United States Patent

[11] 3,564,166

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[73] Assignee **Painton & Co. Ltd.**
Northampton, England
[32] Priority **Apr. 24, 1968**
[33] **Great Britain**
[31] **19502/68**

[54] **ELECTRICAL LEVER ACTUATED KEY SWITCH WITH IMPROVED CAM POSITIONING MEANS**
14 Claims, 15 Drawing Figs.

[52] **U.S. Cl.** **200/1,** 200/166
[51] **Int. Cl.** **H01h 9/00**
[50] **Field of Search** ..... 200/1 (ATK), 1 (A), 166 (SD), 166.1; 74/527; 179/176; 200/6 (B2), (B3)

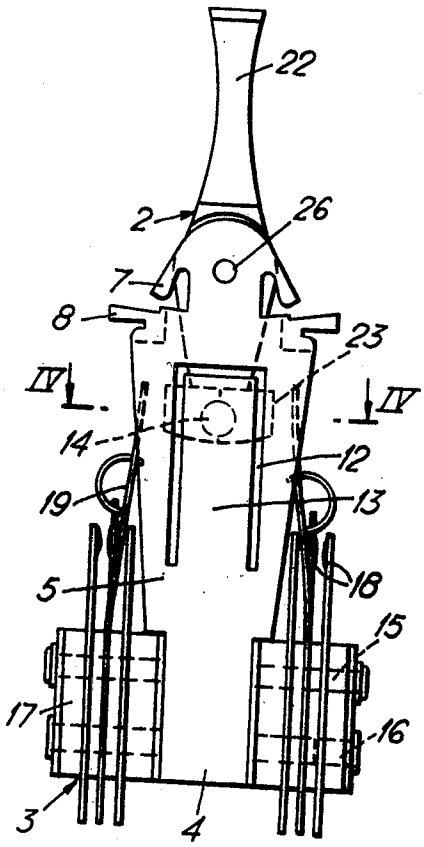
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Primary Examiner—Robert K. Schaefer
Assistant Examiner—J. R. Scott
Attorney—Kurt Kelman

ABSTRACT: A versatile electrical key switch and components for forming the same, comprising a switch body supporting pivotally a switch lever, the lever carrying cam means of any desired shape which are engaged by a resilient member carried by the body and which biases the lever to at least one stable position, this position being dependent upon the cam configuration of the cam means.

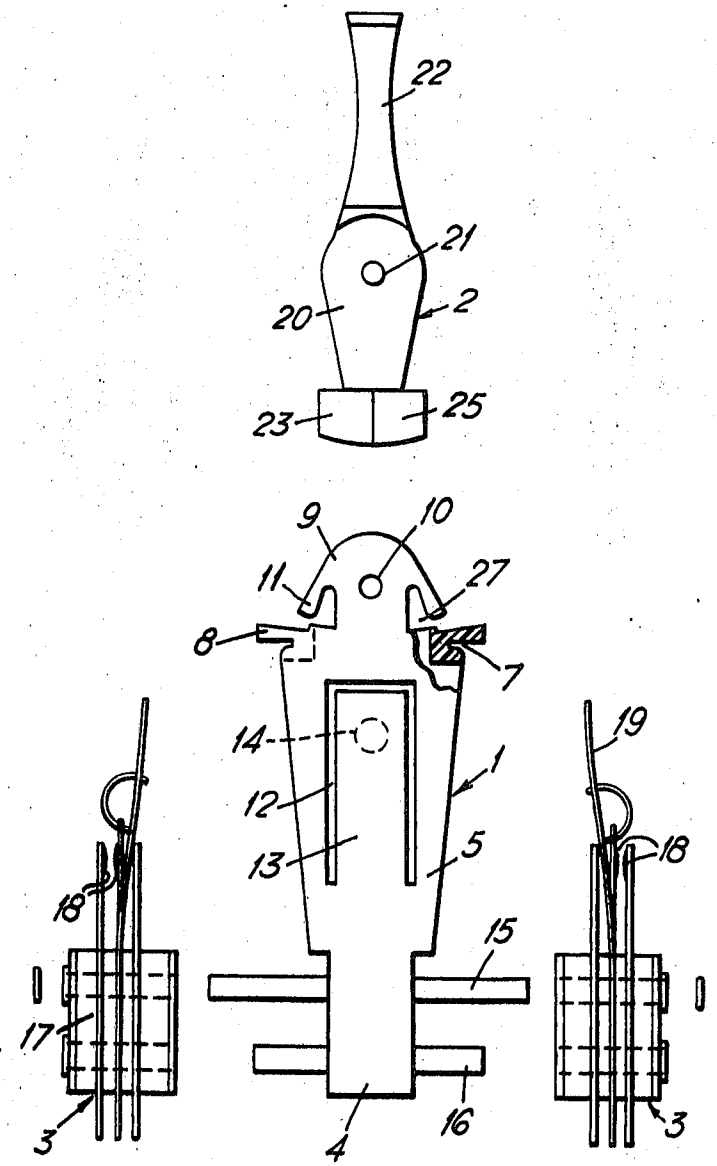


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SHEET 1 OF 5

Fig. 1.



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Fig. 2.

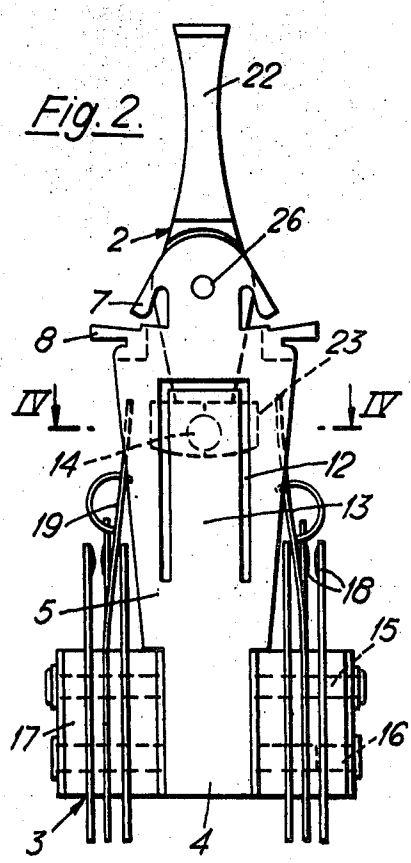


Fig. 8.

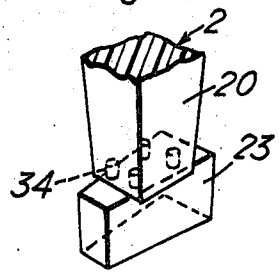


Fig. 3.

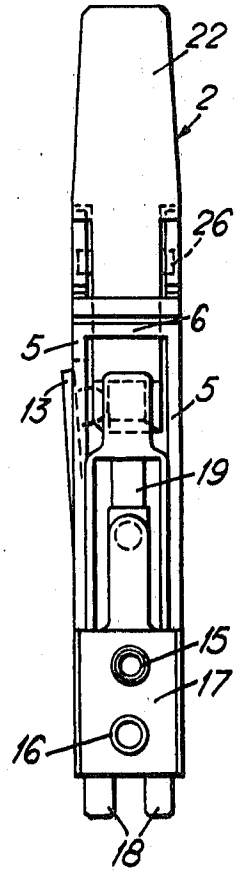
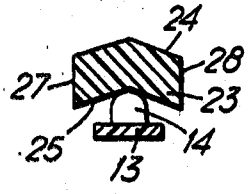


Fig. 4.



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Fig. 5.

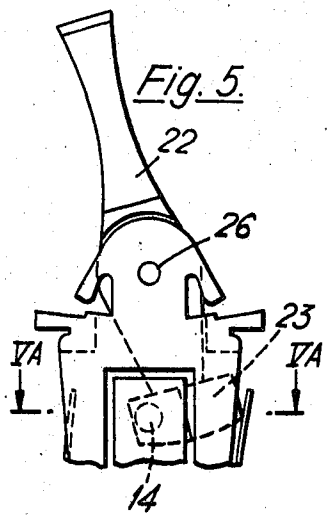


Fig. 5A.

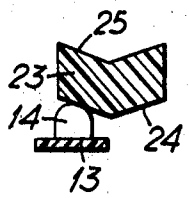


Fig. 6.

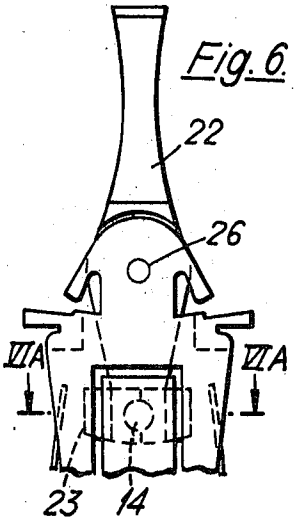


Fig. 6A.

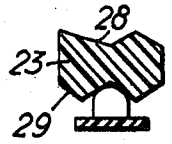


Fig. 7.

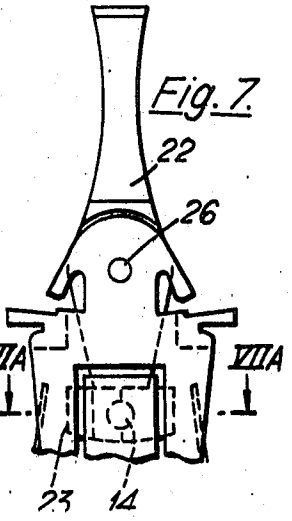


Fig. 7A.

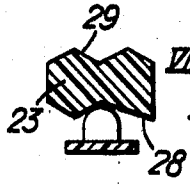
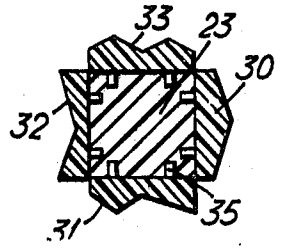
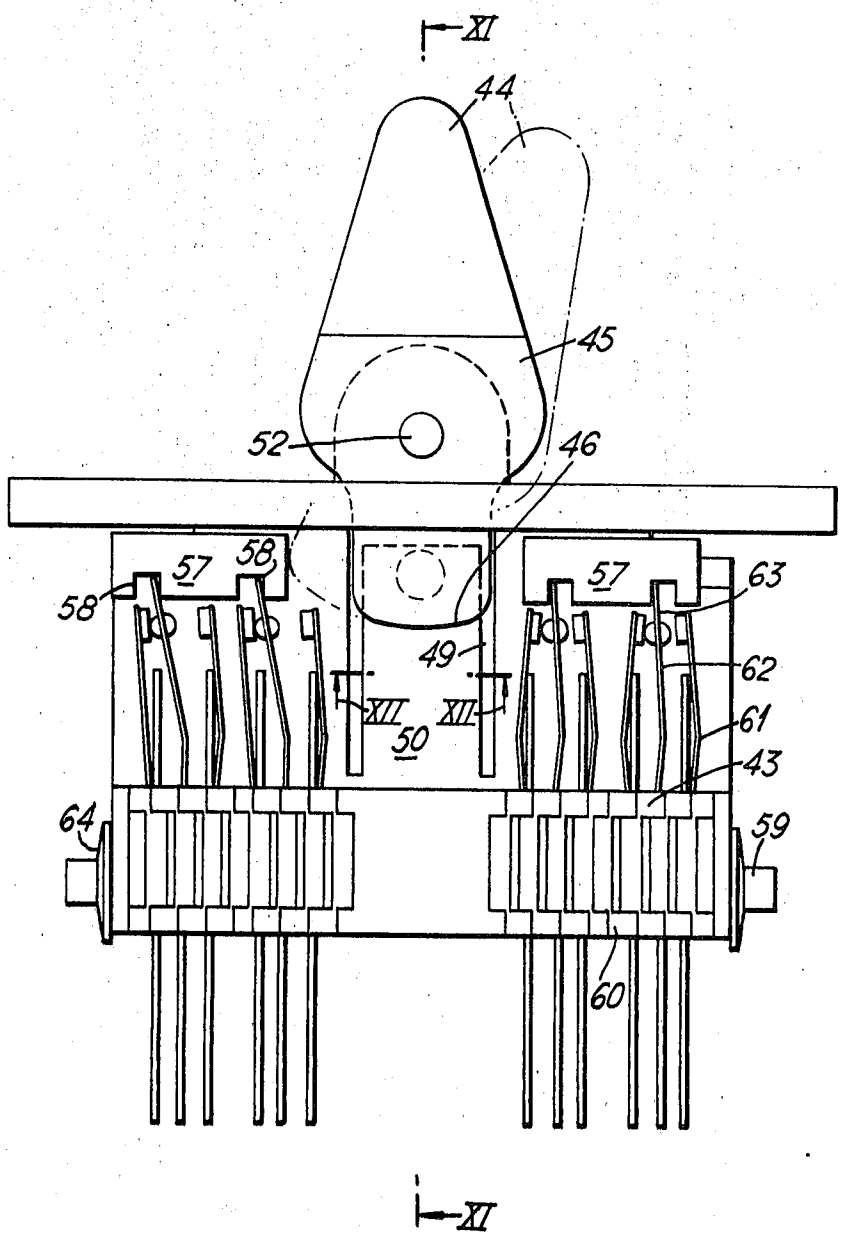


Fig. 9.



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Fig. 10.



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Fig. 11.

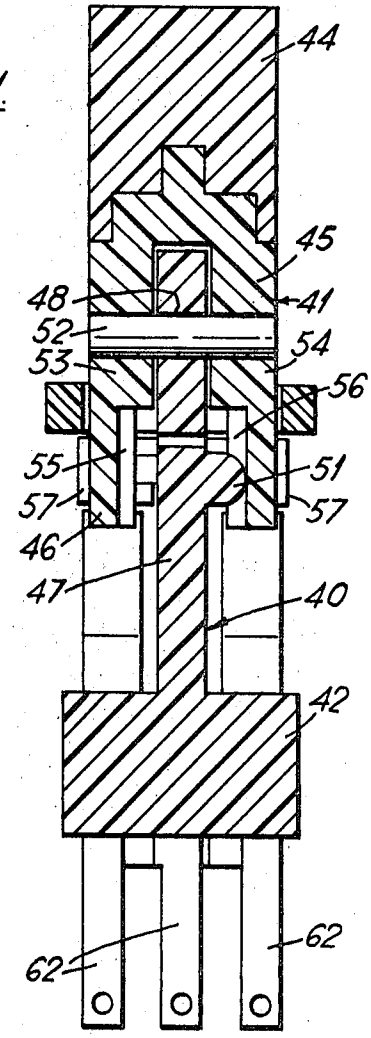
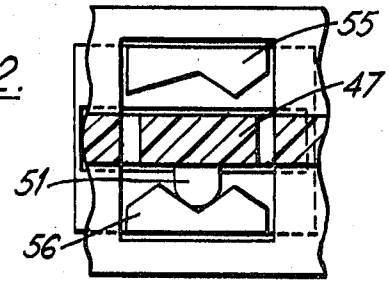


Fig. 12.



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ELECTRICAL LEVER ACTUATED KEY SWITCH WITH IMPROVED CAM POSITIONING MEANS

This invention concerns electrical switches and relates, in particular, to electrical key switches.

A key switch is a switch in which a lever is pivotally mounted so as to be movable between at least two positions and when the lever is in one of such positions one end thereof directly, or indirectly, actuates electrical contacts. The lever of such a switch may be lockable in, or biased towards, one or more of its contact-actuating positions and/or to a position or positions in which the lever does not actuate any contacts.

It is an object of the invention to provide an improved key switch which is economical to form on a mass production basis and which is reliable and robust. A further object of the invention is to provide a switch which may have its switching characteristics changes merely by altering the orientation of one or more of its components with respect to other components thereof.

To this end, and in accordance with this invention, there is provided a key switch comprising a body having, pivotally mounted thereon, a lever movable to actuate electrical contacts, and cam means having at least one cam face on the lever for cooperation with a resilient member carried by the body and which urges the lever towards at least one particular stable position.

Expediently the cam means may include a plurality of cam faces and such cam means may be assembled with respect to the body so that a selected one of said cam faces is engaged by the resilient member. By enabling particular cam faces to be selected the switch may be assembled to produce different switching characteristics by altering the orientation of the cam means with respect to the resilient member and the body carrying such member.

Conveniently said cam faces have different configurations. Furthermore, advantageously the cam means may be formed integrally with the switch lever although such cam means could be detachably secured to the lever.

According to one feature of the invention the or each cam face could be detachably secured to the remainder of the cam means to enable such cam surface or surfaces to be replaced by a surface or surfaces of a different configuration.

According to another feature of the invention the cam means may have portions which are provided to actuate members associated with said electrical contacts, to effect switching although it will be understood that actuating portions may be provided on the lever at a position spaced away from the cam means.

In one embodiment of switch in accordance with this invention said members associated with the contacts may comprise extensions of such contacts. However, alternatively one or more slidable shoes may constitute said members which are associated with said contacts and such shoes engage such contacts or extensions thereof.

More specifically in one embodiment the switch may comprise a body moulded from a plastics material and having a resilient member formed integrally therewith, such resilient member carrying a pip or protrusion arranged to engage a cam surface of the cam means, the lever carrying such cam means being pivotally connected to the body, such body also carrying at least two electrical contact assemblages which are adapted to be moved in response to movement of such lever with respect to the body.

More specifically, the body may be provided with a hollow defined by two walls of the body and said lever may be mounted on the switch body with the cam means within such hollow, the cam faces being provided on those faces of the cam member which lie adjacent said body side walls and one of such cam faces being engaged by said pip or protrusion.

Alternatively, said cam member may be bifurcated and the bifurcations may each carry a cam surface, a portion of said resilient member extending between the bifurcations so that the pip or protrusion engages one only of said cam faces.

In order that the invention may be more readily understood, and further features of the same more readily appreciated, embodiments of key switches in accordance with this invention and particular switch levers or keys therefor, will now be described by way of example, and with reference to, the accompanying drawings in which:

FIG. 1 is an exploded elevational view of a first embodiment of key switch which shows the principal parts thereof, one of these parts being the switch body and another being the switch lever or key;

FIG. 2 is a front elevational view of the switch of FIG. 1, the principal parts thereof being assembled in a manner to provide a three position, centeroff, switch;

FIG. 3 is a side elevational view of the switch of FIG. 2;

FIG. 4 is a fragmentary cross-sectional view on the line IV–IV of FIG. 2;

FIG. 5 is a fragmentary front elevational view of the switch of FIG. 1 but the principal parts thereof being assembled to provide a two position switch;

FIG. 5A is a fragmentary cross-sectional view on the line VA–VA of FIG. 5;

FIG. 6 is a second switch using the same switch body as that shown in FIGS. 1 to 5 but having a different switch lever or key, the lever being assembled in the body to provide a three position switch;

FIG. 6A is a fragmentary cross-sectional view on the line VIA–VIA of FIG. 6;

FIG. 7 is a further elevational view of the switch of FIG. 6 but the switch lever being assembled to provide a switch which has two principal positions but yet being movable to a third position against a bias;

FIG. 7A is a fragmentary cross-sectional view on the line VIIA–VIIA of FIG. 7;

FIG. 8 is a fragmentary perspective view of a switch lever for introduction into a switch body, such switch lever providing with the body a two position switch which is at all times biased to one of its two positions, this FIG. 8 also showing how a cam member on the lever could be separately formed from the remainder of the lever and thus secured in more than one particular orientation with respect to the remainder of such lever;

FIG. 9 is a fragmentary and diagrammatic cross-sectional view through the cam member of a switch lever showing a plurality of cam faces which are separately applied to the lever, this figure exemplifying the fact that the lever may carry a substantial number of different can faces so that switches having differing switching characteristics may be produced merely by changing the orientation of the lever in the switch body and indicating that more than two such cam faces may be provided on the lever;

FIG. 10 is a front elevational view of a further embodiment of switch using a different body and switch lever construction to that shown in FIGS. 1 to 9;

FIG. 11 is a cross-sectional view on the line XI–XI of FIG. 10; and

FIG. 12 is a fragmentary cross-sectional view on the line XII–XII of FIG. 10.

In broad terms the switches depicted in the accompanying drawings comprise a body generally designated 1, a switch lever or key generally designated 2 and associated contact mounts or assemblages generally designated 3.

In all the embodiments shown in FIGS. 1 to 7 the body 1 is of the same construction and comprises a single moulding of a plastics material which may very conveniently be the material manufactured and sold under the Registered Trade Mark DELRIN.

In elevation the body 1 comprises a base block 4 which carries on opposite faces thereof upstanding side walls 5 which are coupled together by a cross piece 6 so that when the body is viewed from its side it is of generally H-shape, the sidewalls 5 constituting the uprights of the H and the cross piece 6 constituting the cross member of the H. The lower portions of the upstanding side walls are coupled together by the base block 4.

The sidewalls 5 when viewed in elevation increase in width towards their upper end, that is the end remote from the base block 4, and are each provided with indents 7 adjacent which are outwardly extending fingers 8 dimensioned so as to be resilient. Upper terminal end portions 9 of the sidewalls 5 are apertured at 10 and furthermore carry downwardly and outwardly divergent arms 11, these arms also being dimensioned so as to be resilient.

At a position between the fingers 8 and the base block 4 one of the sidewalls 5 is provided with an inverted U-shaped slot 12 which creates, within itself, a rectangular tongue 13 which is coupled at its lower end to the remainder of the wall 5. This tongue 13 provides a resilient carrier for an inwardly directed integrally formed pip 14 which extends into the space between the side walls of the body 1 at a position immediately below the cross member 6.

The base block 4 is moulded with a pair of bores in which are housed contact assemblage-carrying shafts 15, 16. If desired such shafts 15, 16 may be moulded integrally with the remainder of the body. These shafts 15, 16 protrude from opposite sides of the base block 4 and are provided to rigidly support the contact assemblages 3. Such assemblages 3 comprise a required number of contact blades which are sandwiched between insulating blocks 17. By way of example FIGS. 1, 2 and 3 depict, as being carried on each of the shafts 15, 16 and on each side of the body 1, a pair of contact-carrying blade 18, one of these contact blades carrying a fixed contact and the other carrying a movable contact. The blade carrying the movable contact is provided with an extension 19 which, when the contact assemblages 3 are secured in their operating positions on the shafts 15 and 16 lie within the confines of the upstanding sidewalls 5 of the body 1 so that their upper terminal portions lie on opposite sides of the pip 14.

Referring now to the lever 2 it will be seen from FIGS. 1 to 7 that the lever comprises a body part 20 which is apertured at 21 and such body part 20 carries, on one end thereof, a digitally operable part 22 and at its opposite end a cam member 23, such cam member having a pair of cam surfaces. In FIGS. 1 to 4 such cam surfaces are designated respectively 24, 25.

When the principal switch components shown in FIG. 1 are assembled to form a switch as shown in FIGS. 2, 3 and 4 the aperture 21 in the lever 2 is aligned with the apertures 10 in the side walls 5 of the body 1 so that the cam member 23 will lie below the cross piece 6 and one or other of its cam surfaces 24, 25 will be engaged by the pip 14. Pivotal connection between the body 1 and the lever 2 is effected by a pivot pin 26 which extends through apertures 10 and through the aperture 21.

Because the tongue 13 carrying the pip is dimensioned so as to be resilient the pip is provided with a resilient bias and the lever 2 is biased into a particular position, such position being determined by the configuration of the cam surface which lies adjacent such pip 14.

In the embodiment of FIGS. 1 to 4 it is the cam surface 25 that is positioned adjacent the pip and thus the lever is biased into a positioned where the pip lies centrally of the cam surface 25 and thus the lever is biased to a center position.

From FIG. 2 it will be seen that when the digitally operable part 22 of the lever 2 is moved so that the lever 2 moves about the pivot pin 26, one of the end portions of the cam member 23 (these end portions being designated 27 and 28) engages a respective one of the extensions 19 of the movable contact blades 18 thereby to move such contact for example to close the same.

In the embodiment of FIGS. 1 to 4 the switch provides a capability of three positions, the cam surface 25 serving at all times to bias the lever to a stable "centreoff" position in which the contacts are open.

The particular form of switch illustrated in FIGS. 1 to 4 is arranged to be set into a mounting plate (not shown). Such a mounting plate would conveniently be provided with a rectangular aperture in which the switch body is to be located and location is effected by introducing the switch into the aperture from below the plate so that the arms 11 are guided into the aperture in the plate and are deformed inwardly until the peripheral edge portions of the plate aperture lie in a rebate 27 which lies between the terminal end portions of the arms 11 and the fingers 8. When the mounting plate reaches this position the arms 11 snap outwardly and the plate is sandwiched between such fingers 8 and arms 11 so that the switch is firmly retained on the mounting plate.

The switch described with reference to FIGS. 1 to 4 may have its switching characteristic changed radically without varying the body or lever construction in any way by rotating the lever 2 about its own longitudinal axis through 180°before introducing the lever into the body so that when the lever is assembled on the body the cam surface 24 engages the pip 14. With this form of assembly a switch is provided in which the lever is biased towards either one of two stable positions. As switch assembled in this way is shown in FIG. 5 and FIG. 5A shows particularly the pip 14 urging the cam member 23 into one of the two said stable positions.

In FIGS. 1 to 5 the cam member 23 has cam surfaces 24, 25 each of which comprise a pair of inclined planes. However in FIGS. 6, 6A, 7 and 7A the cam member 23 has two cam surfaces 28, 29, the cam surface 28 comprising three inclined planes and the cam surface 29 comprising four inclined planes.

In FIG. 6 the cam surface 29 is shown to be in engagement with the pip 14 whereas on FIG. 7 it is the cam surface 28 that is so engaged. Because of the four inclined surfaces on the cam surface 29 the switch shown in FIGS. 6 and 6A is a three stable position switch, the lever being biased either to a center position or either one of two other positions. In the case of FIG. 7, where the cam surface 28 is engaged by the pip 14, a three position switch is again provided but it has two stable positions only and a bias exists which at all times biases the switch towards one of the two stable positions.

Referring now to FIG. 8, which is a fragmentary perspective view of a part of a lever 2, it will be seen that a cam member 23 is depicted which is generally wedge-shaped. It will be understood that if this lever 2 were to be introduced into the body of the switch, a switch could be provided which would have two positions and that the lever would at all times be biased into one of such two positions. By rotating the lever 2 through 180°with respect to the switch body 1 the opposite switching characteristic could be provided. In FIG. 8 however the cam member 23 is shown to be connected to the body part 20 of the lever 2 by means of a plurality of pins. The purpose of this FIG. is to indicate that, if desired, the lever and the cam member may be formed separately of one another and that any desired cam member may be secured in a particular orientation with respect to the lever.

In this respect FIG. 9 shows how the cam member 23 could be formed integrally with the body part 20 of the lever 2 but that the cam surfaces (which in FIG. 9 being respectively designated 30 to 32 inclusive) could be formed separately of such cam member 23 and could be attached to two (or more) surfaces of such cam member in any required orientation.

The pins on the cam member 23 of FIG. 8 are designated 34 and the pins carried by the cam surfaces 30 to 33 inclusive in FIG. 9 are designated 35.

Referring now to the embodiment of switch shown in FIGS. 10 to 12 inclusive, whilst the principle of the switch is extremely similar to the switch shown in earlier FIGS. the actual construction form of the same is slightly different.

In this embodiment the switch comprises a body 40, a lever 41, a base block 42 and contact assemblages 43.

Likewise the lever comprises a digitally operable part 44, a body part 45 and a cam member 46.

In cross section the body part 40 comprises a single spine 47 which is connected at its lower end to the base block 42 and this spine 47 is apertured towards its upper terminal end portion at 48. The base block 42 and spine 46 together form a structure which is substantially of inverted T-shaped in cross section.

An inverted U-shaped slot **49** is provided in the spine **47** which creates a resilient tongue **50** which carries a pip **51**.

The aperture **48** is provided to receive a pivot pin **52** which also extends through apertures in the body part **45** of the lever **41**. In this particular embodiment the body part **45** of the lever **41** is bifurcated and the spine **47** extends upwardly between the bifurcations, such bifurcations respectively being designated **53** and **54**. The lower portions of the bifurcations **53, 54** are rebated in the region of the pip **51** and these rebated regions constitute the cam member **46** and carry respectively cam surfaces **55, 56**. In this way the pip **51** engages one or other of the cam surfaces **55, 56** in dependence upon the orientation of the lever **41** in the body **40**. In this instance the pip **51** engages the cam surface **56**.

As will be seen from FIG. **10** the upper portions of the spine **47** of the body **40** serves to carry a pair of slidable shoes **57** rebated at **58**. These shoes are provided to transmit movement of the lever **41** to contact assemblages **43**. The contact assemblages **43** comprise a plurality of contact carrying blades which are carried on a shaft **59** extending from the base block **42** and are spaced from one another by a series of spacers **60**. The contact carrying blades comprise a plurality of fixed resilient blades **61** arranged in pairs and having positioned therebetween movable contact blades **62**, these movable contact blades **62** each having an extension **63** which extends into the rebates **58** on shoes **57**. With this arrangement sliding movement of the shoes **57** causes movement of the extensions **63**, and thus the movable contact blades **62**, with respect to the fixed contact blades **61**.

Any suitable means may be provided for locking firmly the contact assemblages on the shaft **59** and in this embodiment a spring washer **64** is shown for this purpose.

It will be further seen from FIG. **10** that end portions of the bifurcated cam member engage the shoes **57** to effect said sliding movement thereof in response to movement of the lever **41**. A position of the lever **41** in which one of the shoes is so engaged is indicated in dot-and-pic lines in FIG. **10**.

In this particular embodiment the cam faces **55, 56** respectively comprise three, and four, inclined planes and with the pip **51** in engagement with the cam surface **56** a three position switch is provided. If however the lever **41** is rotated through 180° about its longitudinal axis and with respect to the body, the cam surface **55** becomes engaged with the pip **51** a three position switch is again provided but the pip **51** would, at all times, urge the lever away from one of the three positions.

As in the case in the embodiments shown in FIGS. **1** to **9** the major components of the switch are moulded from a plastics material such as that manufactured and sold under the Registered Trade Mark DELRIN. This particular material produces a sufficiently rigid structure for the main components of the switch and enables a resilient tongue **50** to be formed integrally therewith by appropriate dimensioning thereof.

As will be seen particularly from FIG. **11** the digitally operable portion **44** of the lever is formed separately of the body part **45**. This enables differently shaped portions **44** to be provided on a lever **41** having a common body part and common cam member.

It will be understood from the above description that a very wide variety of switches having a wide variety of differing switching functions can be provided simply by varying one or other of the components forming the switch or, in fact, merely by varying the orientation of one of such components with respect to the other during assembly. Thus a wide range of switches may be produced economically. Furthermore it will be seen that the actual structure of the switches is relatively simple and robust so that the switch is not only relatively cheap to manufacture but is also reliable in its operation.

It will also be understood that assembly of the switch is extremely simple it merely being necessary to introduce the lever into the body and to coalign the apertures in such parts so that a pivot pin (**26,52**) may be introduced therein and to arrange the appropriate number of contact members (movable and fixed) on the shafts (**15,16,59**) protruding from the base block (**4,42**) and to locate the same in position with the aid of the spacers (**17,60**).

Whilst in the above described embodiments of switch the end portions of the cam members effect movement of a moving contact blades, alternatively the lever could be provided with an extension (for example below the cam member) which carries a bridging contact which wipes across, and bridges, fixed takeoff contacts. Naturally if such an arrangement were adopted it would probably be desirable to bias one of the contacts towards the other. In one such embodiment the moving contact on the extension of the lever could compromise a silver/graphite block which merely wipes across and bridges pairs of said fixed takeoff contacts.

I claim:

1. A key switch comprising:
a body moulded from a plastics material;
a resilient member formed integrally with such body;
a detent on said resilient member;
a lever pivotally mounted on the body;
electrical contacts mounted on the body and actuable in response to movement of the lever;
cam means on said lever;
at least one cam face on the cam means for cooperation with said detent on said member to urge the lever to at least one particular stable position.

2. A key switch according to claim **1**, wherein a plurality of cam faces are provided on said cam means and the cam means may be assembled with respect to the body so that a selected one of said cam faces is engaged by the resilient member.

3. A key switch according to claim **2**, wherein said cam faces have different configurations so that the switching characteristics of the switch may be altered by altering the orientation of the cam means with respect to the resilient member of the switch body.

4. A key switch according to claim **1**, wherein the cam means are formed integrally with the lever.

5. A key switch according to claim **1**, wherein the cam means are detachably secured to the lever.

6. A key switch according to claim **1**, wherein at least one cam face is detachably secured to the remainder of the cam means to enable such cam surface to be replaced by a surface of a different configuration.

7. A key switch according to claim **1**, wherein members associated with said electrical contacts are provided and the cam means has portions which are provided to actuate such members to effect the switching.

8. A key switch according to claim **7**, wherein extensions of such contacts constitute said members.

9. A key switch according to claim **7**, wherein slidable shoes constitute said members which are associated with said contacts and such shoes engage such contacts.

10. A key switch according to claim **1**, wherein at least two electrical contact assemblages are carried by the body, the contacts of such assemblages being adapted to be moved in response to movement of such lever with respect to the body.

11. A key switch according to claim **1**, wherein two sidewalls of the body define a hollow and said lever is mounted on the body with the cam means within such hollow, the cam faces being provided on those faces of the cam member which lie adjacent said body sidewalls and one of such cam faces being engaged by said detent.

12. A key switch according to claim **1**, wherein said cam member is bifurcated and the bifurcations each carry a cam surface, a portion of said resilient member extending between the bifurcations so that the detent engages one only of said cam surfaces.

13. A key switch according to claim **1**, wherein the lever and cam member are moulded from a plastics material.

14. A key switch according to claim **1**, wherein said body is formed integrally with means for firmly mounting said body on a mounting plate or the like.