contacts **26** is arcuately formed as at **29**. The arcuately formed ends **29** are in opposition, one to the other, and in spaced-apart relationship to permit the entry of a bridging member therebetween to effect the flow of current across the electrical leads **27** and **28**.

A key **33** is substantially cylindrical in configuration, preferably molded or formed of a thermoplastic material and comprising an outer cylindrical shell **35**, as well as an inner cylindrical shell **36**, integrally formed at their upper end with a closed end portion **37**, which provides the operator touch surface for controlling the depression of the key. As the key **33** is depressed, it is guided in its movement by the engagement of the upper cylindrical portion of the guide member **10** in an annular channel **38** formed between the wall of the outer shell **35** and that of the concentric inner shell **36**. Normally, compression spring **13** serves to resiliently maintain the key **33** in the upper or nondepressed position shown in FIG. 1, the lower end of the spring **13** being seated in the annular groove **12** in the transverse wall **11** and its upper end urged against the lower edge of the inner shell **36**.

The extent of the upward travel of the key **33**, under the influence of spring **13**, is determined by a spring clip, generally indicated at **39**, and comprising a ring **40** and a pair of vertically disposed spring clips **41**. Ring **40** is secured in place between the collar **15** and mounting plate **16** by means of the flanged base **22**. Formed upwardly from the outer peripheral edge of, and at right angles to, the ring **40** are the two diametrically opposed clips **41**. At its upper free end, each clip **41** extends laterally inwardly and angularly upwardly providing a shoulder **42** engageable by an annular flange **43** formed at the open end of the outer shell **35**, thereby limiting the upward movement of the key **33**.

As the key **33** is depressed, a shuttle, generally indicated at **34**, is urged into axial alignment with the bore **14** in the wall **11** of guide member **10** for immediate engagement thereafter with contacts **26**. Normally, the shuttle **34**, which may be formed of an electrically conductive material, such as brass, is at rest in a position such that the axis of the shuttle is angularly disposed to the axis of the guide member **10** and bore **14** as seen in FIG. 1. However, upon depression of the key **33** by a finger pressure approximating four ounces, the shuttle **34** is moved to a position axially coincident with the axis of the guide member **10**. Immediately thereafter, the shuttle moves downwardly to engage between the ends of the respective electrical contacts **26** (FIG. 2). To this end, the main body portion **48** of the shuttle **34** is cylindrical in form, having a diameter slightly less than that of the bore **14** in guide member **10**. Coaxial with the main body portion **48** is a tapered spindle **49** which is integrally formed at its larger end with the convex base **50** of the main body **48**. Extending upwardly of the main body **48** is a conoidal top section **51** connected coaxially by means of a stub shaft **52** with a disk or head **53** having a diameter greater than that of the main body **48** of the shuttle **34**. It will be noted that although the shuttle **34** is preferably formed, in its entirety, of an electrically conductive material, it may, if deemed desirable, be formed or molded of a thermoplastic material with the spindle **49** only formed of brass or other conductive material.

Normally, the lower surface of the disk **53**, adjacent the peripheral edge thereof, rests on the elliptical surface **54**, formed by the inclined plane of a cylindrical stop sleeve **55** press fitted into a counterbore in the open end of the inner shell **36**. The engagement of the head **53** of the shuttle **34** with the surface **54** of sleeve **55** is resiliently maintained by a compression conical spring **56**. The upper, or larger, end of spring **56** is disposed in an indented seat in the inner surface of the closed end portion **37** of key **33** coaxial with bore **14**, while the smaller end of the spring is seated in a concentric recess in the disk **53** of shuttle **34**.

In the normal, or nondepressed, position of the key **33**, an angular portion of the convex surface **50** of the shuttle **34** is disposed adjacent a corresponding portion of a chamfer, or bevelled edge, **60** of the bore **14**. Upon the application of approximately a four-ounce operator load on the key **33**, and following approximately a .032 of an inch of travel, the bevelled edge **61** of sleeve **55** contacts the surface of the conoidal section **51** of shuttle **34**. During the succeeding .053 of an inch of travel of the key, the shuttle **34** is cammed off of the chamfer **60** into axial alignment with the bore **14**. As the key **33** travels this initial .085 of an inch, approximately, the inclined plane surface **54** of sleeve **55** moves out of engagement with the disk **53** of the shuttle. At this same time, the conical spring **56** is further compressed so that, upon axial alignment of the shuttle **34** with the bore **14**, the shuttle is triggered and, under the influence of compressed spring **56**, is immediately urged downwardly to engage the spindle **49** between the arcuately-formed ends **29** of contacts **26**, as seen in FIG. 2. As the engagement of the spindle **49** with the contacts **26** is effected, the depression of the key **33** is completed for a full travel of approximately .125 of an inch. Thus, current flow is effected across leads **27** and **28** for the control of associated equipment or circuitry.

What is claimed is:

1. A keyboard key assembly comprising:

a guide cylinder adapted to be supported in a keyboard and including a transverse wall having a coaxial bore therein,

a base element removably mounted on said guide cylinder for retaining said guide cylinder in said keyboard,

a pair of electrical conductors supported in spaced apart relationship in said base element,

a manually operable key slidably supported on said guide cylinder for movement from a normally inoperative to an operative position,

a resilient means biasing said key to the inoperative position,

a contact means normally inactively supported within said key for movement to an active position relative to the bore in said transverse wall of said guide cylinder upon the initial depression of said key for engagement thereafter between said electrical conductors,

a cylindrical support member movable with said key normally yieldably supporting said contact means in axial misalignment with the bore in said transverse wall of said guide cylinder and operable upon initial movement of said key to move said contact means into active position for passage within said bore, and

a conical compression spring normally biasing said contact means into engagement with said cylindrical support member and compressible by said key, during the initial portion of the depression of the key and the movement of said contact means to active position, to immediately thereafter effect passage of said contact means through said bore and into engagement between said electrical conductors.

2. A key assembly of the character described in claim **1** wherein said contact means comprises a shuttle having a cylindrical main body element for movement axially in said bore,

an electrically conductive tapered spindle carried by said main body element for engagement between said electrical conductors,

a disk normally maintained in engagement with said support member by said conical spring, and

a conoidal section connecting said disk with said main body element whereby said main body element is resiliently maintained out of axial alignment with the bore in said transverse wall.

3. A key assembly of the character described in claim **2** wherein said support member comprises a hollow cylinder carried by said key coaxial with said bore having the top surface disposed in an inclined plane for engagement by said disk under the influence of said conical spring and the lower inner edge bevelled to engage the inclined surface of said conoidal section to cam said main body element into axial alignment with said bore during the initial depression of said key.

4. A key assembly of the character described in claim **3** wherein said conical spring is disposed between said key and said disk and is compressed during the initial depression of said key to cam said main body element into axial alignment with said bore and is thereafter effective to actuate said main body element to cause said spindle to complete a current flow across said conductors.

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