Multi-directional operating switch and multi-directional operating device using the same
Mehrrichtungsschalter und Betätigungsvorrichtung
Interrupteur multi-directionnel et dispositif de commande

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Description

[0001] The present invention relates to a multi-directional operating switch activated by a tilting manipulation as well as a pushing manipulation of a manipulating shaft, used mainly in an input controller or the like of a mobile communications device such as a portable telephone, a radio pager, etc., as well as various electronic devices such as remote controllers, audio equipment, game machines, car navigation systems, electronic cameras, and the like. The invention also relates to a multi-directional operating device using the same.

[0002] A conventional multi-directional operating switch will be described hereinafter by referring to Fig. 13 through Fig. 16.

[0003] In Fig. 13 depicting a sectioned front view, a box-like case 1, made of plastic resin, has an opening in an upper surface covered by a cover 2 made of a metal plate, or the like.

[0004] A bottom surface of the case 1 is provided with a central contact 3A, an outer contact 3B, and four peripheral contacts 4, 5, 6 and 7 disposed in positions equidistant from the central contact 3A toward directions of right, left, back and front, all fixed by an insert molding. These contacts are connected individually to their respective terminals 14A, 14B, and 15, 16, 17 and 18. A dome-like circular movable contact 8 is placed over the outer contact 3B. A common movable contact 9 is fixed by dowels 1A above the peripheral contacts 4, 5, 6 and 7 in such a manner that flexible contact leaves 10, 11, 12 and 13 of the common movable contact 9 face their respective peripheral contacts 4, 5, 6 and 7. The common movable contact 9 is connected to a terminal 19A for external connection via a contact 19 on the bottom surface of the case 1.

[0005] A supporting body 21 is positioned above the common movable contact 9, and a square-shaped upper end 21A of the supporting body 21 maintains a resilient contact with an underside surface of the cover 2, as it is biased upwardly by a compression coil spring 20 disposed beside an inner periphery along side walls of the case 1. A recessed portion 21B in the center of the supporting body 21 holds a semispherical rotary body 22.

[0006] The rotary body 22 is in a position where a flange portion 22A at its lower perimeter rests on a bottom surface of the recess portion 21B in the center of the supporting body 21, and an upper spherical portion 22B fits in contact with a spherical surface of a circular hole 2A in the center of the cover 2. A rod-like manipulating shaft 23 made of metal is inserted and held in a vertical center hole 22C having a noncircular shape in the rotary body 22 in a vertically slidable manner.

[0007] The manipulating shaft 23 has a lower end 23A projecting downwardly from the rotary body 22, so as to rest in contact with the dome-like circular movable contact 8 in the center of the bottom surface of the case 1. A manipulation knob 24 is mounted on a tip end 23B of the manipulating shaft 23 projecting upwardly above the case 1.

[0008] A lower surface around an outer perimeter of the supporting body 21 is provided with depressing points 25A, 25B, 25C and 25D, corresponding respectively to the flexible contact leaves 10, 11, 12 and 13 of the common movable contact 9. Incidentally, the depressing points 25C and 25D corresponding to the flexible contact leaves 12 and 13 are not shown in Fig. 13, since it is a sectional view depicting only one side of the switch.

[0009] The multi-directional operating switch operates in a manner as described hereinafter. First, the manipulating shaft 23 is in its vertical neutral position, and all contacts of the multi-directional operating switch are in their OFF positions in a state of Fig. 13, wherein the lower end 23A of the manipulating shaft 23 does not depress the dome-like circular movable contact 8 at the center.

[0010] When a left upper surface of the manipulation knob 24, mounted on the tip end 23B at an upper part of the manipulating shaft 23, is depressed downward, as indicated by an arrow 100 in a sectioned front view of Fig. 15, the manipulating shaft 23 tilts and the rotary body 22 rotates toward the left side while maintaining a contact with the spherical surface of the circular hole 2A of the cover 2. This causes an edge of the flange portion 22A on the underside of the rotary body 22 to push the bottom surface of the recess portion 21B of the supporting body 21 downward. The supporting body 21 then tilts left around a fulcrum at one side of the square-shaped upper edge 21A opposite to the surface being pushed, and thereby the flexible contact leaf 10 corresponding to the depressed point 25A is pushed downward to come in contact with the peripheral contact 4. This establishes electrical continuity between the common movable contact 9 and the peripheral contact 4, and completes a state of continuity between the terminals 19A and 15 for external connections. During this movement, a left side of the upper edge 21A in the perimeter of the supporting body 21 separates from the underside surface of the cover 2, while depressing the compression coil spring 20 downward.

[0011] When the depressing force applied to the manipulation knob 24 is subsequently removed, the restoring force of the compression coil spring 20 pushes the supporting body 21 and the rotary body 22 back to their original neutral positions shown in Fig. 13. At the same time, the resilient restoring force also returns the flexible contact leaf 10 to the original position shown in Fig. 13 by separating it from the peripheral contact 4, thereby returning the switch contact to the OFF state.

[0012] Likewise, electrical continuity can be established between any of the terminals 16, 17 and 18 and the terminal 19A for external connections, by changing a position to be depressed between the right side, near side and a back side, respectively, on the upper surface of the operating knob 24 mounted on the manipulating
When a upper center surface of the operating knob 24, i.e. the manipulating shaft 23, is pushed downwardly by placing a vertical depressing force from above, as shown by arrow 200 (indicated in a sectioned front view of Fig. 16), the lower end 23A pushes the dome-like circular movable contact 8 on the bottom surface of the case 1, causing it to deform. This makes the dome-like circular movable contact 8 on the bottom surface produce a tactile response, and establish a state of continuity between the central contact 3A and the outer contact 3B. The manipulating shaft 23 is pushed up by the restoring force of the dome-like circular movable contact 8, and returned to its original position shown in Fig. 13, when the depressing force is removed.

In spite of a growing demand for downsizing of a variety of the latest electronic apparatuses, it has been difficult to realize a reduction in the overall dimension and thickness of the above described conventional multi-directional operating switch. In addition, the cost has been too high due to the large number of constituent components. The conventional switch also has had a problem in that it is difficult for an operator to sensory determine when a switch contact turns on, since the switch does not produce a positive tactile response when switching is made by tilting the manipulating shaft.

A multi directional switch having peripheral contacts and a center dome type switch on the bottom surface of its housing is disclosed in JP-11 126126. The center switch supports a rigid plate with an electrically conductive gum at its lower surface and a control lever attached to it. When the control lever is depressed vertically, the center dome type switch is turned to a conductive state. When the control lever is tilted, a pair of peripheral contacts are connected by the conductive gum.

It is an object of the present invention to provide an improved multi-directional switch which may be used in an electronic device employing multi-directional operation.

This object is achieved by the features of claim 1 for a multi-directional switch and by the features of claim 12 for a multi-directional operating device.

Further embodiments are the subject-matter of the dependent claims.

The present invention provides a multi-directional operating switch that allows a selection of either state of continuity or non-continuity between the central contact and the outer contact by way of varying a manipulatory force to tilt the shaft, after an electrical continuity is made between any adjacent pair of the peripheral contacts. In an electronic apparatus equipped with this multi-directional operating switch, for example, it is possible to use the switch in a such functional manner that a variety of items displayed on a display window and the like are scrolled, or moved, at a low speed, when only the peripheral contacts are turned on, and they are scrolled at a high speed, when the central contact and the outer contact are additionally turned on. Moreover, this structure of the switch can prevent damage to contact members such as the peripheral contacts, even if the shaft is tilted excessively due to an unintentional large force given to the manipulation body, since the flange is resilient.

The invention can realize the multi-directional operating switch that is small and thin in size, and exceedingly manipulatable with reliable switching capability, at low cost and having a small number of constituent components. The switch is also capable of producing a certain magnitude of tactile response with only a single dome-like circular movable contact disposed in the case, even when a switching operation is performed between adjacent pairs of the peripheral contacts by tilting the shaft of the manipulation body sideways, in addition to establishing electrical continuity between the central contact and the outer contact by pushing the shaft of the manipulation body vertically downward.

According to one embodiment, the multi-directional operating switch of the present invention includes a case having an opening of a general square shape, provided with a peripheral contact at each corner of the opening, in which a flange of a manipulation body formed into a shape generally similar to the opening is housed. This structure can easily prevent the flange of the manipulation body from turning within the case when the manipulation body is manipulated, and maintain proper positions of both components with respect to each other at all times. Consequently, the manipulating shaft can be tilted and held reliably in a direction intermediate between any adjacent pair of the peripheral contacts disposed at each corner in the case, since the generally square-shaped flange stays stationary with one of its lower sides resting on a bottom surface of the case when the manipulation body is tilted. In addition, the structure makes it easy to set an equal tilting angle of the shaft of the manipulation body at all tilting directions, at which any adjacent pair of the peripheral contacts come into an ON state. Therefore, the invention provides an advantage of realizing a multi-directional operating switch, which is small in overall dimensions with a simple structure, yet capable of making switching operations with an equal angle of tilting manipulation toward all four directions that are frequently used.

In another aspect of this invention, a multi-directional operating switch is constructed so that both an opening in a case and a flange of a manipulation body have a generally rectangle shape. This structure realizes a multi-directional operating switch that can differentiate tilting angles of a shaft of the manipulation body, at which any adjacent pair of peripheral contacts come into an ON state, between two tilting directions intersecting with each other, by varying a proportion in length between a longitudinal side and a lateral side of the rectangular opening and the flange.

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In yet another aspect of the invention, a multi-directional operating switch includes a case having an opening having a generally pentagonal, hexagonal, or octagonal shape, provided with a peripheral contact at each corner of the opening. The opening houses a flange of a manipulation body, formed into a shape generally similar to that of the opening. This structure is able to readily provide the multi-directional operating switch wherein the flange of the manipulation body is restricted from turning within the case, and the manipulation body is tiltable toward a desired number of directions by adopting the polygonal shape having the desired number of sides.

In another aspect of this invention, a multi-directional operating switch includes a case having a generally pentagonal, hexagonal, or octagonal shape, provided with a peripheral contact at each corner of the opening. The opening houses a flange of a manipulation body, formed into a shape generally similar to that of the opening. The opening provides a turn restricting means at a portion where a shaft of the manipulation body engages with a through hole in a cover, in order to maintain a relative position of the flange of the manipulation body with respect to the peripheral contacts in the case. This multi-directional operating switch can be manipulated in a manner that a top end of the shaft of the manipulation body moves circularly while the shaft is kept tilted, since the manipulation body has the circular-shaped flange. Thereby, making it capable of switching a plurality of the peripheral contacts disposed in the circular opening smoothly in a consecutive manner.

Furthermore, a multi-directional operating switch of this invention is provided with a cover having a through hole in a shape other than a circle, and a manipulation body having a shaft also in a shape other than a circle in cross-section, for insertion into the through hole, to serve as a turn restricting means for the manipulation body provided with a circular flange. This structure, despite its simple construction, can reliably prevent the manipulation body from turning within the case.

In a multi-directional operating switch of the present invention having the above-described structure, at least a projection provided on a lower surface of a flange of a manipulation body is constructed of an insulating material. This projection can positively isolate a group of switching circuits through peripheral contacts from another group of switching circuits connected through a central contact and an outer contact via a dome-like circular movable contact.

In another aspect of this invention, a multi-directional operating switch includes a cover made of a rigid insulation material, a manipulation body having a shaft and a projection molded integrally on a lower end of a flange with a rigid insulation material, and an electrically conductive plate-like contact plate secured to the manipulation body. This multi-directional operating switch is capable of obstructing external electrostatic noises and the like from entering into a switching circuit, because the structure protecting the switch contacts a space with the insulative cover. The structure can also provide a product of thin configuration, since it reduces a thickness of the flange secured to the manipulation body.

In still another aspect of this invention, a multi-directional operating switch includes a cover made of a rigid insulation material, a manipulation body having a shaft and a flange composed integrally with an electrically conductive material, and a projection made of an insulation material attached to a lower surface in the center of the flange. Since the shaft and the flange of the manipulation body are integrally composed, they move solidly and positively to create reliable switching with individual contacts, without wobbling, when the manipulation body is subjected to a predetermined manipulatory movement. In addition, the above structure facilitates adjustment of a magnitude of tactile response during a manipulation, if necessary, by selecting a shape and a size of the projection to be attached.

As has been described, this multi-directional operating switch, when mounted in a variety of multi-directional operating devices, can achieve congregation and simplification of a variety of manipulations as well as downsizing, and reductions in thickness and weight at the same time.

Fig. 1 is a sectional front view depicting a multi-directional operating switch of an exemplary embodiment;

Fig. 2 is an exploded perspective view depicting the switch of Fig. 1;

Fig. 3 is a plan view depicting a case of the switch of Fig. 1;

Fig. 4 is a perspective view depicting an underside of an exemplary manipulation body of the switch of Fig. 1;

Fig. 5 is a sectional front view depicting the switch of Fig. 1 with the manipulation body in a tilted position;

Fig. 6 is a sectional front view depicting the switch of Fig. 1 with the manipulation body in a position being depressed vertically downward;

Fig. 7 is a sectional front view depicting another exemplary manipulation body of the switch of Fig. 1;

Fig. 8 is a sectional front view depicting a multi-directional operating switch of a first exemplary embodiment of this invention;
Fig. 8 is a sectional front view depicting the switch of Fig. 7 in a state where a flange is in contact with peripheral contacts during a tilting manipulation;

Fig. 9 is a sectional front view depicting the switch of Fig. 8 in a state where a flange is in contact with peripheral contacts during a tilting manipulation;

Fig. 10 is a sectional front view depicting the switch of Fig. 8 in a state where a shaft of a manipulation body is tilted to a full extent in the tilting manipulation;

Fig. 11 is an exploded perspective view depicting a multi-directional operating switch of a second exemplary embodiment of this invention;

Fig. 12 is an exploded perspective view depicting a multi-directional operating switch of a third exemplary embodiment of this invention;

Fig. 13 is a sectional side view depicting a multi-directional operating switch of the prior art;

Fig. 14 is an exploded perspective view depicting the switch of Fig. 13 with the case partially cut away;

Fig. 15 is a sectional front view depicting the switch of Fig. 13 with the manipulation body in a tilted position; and

Fig. 16 is a sectional front view depicting the switch of Fig. 13 with the manipulation body in a position being depressed vertically downward.

Referring to Fig. 8 through Fig. 12, there is described hereinafter a multi-directional operating switch of exemplary embodiments of the present invention, and a multi-directional operating device equipped with this switch.

Fig. 1 is a sectional front view depicting a multi-directional-operating switch of an exemplary embodiment useful for the understanding of the present invention, and Fig. 2 is an exploded perspective view of the same. In Fig. 1 and Fig. 2, a box-like case 31 made of molded resin for example, is provided in its upper surface with an opening having a generally square shape as viewed from above. This opening is covered by a cover 32 made of a metal plate or the like in the same manner as that of the prior art switch.

Provided on the inner bottom surface of case 31 is a central contact 33, and an outer contact 34 disposed in a position at a predetermined space apart from the central contact 33, as shown in the plan view of Fig. 3. There is provided a raised portion 31A of a predetermined height in an area outside of a circular space having a radius equal to a distance from the central contact 33 to the outer contact 34. In addition, there are four peripheral contacts 35, 36, 37 and 38, all fixed by the insert molding on the raised portion 31A at four corners of the opening. In other words, these peripheral contacts 35, 36, 37 and 38 are disposed in positions equally spaced from the central contact 33 toward its left, right, rear and front at equal angles. There are also terminals 39, 40, 41, 42, 43 and 44 for external connections, respectively corresponding to the central contact 33, the outer contact 34, and the peripheral contacts 35, 36, 37 and 38, protruding outwardly from the case 31.

A dome-like circular movable contact 45 made of a thin resilient sheet metal is disposed in such a manner that an underside surface of a top center portion 45A is above the central contact 33 positioned on the bottom surface of the case 31, and a lower peripheral rim 45B rests directly on and in contact with the outer contact 34 in the case 31.

A manipulation body 46 made of insulation resin, for example, includes a shaft 46A, a flange 46B having a generally square shape formed integrally at a lower end of the shaft, and a projection 46C for a depressing function. Projection 46C is provided coaxially with the shaft 46A in the center portion of a lower surface of the flange 46B. The projection 46C on the manipulation body 46 rests on and is supported by the top center portion 45A of the dome-like circular movable contact 45. The flange 46B is housed in the case 31 with the shaft 46A protruding upwardly from the central through hole 32B in the cover 32. That is, the opening of generally square shape in plan view of the case 31 houses the flange 46B of the manipulation body 46, formed into a generally square shape of a similar configuration. Thereby, the manipulation body 46 can maintain a proper position with respect to the case 31 without turning.

Fig. 4 illustrates a perspective view of an underside of the manipulation body 46. As shown in Fig. 4, the manipulation body 46 has a metal contact plate 47, formed into generally a square shape of substantially the same size as the flange 46B, and fixed to a lower surface of the flange 46B by the outsert molding. This contact plate 47 provides the flange 46B electrical conductivity throughout its lower surface, except for the projection 46C provided in the center portion of the surface.

The manipulation body 46 is provided with an upward thrusting force by the dome-like circular movable contact 45 via the projection 46C on the lower surface at the center of the flange 46B. Under a normal state, in which a manipulating force is not placed on the shaft 46A, the thrusting force holds the flange 46B in direct contact with a lower surface of the cover 32, so as to keep the shaft 46A in its neutral position. The manipulation body 46, i.e. the shaft 46A, is thereby movable according to a vertical manipulation and a tilting manipulation in a predetermined way.

In addition, a manipulation knob 48 of a predetermined shape is attached to the manipulation body 46 by press-fitting a top end of the shaft 46A into a bottom hole 48A of the knob 48. An external configuration of the manipulation knob 48 can be of any shape such as circle, polygon, and the like.

An operation of the multi-directional operating switch of the present exemplary embodiment will be de-
scribed next.

[0039] First, in the normal state shown in Fig. 1, wherein a manipulatory force is not applied to the shaft 46A of the manipulation body 46, all of the contacts of this switch remain in their open state, i.e. OFF position, since the shaft 46A stays in the upright neutral position.

[0040] The description hereinafter pertains to an operation, when a depressive force is placed on the manipulation knob 48 in a manner to push it downward at a point between any adjacent pair of the peripheral contacts disposed on the bottom surface of the case 31, between the contacts 35 and 37 for instance, as shown by an arrow 100 in a sectional front view of Fig. 5. The depressive force makes the manipulation body 46 tilt about a fulcrum at an upper edge 49 of the flange 46B, at a side opposite the position where the depressive force is placed. This causes the projection 46C on the lower surface of the manipulation body 46 to depress and deform the dome-like circular movable contact 45 downward, thereby providing a tactile response. At the same time, it also causes the conductive plate 47 on the lower surface of the flange 46B to contact the peripheral contacts 35 and 37 to make them electrically conductive. Accordingly, this establishes electrical continuity between the terminals 41 and 43 for external connections, as they are integrally formed with the peripheral contacts 35 and 37 respectively.

[0041] Since the flange 46B of the manipulation body 46 (formed into generally square shape) is housed in the opening, (also formed into a generally square shape in a size slightly larger than the flange 46B in plan view,) in the case 31, the manipulation body 46 is effectively prevented from turning. In the above embodiment, the peripheral contacts 35 and 37, i.e. two peripheral contacts adjacent to each other in general, conduct with one another resulting in electrical continuity.

[0042] When the depressive force placed on the manipulation knob 48 is subsequently removed, the dome-like circular movable contact 45 restores the original configuration by a resilient restoring force of its own, and pushes back the projection 46C on the lower surface of the flange 46B upward. The conductive plate 47 on the lower surface of the flange 46B separates from the peripheral contacts 35 and 37 to return these peripheral switch contacts into an open state, and the manipulation body 46 resumes a normal state, in which the shaft 46A is in the upright neutral position, as shown in Fig. 1.

[0043] When the manipulation knob 48 is depressed in the like manner at another position corresponding to a point between any adjacent pair of the peripheral contacts, the manipulation body 46 tilts toward that direction, thereby causing the corresponding peripheral switch contacts to conduct with one another resulting in electrical continuity. An electrical continuity can thus be established between two corresponding terminals for external connections, among combinations of 41 - 42, 42 - 44, 44 - 43, and 43 - 41.

[0044] A signal transmitted through thus established continuity between the peripheral switch contacts is read and examined by a microcomputer for example (not shown in the figure), serving as a switching recognition means, connected to the terminals 41, 42, 43 and 44 for external connections. As a result, the microcomputer is able to recognize that the shaft 46A is tilted toward a direction midway between the above-described adjacent pair of the peripheral switch contacts.

[0045] During a tilting manipulation of the manipulation knob 48, there occurs an inclining force in a lateral direction at a portion where the shaft 46A of the manipulation body 46 engages the bottom hole 48A of the manipulation knob 48. Wobble between the shaft 46A and the bottom hole 48A can be reduced, however, when they are so constructed as to fit and engage by a large margin of dimension.

[0046] If the manipulation knob 48 is depressed in a position closer to the peripheral contact 35 due to an inadvertent deviation from where the pushing manipulation is sought, in an attempt to turn on between the peripheral contacts 35 and 37, the shaft 46A of the manipulation body 46 tilts toward that direction, and causes the contact plate 47 on the lower surface of the flange 46B to come in contact with the peripheral contact 35 first at a corner of it corresponding to the contact 35. However, the flange 46B, as it is formed into an external configuration having a generally square shape, shifts along a side of the bottom surface contiguous to the corner toward the midway point between the peripheral contacts 35 and 37, and rests in that position to eventually provide the peripheral contacts 35 and 37 with a state of electrically continuity.

[0047] There is an occasion in that another signal is transmitted externally through the terminals 39 and 40 for external connections, if the dome-like circular movable contact 45 make unintentional contact with the central contact 33, thus causing continuity between the central contact 33 and the outer contact 34, when the dome-like circular movable contact 45 deforms downward during the tilting manipulation. This signal can be disregarded by the microcomputer (not shown in the figure) and so on, so that it detects a direction of the tilting manipulation only with a continuity signal through an adjacent pair of the peripheral contacts.

[0048] Next, when a vertically downward depressing force is applied on the upper surface at the center of the manipulation knob 48, i.e. the shaft 46A of the manipulation body 46, as shown by an arrow 200 in a sectioned front view of Fig. 6, the manipulation body 46 moves vertically downward. This causes the projection 46C on the lower surface of the flange 46B to depress and deform the dome-like circular movable contact 45 downward, thereby yielding a tactile response. This, in turn, makes the underside surface of the top center portion 45A of the dome-like circular movable contact 45 come in contact with the central contact 33, and establishes electrical continuity between the central contact 33 and the outer contact 34 via the dome-like circular movable con-
contact 45. The terminal 39 for external connection extend- ing from the central contact 33 and another terminal 40 also for external connection extending from the outer contact 34 are thus provided with a state of electrically continuity.

[0049] An erroneous contact does not take place dur- ing this manipulation among the peripheral contacts 35, 36, 37 and 38, because a sufficient space is maintained between the contact plate 47 on the lower surface of the flange 46B and the peripheral contacts 35, 36, 37 and 38.

[0050] When the depressing force is removed from the manipulation knob 48, the dome-like circular movable contact 45 restores its original configuration by its own restoring force, and the manipulation body 46 is pushed back to the normal state shown in Fig. 1.

[0051] As described above, the multi-directional oper- ating switch of this exemplary embodiment is intended to transmit predetermined signals corresponding to a tilting manipulation and a pushing manipulation. In an electronic device in which this switch is provided, there- fore, this switch can readily perform such functions as, for example, selecting a certain item among what are displayed in a display window of the electronic device by moving a cursor or the like in the display with a signal obtained by a tilting manipulation, and entering the se- lected item with a signal obtained by a pushing manip- ulation.

[0052] Furthermore, the multi directional operating switch of this exemplary embodiment has the structure capable of obtaining a tactile response using only the single dome-like circular movable contact 45 disposed in the case 31, when turning an adjacent pair of the peripheral contacts into a conductive state by tilting the shaft 46A of the manipulation body 46, and also when gaining electrical continuity between the central contact 33 and the outer contact 34 by depressing the shaft 46A of the manipulation body 46 vertically downward. Ac- cordingly, this structure can reduce the number of constituent components, and results in a small and thin multi-directional operating switch capable of making a reliable and stable switching function while also attaining a superior manipulatory feeling and operability, at a low cost.

[0053] In the present exemplary embodiment, al- though what has been described is an example of the contact plate 47 being fixed to the lower surface of the flange 46B of the manipulation body 46, the contact plate 47 can be omitted, if the manipulation body 46 is fabricated of an electrically conductive material, and the switch contact space is covered by a cover formed of a rigid insulation material. In this case, the manipulation body can be made easily at even a lower cost. The struc- ture of this example can provide a switch that addition- ally brings the outer contact 34 in electrical continuity with the adjacent pair of peripheral contacts.

[0054] In the above described structure, an isolated condition can be maintained between a group of switch- ing elements consisting of the adjacent pair of peripheral contacts and another group of switching elements consist- ing of the central contact and the outer contact, if a rivet 51 or the like, made of an insulation material, is attached to a lower end of a flange 50, made of an electrically conductive material, as shown in Fig. 7. With the adoption of this structure, a switch having a desired manipulatory feeling can be easily manufactured by simply selecting and mounting a rivet 51 of certain shape, with- out requiring an alteration of the other components.

[0055] Moreover, although what has been described above is an example wherein both the flange of the manip- ulation body and the opening in the case are gener- ally square in shape, this is not restrictive, and they can be of any configuration including a quadrangle. By adopting a rectangular shape for both components, there can be realized easily a multi-direction operating switch that differentiates tilting angles between direc- tions intersecting with each other.

[0056] In the above exemplary embodiment, although what has been described in detail is an example where the peripheral contacts are disposed at each corner of the generally square opening in the case, a pair of the peripheral contacts may be disposed at each side of the opening, so as to provide electrical continuity between them. This arrangement can completely isolate each group of circuits connected to the contacts located at each side of tilting direction from the other groups. Al- ternatively, a state of electrical continuity can be estab- lished between one of the peripheral contacts and the outer contact via an electrically conductive flange, if the manipulation body is constructed of an electrically con- ductive material and the peripheral contacts are dis- posed one at each side of the opening.

[0057] As shown in Fig. 8, a multi-directional operat- ing switch of a first exemplary embodiment of the present invention differs from that of the previously de- scribed exemplary embodiment with respect to the structure of a manipulation body 60 and a cover 66.

[0058] The manipulation body 60 is composed of a shaft body 61 made of a rigid insulation material having an electrically conductive flange 62 having a generally square shape and made of a resilient metal plate se- cured to a lower end portion thereof. The shaft body 61 is such that an upper portion serves as a shaft 63, and a lower end portion protruding below the flange 62 serves as a projection 64.

[0059] The manipulation body 60 is disposed so that the projection 64 on a lower surface of the flange 62 rests in contact with a top center portion 45A of the dome-like circular movable contact 45, so as to receive a thrusting force of the dome-like circular movable con- tact 45 in an upward direction, similar to the first exem- plary embodiment. The flange 62 is housed in a case 31 in such a manner that an upper surface of the flange 62 stays in contact with a lower surface of the cover 66 by the thrusting force, and the shaft 63 protrudes up- wardly from a central through hole 66A in the cover 66.
[0060] In other words, this manipulation body 60 is also movable in response to a vertical manipulation as well as a tilting manipulation of the shaft 63, while being restricted from turning with respect to the case 31, similar to the previous exemplary embodiment.

[0061] Since the cover 66, covering an opening in the case 31, is formed of a rigid insulation material, it is capable of preventing external electrostatic noise and so on from entering into a switching circuit.

[0062] A description of constituent components other than the manipulation body 60 and the cover 66 will not be repeated, as they are identical to those of the previous exemplary embodiment.

[0063] Operation of the multi-directional operating switch as constructed above will be described next. As shown in Fig. 9, when a manipulation knob 48 attached to an upper part of the shaft 63 is depressed at a position between any adjacent pair of peripheral contacts disposed on a bottom surface of the case 31, between the contacts 35 and 37 for instance, as shown by arrow 100, the manipulation body 60 tilts about a fulcrum at an upper edge 65 of the flange 62 of a side opposite the position where the depressing force is applied. This causes the projection 64, an integral part of the shaft 63, to depress and deform the dome-like circular movable contact 45, thereby yielding a tactile response, while also causing a lower surface of the electrically conductive flange 62 to contact with the peripheral contacts 35 and 37 at the same time.

[0064] This establishes a state of electrical continuity between the peripheral contacts 35 and 37 through the electrically conductive flange 62, i.e. an ON state between them, thereby providing an electrical continuity between terminals 41 and 43 for external connections.

[0065] The multi-directional operating switch of this exemplary embodiment is provided with a space (denoted by “L” in Fig. 8) between the lower surface of the electrically conductive flange 62 and upper surfaces of the peripheral contacts 35, 36, 37 and 38. This space is set so that the electrically conductive flange 62 comes in contact with the peripheral contacts 35 and 37 before the dome-like circular movable contact 45 comes in contact with a central contact 33, after the dome-like circular movable contact 45 yields a tactile response when being deformed downward during the tilting manipulation of the manipulation body 60.

[0066] As shown in Fig. 10, when the tilting force is increased thereafter, the dome-like circular movable contact 45 is further depressed downward, as the flange 62 deforms. Consequently, an underside surface of the dome-like circular movable contact 45 comes in contact with the central contact 33, to establish a state of electrical continuity between the central contact 33 and the outer contact 34.

[0067] When the depressing force placed on the manipulation knob 48 is subsequently removed, the manipulation body 60 is pushed upward by resilient restoring forces of the flange 62 and the dome-like circular movable contact 45. As shown in Fig. 8, the lower surface of the flange 62 separates from the peripheral contacts 35 and 37, and the shaft 63 resumes a normal state, i.e. an upright neutral position.

[0068] When the manipulation knob 48 is depressed in the like manner at another position between any adjacent pair of the peripheral contacts, the manipulation body 60 tilts toward that direction, thereby making the corresponding peripheral switch contacts into a state of continuity. Accordingly, the switch functions in the like manner as the previous exemplary embodiment, in that it provides electrical continuity between corresponding terminals, allows a microcomputer to detect a signal delivered through the terminals, and thereby the microcomputer is able to determine a direction of the tilting manipulation of the manipulation body 60.

[0069] When a vertically downward depressing force is applied on the upper surface at the center of the manipulation knob 48, i.e. the shaft 63 of the manipulation body 60, the projection 64 depresses and deforms the dome-like circular movable contact 45 downward, as the manipulation body 60 shifts downwardly, thereby yielding a tactile response, while also causing the dome-like circular movable contact 45 to contact with the central contact 33. This establishes a state of electrical continuity between the central contact 33 and the outer contact 34. When the depressing force is removed, the dome-like circular movable contact 45 restores its original shape by its own restoring force, and pushes the manipulation body 60 back into the normal state shown in Fig. 8. These operations are same as what has been described in the previous exemplary embodiment.

[0070] As described above, the multi-directional operating switch of this exemplary embodiment is operable for electrically making and breaking continuity between the central contact 33 and the outer contact 34 via the dome-like circular movable contact 45 after turning any combination of two contacts among the peripheral contacts 35, 36, 37 and 38 into an ON state by a tilting manipulation of the shaft 63, in addition to the same switching functions provided by the previous exemplary embodiment. Therefore, this multi-directional operating switch is adaptable for such an application, wherein a cursor or the like shown in a display window of a device equipped with this switch is moved to a desired direction at a first speed using a switching signal obtained through the peripheral contacts 35, 36, 37 and 38 by a tilting manipulation, and the moving speed shifted to an even faster second speed with another switching signal through the central contact 33 and the outer contact 34 by depressing the shaft 63 further into the same tilting direction.

[0071] In addition, when the switch is used in a two step operation in a manner as described above, a microcomputer (not show) is able to detect a difference in time of electrical continuity between the switching signal transferred through two contacts among the peripheral contacts 35, 36, 37 and 38 and the other switching signal.
transferred through the center contact 33 and the outer contact 34. Accordingly, the cursor and so on can be scrolled at a speed corresponding to a tilting speed, force, etc. applied to the shaft 63, as they are calculated from the detected results.

[0072] What has been described above is an example wherein the shaft 63 of the manipulation body 60, when tilted, is capable of turning any adjacent pair of the peripheral switch contacts into an ON state after making the dome-like circular movable contact 45 deform and yield a tactile response, followed thereafter by causing the center contact 33 and the outer contact 34 into the state of continuity. However, the switch may be altered into such an operational order that a tilting manipulation of the shaft 63 connects the electrically conductive flange 62 with an adjacent pair of the peripheral contacts, making them first into the state of continuity, and a further tilting force given thereafter to the shaft 63 depresses the dome-like circular movable contact 45 downward by deforming the flange 62, thereby making the center contact 33 and the outer contact 34 into the state of continuity while downwardly deforming the dome-like circular movable contact 45 to yield the tactile response.

[0073] Altering the switch to provide the foregoing operation can produce the tactile response only after the peripheral switch contacts turn into the state of continuity during the tilting manipulation of the shaft 63. However, an operator can get a feel of clicking while making a manipulation of the peripheral switch contacts, since the moment when the peripheral switch contacts turn into the state of continuity and another moment of yielding the tactile response are very close to each other in actual use.

[0074] Even with the multi-directional operating switch constructed as above, the operator is able to know positively a validness of his manipulation by the feel of clicking when making a tilting manipulation, if the microcomputer (not shown) employed for determining the tilting direction is arranged to carry out a process in such a way that it determines a signal from the peripheral switch contacts as being a valid one, only when both of a signal from the peripheral switch contacts and a signal from the center contact 33 and the outer contact 34 are delivered within a predetermined period of time.

[0075] As described above, the cover 66 covering the opening in the case 31 is constructed of a rigid insulation material. This multi-directional operating switch is thus capable of preventing external electrostatic noise and so on from entering a space of the switch contacts, and thereby the switch can be used reliably in an application involving very small voltages and currents.

[0076] In addition, this multi-directional operating switch provides an effect of avoiding damage to the contacts, etc. since the flange 62 is constructed of a resilient body and capable of absorbing an excessive manipulatory force applied to the shaft 63.

[0077] Referring now to Fig. 11, a multi-directional operating switch of a second exemplary embodiment employs an opening of a case and a flange of a manipulating body having different shapes as compared to that of the above-described first exemplary embodiment.

[0078] In other words, a flange 71 of a manipulation body 70 constructed of an insulation material has generally an octagonal shape, for example, in the multi-directional operating switch of this exemplary embodiment, as shown in the Fig. 11. A contact plate 72 fabricated of an electrically conductive material into a shape substantially similar to that of flange 71 is secured to the flange 71 by the outset molding in such a manner as to cover an entire lower surface, except for a lower projection (not shown in the figure) provided on the lower surface in the center of the flange 71.

[0079] The flange 71 is housed in a case 74 having a top opening formed into a generally octagonal shape of a similar configuration in plan view and having a size slightly larger than the flange 71. The case 74 is provided with peripheral contacts 73 on an inner bottom surface, one at each corner of the opening, and a respective terminal protrudes outwardly from each of the peripheral contacts 73. Further description will not be repeated, since the manner in which the flange 71 is housed and the other constituent components are identical to those of the exemplary embodiment.

[0080] The description pertaining to the operation of the switch will also not be repeated, as it operates in a similar manner to that of the first exemplary embodiment.

[0081] This multi-directional operating switch is adaptable to a tilting manipulation in eight directions, since it is provided with a combination of the flange 71 and the opening of the case 74, both being generally octagonal in shape, and eight peripheral contacts 73 positioned on the inner bottom surface at each corner of the opening in the case 74 at an equal distance and an equal angle from each other, it.

[0082] A multi-directional operating switch tiltable to a desired number of directions can also be obtained by arranging a combination of the flange of the manipulation body and the opening of the case having a polygonal shape, such as a pentagon, a hexagon, and the like according to the desired number of tilting directions, and disposing the peripheral contacts on the inner bottom surface at each corner of the opening.

[0083] Referring now to Fig. 12, a multi-directional operating switch of a third exemplary embodiment employs a circular shape for an opening of a case and a flange of a manipulation body, as opposed to those of the above described exemplary embodiments.

[0084] As shown in Fig. 12, a contact plate 82 fabricated of an electrically conductive material into substantially the same shape as a flange 81 is mounted on a flange 81 having a circular shape, for example, of a manipulation body 80 constructed of an insulation material by the outset molding to make a lower surface of the flange 81 electrically conductive, in a manner similar to...
the previous exemplary embodiments. A description of further details will therefore not be repeated.

[0085] A shaft 83 of the manipulation body 80 formed into a quadrangular prism shape is inserted through a central through hole 32B of a cover 32, and the engaged portion between them provides a turn restraining means of the manipulation body 80.

[0086] Moreover, the flange 81 of the manipulation body 80 is housed in the case 84 having the opening of a circular shape as viewed from the above. Peripheral contacts 85 are disposed on an inner bottom surface of the opening in the case 84 in a corresponding manner to an orientation of corners of the shaft 83 so as to be equidistant and equiangular in the four directions with respect to the center of the opening of the case 84. Terminals for external connections of the contacts protrude outwardly from the case 84.

[0087] Further description will not be repeated, since a manner in which the flange 81 is housed in the opening of the case 84 and other constituent components are identical to those of the previous exemplary embodiments. Description as to how the switch operates is also omitted, as it is the same as in the case of the first exemplary embodiment. The multi-directional operating switch of this exemplary embodiment is capable of preventing the manipulation body 80, when being manipulated, from turning within the case 84 by the turn restraining means.

[0088] The turn restraining means may be composed of a combination of other shapes such as a polygonal shape or an elliptical shape, besides the foregoing configuration. In a switch provided with a combination of components with polygonal shape having many corners such as a polygon, in particular, the manipulation body becomes capable of being moved continuously in a manner that a tip of the shaft shifts along a circle while the shaft of the manipulation body is kept tilted, and thereby the peripheral contacts can be switched smoothly and consecutively along a given circular direction.

[0089] The fourth exemplary embodiment relates to a multi-directional operating device using a multi-directional operating switch of this invention. A mobile communications device will be described as an example. In the mobile communications device such as a portable telephone, a radio pager, and the like, equipped with a multi-directional operating switch of this invention, for instance, an operator is able to perform a tilting manipulation of a shaft to move a cursor, to scroll and search a menu, characters, etc., shown in a display window such as a liquid crystal screen, make a pushing manipulation of a shaft again within a predetermined period of time.

[0090] The fifth exemplary embodiment relates to a multi-directional operating device using a multi-directional operating switch of this invention. Various kinds of remote controllers and audio equipment are examples of a device as described below. In a remote controller and audio equipment equipped with a multi-directional operating switch of this invention, an operator can turn a power supply on and off, or select playback and stop one after another for example, by repeating a pushing manipulation of a shaft. The operator can execute a number of prearranged commands, such as selection of a station or music, raise and lower sound volume, fast-forwarding and rewinding, and so on, by making tilting manipulations of the shaft, if the commands are appropriately combined and allocated to each of a forward-to-backward direction and a right-to-left direction in tilting manipulation of the shaft. In addition, the operator can also switch the commands allocated to the multi-directional operating device by making a pushing manipulation of the shaft.

[0091] The sixth exemplary embodiment relates to a multi-directional operating device using a multi-directional operating switch of this invention. A game machine and a car navigation system will be described as an example. In the game machine or the car navigation system equipped with a multi-directional operating switch of this invention, an operator performs a tilting manipulation of a shaft to move a character or a map in a display window according to a certain manner of tilting the shaft, and executes a prearranged command such as changing a magnification of the map, jumping the character, and so on by a pushing manipulation of the shaft.

[0092] The seventh exemplary embodiment relates to a multi-directional operating device using a multi-directional operating switch of this invention, and an electronic camera will be taken as an example. In the electronic camera equipped with a multi-directional operating switch of this invention, an operator performs a tilting manipulation of a shaft to select a shutter speed, a lens opening, and so on, and sets the selected values by a subsequent pushing manipulation of the shaft. Furthermore, the operator can set a position of an object to be focused in a view finder by making another tilting manipulation of the shaft, bring the focus on the subject by pushing the shaft, and release a shutter by pushing the shaft again within a predetermined period of time.

[0093] The eighth exemplary embodiment relates to a multi-directional operating device using a multi-directional operating switch of this invention, and a computer will be taken as an example. In a computer equipped with a multi-directional operating switch of this invention, an operator can enter and execute a menu by making a pushing manipulation of a shaft, after moving a cursor in a display window and selecting the menu by a tilting manipulation of the shaft.

[0094] As has been described, the present invention can provide the multi-directional operating switch having such advantageous features as using a small number of constituent components, small outer dimensions and thickness, a low cost, as well as performing a reliable and steady switching operation with a positive tactile response even when making the switching operation by tilting the manipulation body sideways.
In addition, the multi-directional operating device using the multi-directional operating switch of this invention realizes an effect of achieving congregation and simplification of a variety of operating functions at the same time with reduction in size, thickness and weight.

Claims

1. A multi-directional operating switch comprising:
   a case (31, 74, 84) having an opening in an upper surface thereof, said case including a central contact (33), an outer contact (34) disposed in a position spaced away from said central contact (33), and a plurality of peripheral contacts (35, 36, 37, 38, 73, 85), all disposed on a bottom surface of said opening;
   a dome-like circular movable contact (45) having a center portion (45A) disposed above said central contact (33), and a lower peripheral rim (45B) of said dome-like circular movable contact (45) resting in contact with said outer contact (34);
   a cover (32, 66) having with a through hole (32B, 66A) in a location concentrical to said dome-like circular movable contact (45); and
   a manipulation body (60) comprising a shaft (63) protruding said through hole (32B, 66A), a flange (62) having electrical conductivity on at least a lower surface thereof, said flange (62) disposed at a lower end of said shaft (63), and a projection (64) extending from the lower surface of said flange (62), said shaft (63) being both tiltable and movable in a vertical direction, and said manipulation body (60) biased upwardly by said dome-like circular movable contact (45) in a manner that at least a peripheral surface of said flange (62) is in contact with a lower surface of said cover (32, 66), wherein said projection (64) on said flange (62) depresses and deforms said dome-like circular movable contact (45) to establish a first electrical continuity between said central contact (33) and said outer contact (34), when said shaft (63) is made of an electrically conductive material having resiliency, wherein said multi-directional operating switch establishes said second electrical continuity between an adjacent pair of said plurality of peripheral contacts (35, 36, 37, 38, 73, 85), and, thereafter, said first electrical continuity between said central contact (33) and said outer contact (34), as said projection (64) under said flange (62) subsequently depresses said dome-like circular movable contact (45), when said shaft is tilted.

2. The multi-directional operating switch according to claim 1, wherein said opening in said case (31, 74, 84) and said flange (62) of said manipulation body (60) are substantially similar in shape.

3. The multi-directional operating switch according to claim 2, wherein said opening in said case (31, 74, 84) has a shape of one of a rectangle, a square, a pentagon, a hexagon, an octagon, and a circle.

4. The multi-directional operating switch according to any of claims 1-3, wherein said plurality of peripheral contacts (35-38, 73, 85) are disposed on said bottom surface at respective sides of said opening in said case (31, 74, 84).

5. The multi-directional operating switch according to any of claims 1 to 3, wherein said plurality of peripheral contacts (35-38, 73, 85) are disposed on said bottom surface at respective corners of said opening in said case (31, 74, 84).

6. The multi-directional operating switch according to any of claims 1-5, wherein said opening in said case (84) is substantially circular in shape, said plurality of peripheral contacts (85) are disposed at an equal distance from a center of said case (84), and at substantially equal angular positions, said flange (62) of said manipulation body (60) is formed into a circular shape having a size smaller than a size of said opening, and a turn restricting means for said manipulation body (60) is provided in a portion where said shaft (63) of said manipulation body (60) engages said through hole (32B) in said cover (32).

7. The multi-directional operating switch according to claim 6, wherein said turn restricting means comprises said through hole (32B) in said cover (32) having a non-circular shape and said shaft (63) of said manipulation body (60) having a shape substantially similar to that of said through hole (32B).

8. The multi-directional operating switch according to claim 6 or 7, wherein said through hole (32B) has a square shape and said shaft (63) has a quadrangular prism shape.
9. The multi-directional operating switch according to any of claims 1 to 8, wherein at least said projection (64) provided on a lower surface of said flange (62) of said manipulation body (60) is composed of an insulation material.

10. The multi-directional operating switch according to any of claims 1 to 9, wherein said cover (32) is made of a rigid insulation material, said shaft (63) and said flange (62) of said manipulation body (60) are integrally formed of an electrically conductive material, and said projection (64) is made of an insulation material fixed on the lower surface at a center of said flange (62).

11. The multi-directional operating switch according to any of claims 1 to 10, wherein said manipulation body (60) is anti-rotatable within said case (31, 74).

12. A multi-directional operating device provided with the multi-directional operating switch of claim 1, wherein said device is adapted for:

- detecting an ON state between an adjacent pair of said plurality of peripheral contacts (35, 36, 37, 38, 73, 85) responsive to said shaft (63) of said manipulation body (60) being tilted for performing one of selecting an item among a plurality of items and moving a displayed object, and detecting an ON state between said central contact (33) and said outer contact (34) when said shaft (63) is continuously depressed vertically for a plurality of times within a predetermined period of time, for executing a plurality of predetermined commands in a sequential order by said signals.

- detecting said shaft (63) of said manipulation body (60) being tilted, for selecting an item among a plurality of items; and detecting said shaft (63) being depressed vertically downward, for executing a command pre-allocated to said moved object.

13. A multi-directional operating device according to claim 12, wherein said device is adapted for:

- detecting said shaft (63) of said manipulation body (60) being tilted, for selecting an item among a plurality of items; and detecting said shaft (63) being depressed vertically downward, for executing a command pre-allocated to a selected signal; and detecting said shaft (63) being depressed vertically downward, for executing a command pre-allocated in advance to said moved object.

15. The multi-directional operating device according to claim 13, wherein said device detects sequential switching signals transmitted from said central contact (33) and said outer contact (34) produced when said shaft (63) is continuously depressed vertically for a plurality of times within a predetermined period of time, for executing a plurality of predetermined commands in a sequential order by said signals.

16. The multi-directional operating device according to claim 13, wherein said device executes a command pre-allocated to each of tilting directions of said shaft (63), when said shaft (63) is tilted in directions opposite to each other with respect to a neutral position of said shaft (63).

17. The multi-directional operating device according to claim 13, wherein said device detects an ON state between said central contact (33) and said outer contact (34) when said shaft (63) is depressed vertically downward, and switches a command pre-allocated to each of respective tilting directions of said shaft (63) in a predetermined order.

18. The multi-directional operating device according to claim 14, wherein said device detects sequential switching signals transmitted from said central contact (33) and said outer contact (34) produced when said shaft (63) is continuously depressed vertically for a plurality of times within a predetermined period of time, for executing a plurality of predetermined commands in a sequential order by said signals.

19. The multi-directional operating device according to claim 14, wherein said device executes a command pre-allocated to each of tilting directions of said shaft (63), when said shaft (63) is tilted in directions opposite to each other with respect to a neutral position of said shaft (63).

20. The multi-directional operating device according to claim 14, wherein said device detects an ON state between said central contact (33) and said outer contact (34) when said shaft (63) is depressed vertically downward, and switches a command pre-allocated to each of respective tilting directions of said shaft (63) in a predetermined order.

21. A multi-directional operating device according to any of claims 12 to 20, wherein said device is adapted for detecting an ON state between said central contact (33) and said outer contact (34) responsive to said shaft (63) being tilted and deforming said re-
silient flange (62).

22. A multi-directional operating device according to claim 21, wherein a cursor is moved at a first speed in a direction specified by said tilting direction of said multi-directional operating switch when said ON state between an adjacent pair of peripheral contacts (35, 36, 37, 38, 73, 85) is detected, and said cursor is moved in said direction at a second speed when subsequently said ON state between said central contact (33) and said outer contact (34) responsive to said shaft (63) being tilted is detected.

23. A multi-directional operating device according to claim 21, wherein a time difference between said ON state between an adjacent pair of peripheral contacts (35, 36, 37, 38, 73, 85) and subsequently said ON state between said central contact (33) and said outer contact (34) responsive to said shaft (63) being tilted is detected.

24. A multi-directional operating device according to claim 23 wherein said time difference is used to determine a speed of a cursor.

25. A multi-directional operating device according to claim 23 wherein said time difference is used to validate a signal obtained from said peripheral contacts (35, 36, 37, 38, 73, 85).

26. The multi-directional operating switch according to claim 1, wherein said cover (66) is made of a rigid insulation material, said manipulation body (60) is made of a rigid insulation material and integrally formed with said shaft (63) and said projection (64) on the lower surface of said flange (62), and an electrically conductive contact plate is fixed to the lower surface of said flange (62).

Patentansprüche

1. Mehrrichtungs-Betätigungsschalter, der umfasst:

- ein Gehäuse (31, 74, 84) mit einer Öffnung in einer Oberseite, wobei das Gehäuse einen mittleren Kontakt (33), einen äußeren Kontakt (34), der an einer Position von dem mittleren Kontakt (33) befestigt angeordnet ist, und eine Vielzahl von Randkontakten (35, 36, 37, 38, 73, 85) enthält, die sämtlich auf einer Bodenfläche der Öffnung angeordnet sind;

- einen haubenartigen kreisförmigen beweglichen Kontakt (45) in Kontakt mit dem äußeren Kontakt (34) liegt;

- eine Abdeckung (32, 66) mit einem Durchgangsloch (32B, 66A) an einer Position, die konzentrisch zu dem haubenartigen kreisförmigen beweglichen Kontakt (45) ist; und

- einen Bedienkörper (60), der einen Schaft (63), der durch das Loch (63B, 66A) vorstehend, einen Flansch (62) mit elektrischer Leitfähigkeit an wenigstens einer Unterseite desselben, wobei der Flansch (62) an einem unteren Ende des Schaftes (63) angeordnet ist, und einen Vor sprung (64) umfasst, der sich von der Unterseite des Flansches (62) aus erstreckt, wobei der Schacht (63) sowohl geneigt als auch in einer vertikalen Richtung bewegt werden kann, und der Bedienkörper (60) durch den haubenartigen kreisförmigen beweglichen Kontakt (45) so nach oben gespannt wird, dass wenigstens eine Randfläche des Flansches (62) in Kontakt mit einer Unterseite der Abdeckung (32, 66) ist,

   dadurch gekennzeichnet, dass:

- der Flansch (62) aus einem elektrisch leitenden Material mit Elastizität besteht,

2. Mehrrichtungs-Betätigungsschalter nach Anspruch 1, wobei die Öffnung in dem Gehäuse (31, 74, 84) und der Flansch (62) des Bedienkörpers (60) im Wesentlichen gleich geformt sind.

3. Mehrrichtungs-Betätigungsschalter nach Anspruch
2, wobei die Öffnung in dem Gehäuse (31, 74, 84) eine Form eines Rechtecks, eines Quadrats, eines Fünfecks, eines Sechsecks oder eines Kreises hat.


5. Mehrrichtungs-Betätigungsschalter nach einem der Ansprüche 1 bis 3, wobei die Vielzahl von Randkontakten (35-38, 73, 85) auf der Bodenfläche an entsprechenden Seiten der Öffnung in dem Gehäuse (31, 74, 84) angeordnet sind.

6. Mehrrichtungs-Betätigungsschalter nach einem der Ansprüche 1-5, wobei die Öffnung in dem Gehäuse (84) im Wesentlichen kreisförmig ist, die Vielzahl von Randkontakten (85) in einem gleichen Abstand zu einer Mitte des Gehäuses (84) und an im Wesentlichen gleichen Winkelpositionen angeordnet sind, der Flansch (62) des Bedienkörpers (60) in einer Kreisform ausgebildet ist, die eine Größe hat, die geringer ist als eine Größe der Öffnung, und eine Dreheinschränkeinrichtung für den Bedienkörper (60) in einem Abschnitt vorhanden ist, in dem der Schaft (63) des Bedienkörpers (60) mit dem Durchgangsloch (32B) in der Abdeckung (32) in Eingriff kommt.

7. Mehrrichtungs-Betätigungsschalter nach Anspruch 6, wobei die Dreheinschränkeinrichtung das Durchgangsloch (32B) in der Abdeckung (32) umfasst und der Schaft (63) des Bedienkörpers (60) eine Form hat, die im Wesentlichen der des Durchgangslochs (32B) mit einer Nichtkreisform gleicht.

8. Mehrrichtungs-Betätigungsschalter nach Anspruch 6 oder 7, wobei das Durchgangsloch (32B) eine quadratische Form hat, und der Schaft (63) die Form eines viereckigen Prisms hat.

9. Mehrrichtungs-Betätigungsschalter nach einem der Ansprüche 1 bis 8, wobei die wenigstens eine Vorsprung (64), der an einer Unterseite des Flansches (62) des Bedienkörpers (60) vorhanden ist, aus einem Isoliermaterial besteht.

10. Mehrrichtungs-Betätigungsschalter nach einem der Ansprüche 1 bis 9, wobei die Abdeckung (32) aus einem starren Isoliermaterial besteht, der Schaft (63) und der Flansch (62) des Bedienkörpers (60) integral aus einem elektrisch leitenden Material ausgebildet sind und der Vorsprung (54) aus einem Isoliermaterial besteht, das an der Unterseite in einer Mitte des Flansches (62) befestigt ist.

11. Mehrrichtungs-Betätigungsschalter nach einem der Ansprüche 1 bis 10, wobei der Bedienkörper (60) in dem Gehäuse (31, 74) nicht drehbar ist.

12. Mehrrichtungs-Betätigungsvorrichtung, die mit dem Mehrrichtungs-Betätigungsschalter nach Anspruch 1 versehen ist, wobei die Vorrichtung so eingerichtet ist, dass sie:

   einen AN-Zustand zwischen einem aneinandergrenzenden Paar der Vielzahl von Umfangskontakten (35, 36, 37, 38, 73, 85) in Reaktion darauf erfasst, dass der Schaft (63) des Bedienkörpers (60) geneigt wird, um ein Element aus einer Vielzahl von Elementen auszuwählen oder ein angezeigtes Objekt zu verschieben, und

   einen AN-Zustand zwischen dem mittleren Kontakt (33) und dem äußeren Kontakt (34) in Reaktion darauf erfasst, dass der Schaft (63) vertikal nach unten eingedrückt wird, um das ausgewählte Element einzugeben, wenn das Element durch Neigen des Schaftes (63) ausgewählt wird, oder einen Befehl auszuführen, der dem angezeigten Objekt zugeordnet ist, wenn das angezeigte Objekt durch Neigen des Schaftes (63) verschoben wird.

13. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 12, wobei die Vorrichtung so eingerichtet ist, dass sie:

   erfasst, dass der Schaft (63) des Bedienkörpers (60) geneigt wird, um ein Element aus einer Vielzahl von Elementen auszuwählen; und

   erfasst, dass der Schaft (63) vertikal nach unten gedrückt wird, um das aus der Vielzahl von Elementen ausgewählte Element einzugeben.

14. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 12, wobei die Vorrichtung so eingerichtet ist, dass sie:

   erfasst, dass der Schaft (63) des Bedienkörpers (60) geneigt wird, um eines einer Vielzahl von Signalen auszuwählen, denen Richtungen eines Vektors vorzugeben sind, um ein angezeigtes Objekt in einer Richtung des Vektors zu verschieben, der einem ausgewählten Signal entspricht; und

   erfasst, dass der Schaft (63) vertikal nach unten eingedrückt wird, um einen Befehl auszuführen, der dem verschobenen Objekt im Vor- aus zugeordnet wird.
15. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 13, wobei die Vorrichtung sequentielle Schaltsignale erfasst, die von dem mittleren Kontakt (33) und dem äußeren Kontakt (34) übertragen und erzeugt werden, wenn der Schaft (63) mehrmals innerhalb eines vorgegebenen Zeitraums kontinuierlich vertikal gedrückt wird, um eine Vielzahl vorgegebener Befehle in einer sequentiellen Reihenfolge durch die Signale auszuführen.

16. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 13, wobei die Vorrichtung einen Befehl ausführt, der jeder der Neigungsrichtungen des Schaftes (63) vorzugewiesen ist, wenn der Schaft (63) in Richtungen geneigt wird, die einander in Bezug auf eine neutrale Position des Schaftes (63) gegenüberliegen.

17. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 13, wobei die Vorrichtung einen AN-Zustand zwischen dem mittleren Kontakt (33) und dem äußeren Kontakt (34) erfasst, wenn der Schaft (63) vertikal nach unten gedrückt wird, und einen Befehl, der jeder der entsprechenden Neigungsrichtungen des Schaftes (63) vorzugewiesen ist, in einer vorgegebenen Reihenfolge schaltet.

18. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 14, wobei die Vorrichtung sequentielle Schaltsignale erfasst, die von dem mittleren Kontakt (33) und dem äußeren Kontakt (34) übertragen und erzeugt werden, wenn der Schaft (63) mehrmals innerhalb eines vorgegebenen Zeitraums kontinuierlich vertikal gedrückt wird, um eine Vielzahl vorgegebener Befehle in einer sequentiellen Reihenfolge durch die Signale auszuführen.

19. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 14, wobei die Vorrichtung einen Befehl ausführt, der jeder der Neigungsrichtungen des Schaftes (63) vorzugewiesen ist, wenn der Schaft (63) in Richtungen geneigt wird, die einander in Bezug auf eine neutrale Position des Schaftes (63) gegenüberliegen.

20. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 14, wobei die Vorrichtung einen AN-Zustand zwischen dem mittleren Kontakt (33) und dem äußeren Kontakt (34) erfasst, wenn der Schaft (63) vertikal nach unten gedrückt wird, und einen Befehl, der jeder der entsprechenden Neigungsrichtungen des Schaftes (63) vorzugewiesen ist, in einer vorgegebenen Reihenfolge schaltet.

21. Mehrrichtungs-Betätigungsvorrichtung nach einem der Ansprüche 12 bis 20, wobei die Vorrichtung so eingerichtet ist, dass sie einen AN-Zustand zwischen dem mittleren Kontakt (33) und dem äußeren Kontakt (34) in Reaktion darauf erfasst, dass der Schaft (63) geneigt wird und den elastischen Flansch (62) verformt.


23. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 21, wobei ein Zeitunterschied zwischen dem AN-Zustand zwischen einem aneinandergrenzenden Paar Randkontakte (35, 36, 37, 38, 73, 85) und anschließend dem AN-Zustand zwischen dem mittleren Kontakt (33) und dem äußeren Kontakt (34) in Reaktion auf Neigung des Schaftes (63) erfasst wird.

24. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 23, wobei der Zeitunterschied verwendet wird, um eine Geschwindigkeit eines Cursors zu bestimmen.

25. Mehrrichtungs-Betätigungsvorrichtung nach Anspruch 23, wobei der Zeitunterschied verwendet wird, um ein Signal zu bewerten, das von den Randkontakten (35, 36, 37, 38, 73, 85) bezogen wird.

26. Mehrrichtungs-Betätigungsschalter nach Anspruch 1, wobei die Abdeckung (66) aus einem starren Isoliermaterial besteht, der Bedienkörper (60) aus einem starren Isoliermaterial besteht und integral mit dem Schaft (63) und dem Vorsprung (64) an der Unterseite des Flansches (62) ausgeführt ist, und eine elektrisch leitende Kontaktplatte an der Unterseite des Flansches (62) befestigt ist.

Revendications

1. Interrupteur de commande multidirectionnel comprenant :

un boîtier (31, 74, 84) présentant une ouverture sur sa surface supérieure, ledit boîtier comportant un contact central (33), un contact externe (34) disposé dans une position espacée dudit contact central (33) et une pluralité de contacts périphériques (35, 36, 37, 38, 73, 85), tous dis-
Interrupteur de commande multidirectionnel selon la revendication 1, dans lequel ladite ouverture bascule ladite tige circulaire semblable à un dôme lorsque on fait presser ensuite ladit contact mobile (62) en réponse au déplacement de ladite bride (62) presse et déforme ladit contact mobile circulaire semblable à un dôme (45) ; et un corps de manipulation (60) comprenant une tige (63) dépassant dudit trou traversant (32B, 66A), une bride (62) électriquement conductrice sur une surface inférieure au moins de celle-ci, ladite bride (62) à un niveau d’une extrémité inférieure de ladite tige (63) et une saillie (64) s’étendant à partir de la surface inférieure de ladite bride (62), ladite tige (63) étant à la fois basculante et mobile dans un sens vertical et ledit corps de manipulation (60) étant sollicité vers le haut par ledit contact mobile circulaire semblable à un dôme (45) d’une manière telle qu’une surface périphérique au moins de ladite bride (62) soit en contact avec une surface inférieure dudit couvercle (32, 66), dans lequel ladite saillie (64) sur ladite bride (62) presse et déforme ledit contact mobile circulaire semblable à un dôme (45) pour établir une première continuité électrique entre ledit contact central (33) et ledit contact externe (34) lorsqu’on déplace ladite tige (63) dans un sens vers le bas et la surface inférieure de ladite bride (62) établit une deuxième continuité électrique entre deux contacts adjacents parmi ladite pluralité de contacts périphériques (35 à 38, 73, 85) en réponse au déplacement de ladite tige (63) dans un sens de basculement, caractérisé en ce que ladite bride (62) est constituée d’un matériau électriquement conducteur présentant une élasticité, dans lequel ledit interrupteur de commande multidirectionnel établit ledit deuxième continuité électrique entre deux contacts adjacents parmi ladite pluralité de contacts périphériques (35 à 38, 73, 85) et ensuite ladite premiére continuité électrique entre ledit contact central (33) et ledit contact externe (34) lorsque ladite saillie (64) sous ladite bride (62) presse ensuite ledit contact mobile circulaire semblable à un dôme (45) lorsqu’on fait basculer ladite tige.

2. Interrupteur de commande multidirectionnel selon la revendication 1, dans lequel ladite ouverture dans ledit boîtier (31, 74, 84) et ladite bride (62) dudit corps de manipulation (60) sont de forme sensiblement similaire.

3. Interrupteur de commande multidirectionnel selon la revendication 2, dans lequel ladite ouverture dans ledit boîtier (31, 74, 84) présente une forme parmi celles d’un rectangle, d’un carré, d’un pentagone, d’un hexagone, d’un octogone et d’un cercle.

4. Interrupteur de commande multidirectionnel selon l’une quelconque des revendications 1 à 3, dans lequel ladite pluralité de contacts périphériques (35 à 38, 73, 85) est disposée sur ladite surface de fond aux coins respectifs de ladite ouverture dans ledit boîtier (31, 74, 84).

5. Interrupteur de commande multidirectionnel selon l’une quelconque des revendications 1 à 3, dans lequel ladite pluralité de contacts périphériques (35 à 38, 73, 85) est disposée sur ladite surface de fond sur les côtés respectifs de ladite ouverture dans ledit boîtier (31, 74, 84).

6. Interrupteur de commande multidirectionnel selon l’une quelconque des revendications 1 à 5, dans lequel ladite ouverture dans ledit boîtier (84) est de forme sensiblement circulaire, les contacts de ladite pluralité de contacts périphériques (85) sont disposés à une distance égale à partir d’un centre dudit boîtier (84) et dans des positions angulaires sensiblement égales, ladite bride (62) dudit corps de manipulation (60) est de forme circulaire d’une taille égales, ladite bride (62) dudit corps de manipulation (60) est prévu dans une partie où ladite tige (63) dudit corps de manipulation (60) s’engage dans ledit trou traversant (32B) dans ledit couvercle (32).

7. Interrupteur de commande multidirectionnel selon la revendication 6, dans lequel ledit moyen de limitation de la rotation est composé dudit trou traversant (32B) dans ledit couvercle (32) présentant une forme non circulaire et de ladite tige (63) dudit corps de manipulation (60) présentant une forme sensiblement similaire à celle dudit trou traversant (32B).

8. Interrupteur de commande multidirectionnel selon la revendication 6 ou 7, dans lequel ledit trou traversant (32B) présente une forme carrée et ladite tige (63) présente une forme de prisme quadrangulaire.

9. Interrupteur de commande multidirectionnel selon l’une quelconque des revendications 1 à 8, dans lequel au moins ladite saillie (64) prévue sur une surface inférieure de ladite bride (62) dudit corps de manipulation (60) est composée d’un matériau iso-
10. Interrupteur de commande multidirectionnel selon l'une quelconque des revendications 1 à 9, dans lequel ledit couvercle (32) est constitué d'un matériau isolant rigide, ladite tige (63) et ladite bride (62) du dit corps de manipulation (60) sont formées d'une seule pièce d'un matériau électriquement conducteur et ladite saillie (64) est constituée d'un matériau isolant et fixée sur la surface inférieure au centre de ladite bride (62).

11. Interrupteur de commande multidirectionnel selon l'une quelconque des revendications 1 à 10, dans lequel ledit corps de manipulation (60) est anti-ro-tatif à l'intérieur dudit boîtier (31, 74).

12. Interrupteur de commande multidirectionnel pourvu de l'interrupteur de commande multidirectionnel selon la revendication 1, dans lequel ledit dispositif est adapté pour :

- détecter un état de courant passant entre deux contacts adjacents parmi ladite pluralité de contacts périphériques (35, 36, 37, 38, 73, 85) en réponse au basculement de ladite tige (63) dudit corps de manipulation (60) pour effectuer une des actions parmi la sélection d'un article parmi une pluralité d'articles et déplacer un objet affiché, et
- détecter un état de courant passant entre ledit contact central (33) et ledit contact externe (34) en réponse à la pression sur ladite tige (63) verticalement vers le bas pour effectuer une des actions parmi l'entrée dudit article sélectionné lorsque ledit article est sélectionné en basculant ladite tige (63) et l'exécution d'une commande affectée au dit objet affiché lorsqu'on déplace ledit objet affiché en basculant ladite tige (53).

13. Dispositif de commande multidirectionnel selon la revendication 12, dans lequel ledit dispositif est adapté pour :

- détecter le basculement de ladite tige (63) dudit corps de manipulation (60) pour sélectionner un article parmi une pluralité d'articles ; et
- détecter que ladite tige (63) est pressée verticalement vers le bas pour entrer ledit article sélectionné parmi ladite pluralité d'articles.

14. Dispositif de commande multidirectionnel selon la revendication 12, dans lequel ledit dispositif est adapté pour :

- détecter le basculement de ladite tige (63) dudit corps de manipulation (60) pour sélectionner un signal parmi une pluralité de signaux auxquels les directions d'un vecteur sont pré-attribuées dans ce but, afin de déplacer un objet affiché dans la direction dudit vecteur correspondant à un signal sélectionné ; et
- détecter que ladite tige (63) est pressée verticalement vers le bas pour exécuter une commande attribuée à l'avance audit objet déplacé.

15. Dispositif de commande multidirectionnel selon la revendication 13, dans lequel ledit dispositif détecte des signaux séquentiels de commutation transmis à partir dudit contact central (33) et dudit contact externe (34) produits lorsqu'on presse ladite tige (63) verticalement de façon continue une pluralité de fois dans une période de temps prédéterminée afin d'exécuter une pluralité de commandes, prédéterminées dans un ordre séquentiel par lesdits signaux.

16. Dispositif de commande multidirectionnel selon la revendication 13, dans lequel ledit dispositif exécute une commande pré-attribuée à chacune des directions de basculement de ladite tige (63) lorsqu'on bascule ladite tige (63) dans des directions opposées les unes aux autres par rapport à une position neutre de ladite tige (63).

17. Dispositif de commande multidirectionnel selon la revendication 13, dans lequel ledit dispositif détecte un état de courant passant entre ledit contact central (33) et ledit contact externe (34) lorsqu'on presse ladite tige (63) verticalement vers le bas et commute une commande pré-attribuée à chacune des directions de basculement respectives de ladite tige (63) dans un ordre prédéterminé.

18. Dispositif de commande multidirectionnel selon la revendication 14, dans lequel ledit dispositif détecte des signaux séquentiels de commutation transmis à partir dudit contact central (33) et dudit contact externe (34), produits lorsqu'on presse ladite tige (63) verticalement de façon continue une pluralité de fois à l'intérieur d'une période de temps prédéterminée afin d'exécuter une pluralité de commandes, prédéterminées dans un ordre séquentiel par lesdits signaux.

19. Dispositif de commande multidirectionnel selon la revendication 14, dans lequel ledit dispositif exécute une commande pré-attribuée à chacune des directions de basculement de ladite tige (63) lorsqu'on bascule ladite tige (63) dans des directions opposées les unes aux autres par rapport à une position neutre de ladite tige (63).

20. Dispositif de commande multidirectionnel selon la revendication 14, dans lequel ledit dispositif détecte
un état de courant passant entre ledit contact central (33) et ledit contact externe (34) lorsqu’on presse ladite tige (63) verticalement vers le bas et commute une commande pré-attribuée à chacune des directions de basculement respectives de ladite tige (63) dans un ordre prédéterminé.

21. Dispositif de commande multidirectionnel selon l’une quelconque des revendications 12 à 20, dans lequel ledit dispositif est adapté pour détecter un état de courant passant entre ledit contact central (33) et ledit contact externe (34) en réponse au basculement de ladite tige (63) et à la déformation de ladite bride élastique (62).

22. Dispositif de commande multidirectionnel selon la revendication 21, dans lequel un curseur se déplace à une première vitesse dans une direction spécifiée par ladite direction de basculement dudit interrupteur de commande multidirectionnel lorsque ledit état de courant passant entre deux contacts adjacents des contacts périphériques (35, 36, 37, 38, 73, 85) est détecté et ledit curseur se déplace dans ladite direction à une deuxième vitesse lorsque ensuite ledit état de courant passant entre ledit contact central (33) et ledit contact externe (34) en réponse au basculement de ladite tige (63) est détecté.

23. Dispositif de commande multidirectionnel selon la revendication 21, dans lequel une différence de temps entre ledit état de courant passant entre deux contacts adjacents des contacts périphériques (35, 36, 37, 38, 73, 85) et ensuite ledit état de courant passant entre ledit contact central (33) et ledit contact externe (34) en réponse au basculement de ladite tige (63) est détecté.

24. Dispositif de commande multidirectionnel selon la revendication 23, dans lequel on utilise ladite différence de temps pour déterminer une vitesse d’un curseur.

25. Dispositif de commande multidirectionnel selon la revendication 23, dans lequel on utilise ladite différence de temps pour valider un signal obtenu à partir desdits contacts périphériques (35, 36, 37, 38, 73, 85).

26. Interrupteur de commande multidirectionnel selon la revendication 1, dans lequel ledit couvercle (66) est constitué d’un matériau isolant rigide, ledit corps de manipulation (60) est constitué d’un matériau isolant rigide et formé d’une seule pièce avec ladite tige (63) et ladite saillie (64) sur la surface inférieure de ladite bride (62), et une plaque de contact électriquement conductrice est fixée sur la surface inférieure de ladite bride (62).
FIG. 4
FIG. 6
FIG. 10
FIG. 14  PRIOR ART
FIG. 16  PRIOR ART