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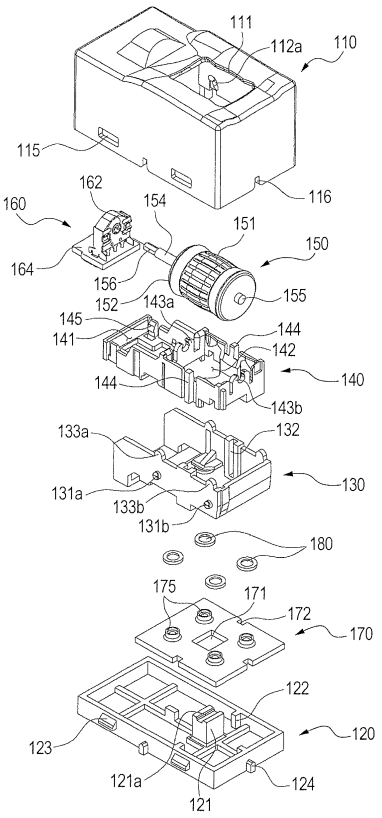
## (54) Combined operation type switch device

(57) A combined operation type switch device (100), includes: an upper case 110; a lower case 120; a holder 130 which is supported inside the upper case 110 so as to rotate left and right; a slider 140 accommodated inside the holder 130 to slide in the vertical direction with respect to the holder 130 and to rotate in left and right directions; a wheel button 150 accommodated inside the slider 140 and rotatably held, and of which a part is exposed through the upper case 110 so as to enable a user to perform a three-way (center, left, and right) pushing operation and a rotating operation; an encoder 160 detects a rotational direction and a rotational amount during rotation of the wheel button 150; and a circuit board 170 fixed to the lower case 120 includes a plurality of electrodes (173) and a plurality of contact switches 175 so as to allow the electrodes (173) to be selectively connected by a vertical sliding motion of the slider (140) interlinked with the three-way pushing operation of the wheel button 150 and a left and right rotating motion of the slider 140 and the holder 130.

*FIG. 3*

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## Description

### CLAIM OF PRIORITY

**[0001]** This application claims benefit of Japanese Patent Application No. 2013-003812 filed on January 14, 2013, which is hereby incorporated by reference.

### BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The present invention relates to a combined operation type switch device, and more particularly, to a combined operation type switch device capable of implementing switch operations in various directions using a single switch device.

2. Description of the Related Art

**[0004]** In general, a rotating operation switch (wheel button) which is provided in various electrical components (for example, a steering wheel and a multimedia device) provided in a vehicle or electronic products (for example, a mouse) for domestic use or for business use is configured so that a rotational displacement of unlimited rotation or a designated angle is input to the internal sensor component thereof and is converted into a digital signal to be transmitted to a control unit. In addition, in order to implement an operational function by a pushing operation force, a contact sensor, a tact switch, and the like are also installed.

**[0005]** Fig. 1 is a schematic diagram illustrating the structure of a wheel button of a mouse which is a type of combined operation type switch device according to the related art (refer to Korean Unexamined Patent Application Publication No. 2010-0112681). When a user rotates the wheel button 1, a sensor 2 coaxially joined to the wheel button 1 outputs a digital signal according to a rotational displacement of the wheel button 1, a push switch 3 is provided to come into direct contact with the circumferential surface of the wheel button 1 which is an object of an rotating operation, and the function of the push switch 3 is implemented by a pushing operation force applied to the wheel button 1. In this manner, in the combined operation type switch device according to the related art, the wheel button 1 having an unlimited rotation function in the body of the switch device and the push switch 3 operated by the pushing operation of the wheel button 1 are joined in one body, and thus the unlimited rotating operation and the one-way pushing operation are enabled by the single wheel button.

**[0006]** However, the combined operation type switch device according to the related art as described above has a structure including an encoder which is a rotary electrical component for detecting a rotational direction and a rotational amount of the wheel button 1 and the single push switch 3 which is operated by the pushing operation of the wheel button 1, and has a form in which only a two-way operation function (the rotating operation function and the pushing operation function) is imparted to the singe wheel button. Therefore, there is a disadvantage that two or more types of button operations cannot be performed by the single button. Accordingly, there is a problem in that in order to implement more various button operation functions such as left push or right push in addition to the rotating operation and one-way pushing operation functions, additional buttons respectively having those functions have to be provided to be individually installed in the switch device. As described above, in the combined operation type switch device of the related art, the wheel button and the plurality of push buttons are separately provided at a plurality of positions in the body of the switch device in order to impart the four-way button operation functions. Therefore, a series of continuous button operations is significantly difficult, and due to an increase in the number of components caused by the installation of the individual buttons, the manufacturing cost of the switch device is high and the structure becomes complex. Accordingly, there is a problem in that assembly operability is significantly degraded, which obstructs the implementation of reduction in size of the switch device.

### SUMMARY OF THE INVENTION

**[0007]** The present invention provides a combined operation type switch device which is implemented to perform an unlimited rotation function and a three-way (left, right and center) pushing function with an operation of only a single wheel button and can quickly and promptly perform a series of continuous button operations with the single wheel button.

**[0008]** The present invention also provides a combined operation type switch device in which the number of components installed in the switch device is minimized to achieve a reduction in the manufacturing cost, assembly characteristics are enhanced to achieve the improvement in productivity, and a reduction in the size of the switch device can be implemented.

**[0009]** The present invention also provides a combined operation type switch device in which an operating sensation during a button operation is properly implemented and thus a concern about malfunction of buttons can be solved.

**[0010]** A combined operation type switch device according to an aspect of the present invention includes: an upper case in which a pair of first guide grooves having symmetrical shapes are formed in opposing inner surfaces thereof; a lower case which is joined to a lower portion of the upper case; a holder in which a pair of first guide protrusions respectively inserted into the first guide grooves are formed in opposing outer surfaces thereof and second guide grooves disposed in a vertical direction are formed in opposing inner surfaces thereof, and which is held inside the upper case via the first guide protrusions inserted into the first guide grooves so as to rotate left

and right; a slider which is accommodated inside the holder, has second guide protrusions inserted into the second guide grooves formed in opposing outer surfaces thereof to slide in the vertical direction with respect to the holder, and is provided to rotate in left and right directions; a wheel button which is accommodated inside the slider and is rotatably held, and of which a part penetrates through the upper case to be exposed to an upper portion so as to enable a user to perform a three-way (center, left, and right) pushing operation and a rotating operation; an encoder which is joined to a drive shaft of the wheel button, detects a rotational direction and a rotational amount of the drive shaft during rotation of the wheel button, and outputs an electrical signal corresponding thereto; and a circuit board which is fixed to the lower case, includes a plurality of electrodes in an upper surface thereof, and includes a plurality of contact switches at positions where the electrodes are respectively provided so as to allow the electrodes to be selectively connected by a vertical sliding motion of the slider interlinked with the three-way pushing operation of the wheel button and a left and right rotating motion of the slider and the holder.

**[0011]** Here, in the slider, a first accommodation portion which accommodates the encoder and a second accommodation portion which accommodates the wheel button may be formed, and holding portions which hold both rotating shafts of the wheel button may be formed in opposing short side parts of the second accommodation portion.

**[0012]** In addition, in the lower case, a vertical shaft which vertically penetrates through the circuit board may be formed, and at the center of a bottom surface of the second accommodation portion of the slider, a stopper protrusion which interferes with a bottom surface of a concave groove formed at an upper end of the vertical shaft and restricts a downward motion of the slider during a left and right pushing operation by the wheel button may be formed.

**[0013]** Here, in a bottom surface of the second accommodation portion of the slider, a pair of first pressing protrusions which press the contact switches of the circuit board during a center pushing operation by the wheel button to allow the electrodes to be connected may be formed, and the first pressing protrusions may be arranged at symmetrical positions in a diagonal direction on the left and the right with respect to the stopper protrusion.

**[0014]** In addition, in a bottom surface of the holder, a pair of second pressing protrusions which press the contact switches of the circuit board along with the first pressing protrusions formed in the bottom surface of the slider to allow the electrodes to be selectively connected during the left and right pushing operation by the wheel button may be formed.

**[0015]** Here, the first pressing protrusions and the second pressing protrusions may be formed to be arranged on the same plane and have a $2\times2$ matrix arrangement structure.

**[0016]** Moreover, the contact switch may include a movable body having a contact made of a conductive material and formed in a surface facing the electrode, and the movable body having the contact may be formed to have an elastic restoring force in such a direction to be separated from the electrode on the circuit board by an elastic connection body which connects the circuit board and the movable body.

**[0017]** Here, in an upper portion of the contact switch, a pressing member having a concave groove protrusion that protrudes downward to be engaged with a concave groove formed at an upper end of the movable body of the contact switch may further be provided.

**[0018]** In addition, pivot protrusions may be formed at upper ends of opposing side surface portions of the holder, and pivot grooves in which the pivot protrusions are held may be formed at upper ends of opposing inner surfaces of the upper case.

**[0019]** According to the combined operation type switch device having the above-described configuration according to the aspect of the present invention, there is an advantage that the 360-degree unlimited rotation function and the three-way (center, left, and right) pushing operation function can be implemented using the single wheel button, and thus a series of continuous button operations desired by a user can be quickly and promptly performed by the single wheel button.

**[0020]** In addition, unlike the switch device according to the related art, there is no need to provide a plurality of buttons respectively having individual switch functions in the switch body in order to implement various buttons functions. Therefore, the number of components provided in the switch device can be reduced, the internal structure of the switch device can be simply implemented, and accordingly a contribution to the implementation of a reduction in the size of the switch device can be made. Furthermore, effects of enhancing assembly characteristics, achieving the improvement in productivity, and reducing the manufacturing cost due to the production of products can be achieved.

**[0021]** In addition, an operating sensation during the operation of the wheel button can be properly implemented and there is an advantage that malfunction during the operation of the wheel button can be prevented.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0022]**

Fig. 1 is a schematic diagram illustrating the structure of a wheel button of a mouse which is a type of a combined operation type switch device according to the related art.

Fig. 2 is a perspective view illustrating a combined operation type switch device according to an embodiment of the present invention.

Fig. 3 is an exploded perspective view of Fig. 2.

Fig. 4 is a cross-sectional view of a section taken along the A-A' direction of Fig. 2.

Fig. 5 is a rear view illustrating the inner structure of an upper case illustrated in Fig. 3.

Fig. 6 is an enlarged detailed view of a holder illustrated in Fig. 3.

Fig. 7 is a rear view of the holder illustrated in Fig. 6.

Fig. 8 is an enlarged detailed view of a slider illustrated in Fig. 3.

Fig. 9 is a rear view of the slider illustrated in Fig. 8.

Fig. 10 is a cross-sectional view of a section taken along the B-B' direction of Fig. 2.

Figs. 11A, 11B, and 11C are operational state diagrams illustrating switching operations during a three-way (center, left, and right) pushing operation by the wheel button according to the embodiment of the present invention.

Figs. 12A, 12B, and 12C are conceptual diagrams illustrating positions of contact switches where electrical connections are made by each pushing operation during the three-way pushing operation by the wheel button.

Figs. 13A, 13B, and 13C are operational state diagrams illustrating states where malfunction is prevented by first guide grooves and first guide protrusions during the three-way pushing operation by the wheel button.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0023]** Hereinafter, an exemplary embodiment of the present invention will be described with reference to the accompanying drawings. In the description of the present invention, the detailed description of well-known configuration will be omitted and the detailed description of configurations that may obscure the gist of the present invention will also be omitted.

**[0024]** Fig. 2 is a perspective view illustrating an external form of a combined operation type switch device according to an embodiment of the present invention, and Fig. 3 is an exploded perspective view of Fig. 2. In addition, Fig. 4 is a cross-sectional view of a section taken along the A-A' direction of Fig. 2, and Fig. 5 is a rear view illustrating an internal structure of an upper case illustrated in Fig. 3. Moreover, Fig. 6 is an enlarged detailed view of a holder illustrated in Fig. 3, Fig. 7 is a rear view of the holder illustrated in Fig. 6, Fig. 8 is an enlarged detailed view of a slider illustrated in Fig. 3, and Fig. 9 is a rear view of the slider illustrated in Fig. 8. In addition, Fig. 10 is a cross-sectional view of a section taken along the B-B' direction of Fig. 2.

**[0025]** Referring to Figs. 2 to 10, the combined operation type switch device 100 according to the present invention is configured to include: upper and lower cases 110 and 120 which are assembled to oppose each other; a holder 130 which is provided to be able to turn left and right inside the upper and lower cases 110 and 120; a slider 140 which is accommodated inside the holder 130 and is provided to be able to vertically slide; a wheel button 150 which is provided to be rotatable inside the slider 140 and to which a 360-degree unlimited rotating operation and a three-way (center, left, and right) pushing operation are input by a user's operation; an encoder 160 which is connected to a rotating shaft 154 on one side of the wheel button 150 to detect a rotational direction and a rotational amount of the wheel button 150 and outputs an electrical signal corresponding thereto; and a circuit board 170 which includes several contact switches 175 that cause electrodes 173 to be selectively connected by left and right turning motions of the holder 130 and the slider 140 interlinked with the three-way pushing operation by the wheel button 150 and vertical sliding motions of the slider 140, the electrodes 173 being provided in an upper surface of the circuit board 170.

**[0026]** A button hole 111 is formed in the upper case 110 to expose a part of the wheel button 150 to the upper portion thereof so that the user can perform a button operation. At this time, the shape of the button hole 111 is formed to have a shape corresponding to the external form of the wheel button 150.

**[0027]** A vertical shaft 121 is formed in the bottom surface of the lower case 120 to restrict a downward sliding motion of the slider 140 to a predetermined movement width. The vertical shaft 121 stands to pass through a through-hole 171 of the center portion of the circuit board 170 in the upward direction, and a concave groove 121a into which a stopper protrusion 146 formed in the bottom surface of the slider 140 is inserted during the downward sliding motion of the slider 140 is formed at the upper end of the vertical shaft 121. At this time, in order for the slider 140 to perform smooth left and right rotations in a predetermined angle range, the left and right width of the concave groove 121a is formed to be sufficiently greater than the left and right width of the stopper protrusion 146. In addition, in the periphery of the inner surface of the lower case 120, a plurality of fixing protrusions 122 which are engaged with a plurality of fixing grooves 172 formed in the outer periphery of the circuit board 170 are formed. Therefore, in a state of being placed in the bottom surface of the inside of the lower case 120, the circuit board 170 can be stably fixed by the fixing groove 172 and the fixing protrusion 122 of the lower case 120 without oscillation.

**[0028]** In addition, a fixing protrusion 124 is formed at the center of the outer surface of the lower case 120, a fixing groove 116 corresponding to the fixing protrusion 124 is formed in the upper case 110, the fixing protrusion 124 is configured to be engaged and fitted with the fixing groove 116 when the upper and lower cases 110 and 120 are assembled with each other, joining protrusions 123 having a wedge shape are formed on the left and right sides of the outer surface of the lower case 120, joining grooves 115 corresponding to the joining protrusions 123 are formed in the upper case 110, the joining protrusions 123 of the lower case 120 are elastically fitted into the joining grooves 115 of the upper case 110 when the upper and lower cases 110 and 120 are assembled

with each other, and thus the assembly is simply achieved by a single touch.

**[0029]** In addition, as illustrated in Fig. 5 illustrating the reversed upper case 110, a pair of first guide grooves 112a and 112b which have the same shape in the inner surfaces of both opposing sides and are disposed in symmetry are formed in the upper case 110. Moreover, a pair of first guide protrusions 131a and 131b which are formed in both outer surfaces of the holder 130 are respectively inserted into the first guide grooves 112a and 112b to be held. At this time, the first guide grooves 112a and 112b are formed to have curved shapes corresponding to paths on which the first guide protrusions 131a and 131b move during the left and right turning motions of the holder 130. Accordingly, during the left and right turning motions of the holder 130, the first guide protrusions 131a and 131b formed in the outer surfaces of the holder 130 move along the paths of the first guide grooves 112a and 112b formed in the inner surfaces of the upper case 110, and thus the holder 130 is able to perform the left and right rotating motions in a predetermined left and right turning width.

**[0030]** Furthermore, a pair of pivot grooves 118a and 118b in which a pair of pivot protrusions 133a and 133b formed at the upper ends of both side surfaces of the holder 130 are held during the left and right turning motions of the holder 130 are formed at the upper ends of both opposing inner surfaces of the upper case 110. Accordingly, during the left and right turning motions of the holder 130, the holder 130 performs the turning motions in the left and right direction about the pivot protrusions 133a and 133b which are held in any of the left and right pivot grooves 118a and 118b of the upper case 110.

**[0031]** In addition, the pair of first guide protrusions 131a and 131b which are respectively inserted into the pair of first guide grooves 112a and 112b formed in the upper case 110 are formed in the outer surfaces on both opposing sides of the holder 130. In this manner, the first guide protrusions 131a and 131b formed in both outer surfaces of the holder 130 are inserted into the first guide grooves 112a and 112b formed in both inner surfaces of the upper case 110 to be held, and thus the holder 130 is held to rotate left and right in the upper case 110. In addition, second guide grooves 132 are formed at the centers of both inner surfaces of the holder 130 to guide vertical sliding movements of the slider 140. At this time, the second guide groove 132 has a structure in which the upper end thereof is open and the lower end thereof is closed. Second guide protrusions 144 formed on the outer surfaces on both sides of the slider 140 are fitted and engaged with the second guide grooves 132 of the holder 130, and thus the straight sliding movements of the slider 140 in the vertical direction are possible in the holder 130.

**[0032]** The slider 140 is accommodated inside the holder 130, and the second guide protrusions 144 which protrude outward are formed in both opposing outer surfaces of the slider 140 so as to be engaged with the second guide grooves 132 formed in both inner surfaces of the holder 130. Therefore, during the vertical sliding movement of the slider 140, the slider 140 can perform the sliding motion in the straight direction along the second guide grooves 132 formed in both inner surfaces of the holder 130. In addition, during the left and right turning motions of the slider 140, in the structure of the second guide protrusion 144 and the second guide groove 132 engaged with each other, the rotating motion of the holder 130 in the left and right direction can be performed by being interlinked with the left and right turns of the slider 140.

**[0033]** In addition, the internal space of the slider 140 is divided into a first accommodation portion 141 which accommodates the encoder 160 and a second accommodation portion 142 which accommodates the wheel button 150. In addition, in the second accommodation portion 142, U-shaped holding portions 143a and 143b in which rotating shafts 154 and 155 on both sides of the wheel button 150 are rotatably held are formed at the upper ends of both opposing short side parts. In addition, at the center of the bottom surface portion of the second accommodation portion 142, the stopper protrusion 146 is formed which is engaged with the concave groove 121a formed at the upper end of the vertical shaft 121 of the lower case 120 to restrict the downward movement width of the slider 140 in a case where the slider 140 straightly moves downward by a predetermined distance. The stopper protrusion 146 restricts the downward motion of the slider 140 so as not to cause the slider 140 to slide off by the interference with the bottom surface of the concave groove 121a formed at the upper end of the vertical shaft 121 of the lower case 120 in a stage in which the holder 130 and the slider 140 rotate left and right during the left and right pushing operations by the wheel button 150. Moreover, even in a case where correct left and right pushing operations by the wheel button 150 are not performed but the center pushing operation is performed by user's mistake, the stopper protrusion 146 provided in the bottom surface of the slider 140 interferes with the bottom surface of the concave groove 121a at the upper end of the vertical shaft 121 and restricts the downward motion of the slider 140, thereby preventing an incorrect operation of the wheel button 150 by the user.

**[0034]** In addition, a pair of first pressing protrusions 147a and 147b which protrude downward are formed in the bottom surface of the second accommodation portion 142 to press the contact switches 175 provided in the circuit board 170 positioned therebelow to be connected to the electrode 173 during the center pushing operation by the wheel button 150. At this time, the first pressing protrusions 147a and 147b are formed to be disposed at symmetrical positions in a diagonal direction on the left and the right with respect to the stopper protrusion 146 formed in the bottom surface of the slider 140.

**[0035]** In addition, a pair of second pressing protrusions 135a and 135b which protrude downward are formed in the bottom surface portion of the holder 130

so as to press the contact switches 175 provided in the circuit board 170 positioned therebelow along with the pair of first pressing protrusions 147a and 147b formed in the bottom surface of the slider 140 so as to be connected to the electrode 173 during the left and right pushing operations by the wheel button 150. At this time, in a state where the slider 140 is mounted in the holder 130, the first pressing protrusions 147a and 147b of the slider 140 and the second pressing protrusions 135a and 135b of the holder 130 are arranged to have a 2×2 matrix arrangement structure on the same plane.

**[0036]** Furthermore, the wheel button 150 is a point at which a direct switch input operation is performed by the user, and the 360-degree unlimited rotating operation and the three-way (center, left, and right) pushing operation are selectively performed. The wheel button 150 has a structure in which the part of the wheel button is exposed to the upper portion of the button hole 111 formed in the upper case 110 so that the user can perform the button operation. In addition, in order to improve the convenience for the user and the accuracy of the operation, the wheel button 150 has a structure in which the outer peripheral surfaces of the center portion and left and right end portions of the wheel button 150 have a shape of a curved surface and are swollen in a radial direction to protrude. Moreover, on the outer peripheral surface of the center portion of the wheel button 150 which is swollen and protrudes, a plurality of slip-preventing protrusions 151 are arranged and formed at predetermined intervals in order to prevent a finger slipping phenomenon during the rotating operation of the wheel button 150 by the user.

**[0037]** In addition, in a state where the wheel button 150 is accommodated inside the space of the second accommodation portion 142 of the slider 140, the rotating shafts 154 and 155 on both sides are rotatably held in the U-shaped holding portions 143a and 143b formed at the upper ends on both short sides of the second accommodation portion 142. At this time, the rotating shafts 154 and 155 on both sides of the wheel button 150 are formed to have different lengths. However, at the end portion of the rotating shaft 154 on the left, which has a relatively great length, a drive shaft 156 having a hexagonal cross-sectional shape corresponding to the cross-sectional shape of the hole 162 is formed to be engaged and joined with a hole 162 formed at the center portion of the encoder 160.

**[0038]** Moreover, the encoder 160 which is joined to the rotating shaft 154 on the left of the wheel button 150 is accommodated in the space of the first accommodation portion 141 of the slider 140 in a state of being mounted on a circuit board 164. At this time, the circuit board 164 on which the encoder 160 is mounted is elastically joined via a pair of wedge-shaped joining protrusions 145 provided inside the first accommodation portion 141 of the slider 140, and is thus strongly fixed on the first accommodation portion 141.

**[0039]** In addition, a plurality of pairs of electrodes 173 are provided in the upper surface of the circuit board 170 provided inside the lower case 120. At this time, the plurality of electrodes 173 are arranged at positions directly below the first and second pressing protrusions 147a, 147b, 135a, and 135b which are provided in the bottom surface portions of the slider 140 and the holder 130, and form the 2x2 matrix arrangement structure. Furthermore, the contact switches 175 made of an elastically restorable material (for example, rubber) are provided on the upper surface of the circuit board 170 in which the electrodes 173 are positioned.

**[0040]** The contact switch 175 includes a movable body 175a having a contact 175b made of a conductive material and formed in the surface facing each of the plurality of electrodes 173 provided in the upper surface of the circuit board 170. In addition, an elastic connection body 175c which connects the circuit board 170 and the movable body 175a is included. Therefore, the movable body 175a having the contact 175b is formed to have an elastic restoring force in the upward direction from the electrode 173 on the circuit board 170 via the elastic connection body 175c. Normally, the contact switch 175 is maintained in a short-circuit state in which the contact 175b of the movable body 175a is positioned on the upper portion side to be separated from the electrode 173. In a case where a downward pressure is applied to the elastic contact switch 175 via the pressing protrusions 135a, 135b, 147a, and 147b formed in the holder 130 and the slider 140, the contact 175b of the movable body 175a comes into contact with the electrode 173 therebelow, and thus current flows.

**[0041]** Here, in the upper portion of contact switch 175, a pressing member 180 is further provided so that the correct pressing action of the contact switch 175 is performed by the pressing protrusions 135a, 135b, 147a, and 147b during the left and right turning motions of the slider 140 and the holder 130. At the center of the bottom surface portion of the disk-shaped body of the pressing member 180, a concave groove protrusion 182 having a downward protruding structure which is engaged with a concave groove 175d formed at the upper end of the movable body 175a of the contact switch 175 is formed. The pressing member 180 is attached to the upper end of the contact switch 175 as the concave groove protrusion 182 is fitted into the concave groove 175d formed at the upper end of the movable body 175a of the contact switch 175. In this configuration, the first and second pressing protrusions 147a, 147b, 135a, and 135b press the pressing members 180 attached to the upper end of the contact switches 175 during the left and right turning motions of the slider 140 and the holder 130 by the left and right pushing operations of the wheel button 150, and thus the pressing operation can be effectively transmitted in the accurate operating direction of the contact switch 175 by the pressing member 180.

**[0042]** Hereinafter, each operation mechanism by the three-way (center, left, and right) pushing operation in the structure of the combined operation type switch de-

vice 100 having the above-described configuration in the embodiment of the present invention will be described in detail with reference to the accompanying drawings.

**[0043]** In the combined operation type switch device according to the embodiment of the present invention, the operation mechanism of the switch by the rotating operation of the wheel button 150 is the same as that of the related art, and thus the specific description thereof will be omitted. Hereinafter, only the operation mechanism by the three-way (center, left, and right) pushing operation by the wheel button 150 will be described in detail.

**[0044]** Figs. 11A, 11B, and 11C are operational state diagrams illustrating switching operations during the three-way (center, left, and right) pushing operation by the wheel button 150 in the combined operation type switch device 100 of the embodiment of the present invention. In addition, Figs. 12A, 12B, and 12C are diagrams illustrating positions of the contact switches where electrical connections are made during the three-way pushing operation by the wheel button.

**[0045]** Fig. 11A illustrates an operation mechanism in which switch-on (ON) is implemented during the center pushing operation by the wheel button 150. In a case where the user presses the center portion of the wheel button 150, the rotating shafts 154 and 155 on both sides of the wheel button 150 press the U-shaped holding portions 143a and 143b of the slider 140 downward, the downward sliding motion of the slider 140 is performed, the pair of first pressing protrusions 147a and 147b provided in the bottom surface of the slider 140 press the contact switches 175 downward via the pressing members 180, and the contacts 175b inside the contact switches 175 come into contact with the electrodes 173 of the circuit board 170, thereby implementing the switch-on. At this time, the parts of the contact switches 175 (an area indicated by a dotted line) where electrical connection is made by the pressing of the center pushing operation of the wheel button 150 is illustrated in Fig. 12A. Particularly, during the center pushing operation by the wheel button 150, the second guide protrusions 144 of the slider 140 straightly move along the second guide grooves 132 of the holder 130, and thus the slider 140 can perform the correct sliding movement in the vertically downward direction. In addition, as illustrated in Fig. 13A, the pair of first guide protrusions 131a and 131b formed in both side surfaces of the holder 130 are hung from the insides of the pair of first guide grooves 112a and 112b having a symmetrical pattern formed in both the inner surfaces of the upper case 110, and thus the downward movement is restricted. Therefore, the downward sliding motion of the holder 130 does not occur, and only the downward sliding motion of the slider 140 with respect to the holder 130 occurs.

**[0046]** In addition, Fig. 11B illustrates an operation mechanism in which switch-on is implemented during the left pushing operation by the wheel button 150. In a case where the user presses the upper left end portion of the wheel button 150, the rotating shaft 154 on the left of the wheel button 150 presses the left portion of the slider 140 to generate the turning motion. At this time, while the holder 130 which is engaged with the slider 140 by the second guide protrusion 144 and the second guide groove 132 is interlinked with the slider 140 and turns in a counterclockwise direction, the first pressing protrusion 147a positioned on the left of the bottom surface of the slider 140 and the second pressing protrusion 135b positioned on the left of the bottom surface of the holder 130 simultaneously press the contact switch 175 positioned immediately therebelow via the pressing member 180, and thus the contact 175b is electrically connected to the electrode 173 of the circuit board 170, thereby implementing the switch-on by the left pushing of the wheel button 150. At this time, the parts of the contact switches 175 (an area indicated by a dotted line) where the electrical connection is made by the pressing of the left pushing operation of the wheel button 150 is illustrate in Fig. 12B. Particularly, during the left pushing operation by the wheel button 150, as illustrated in Fig. 11B, the right pivot protrusion 133b positioned at the upper end of the holder 130 is maintained in a state of abutting on the right pivot groove 118b in the upper case 110 to be held, and the holder 130 performs the turning motion in the counterclockwise direction about the pivot part. In this stage, as illustrated in Fig. 13B, the first guide protrusion 131b formed on the right of the holder 130 is hung from the upper end portion of the first guide groove 112b formed on the right of the upper case 110 such that the movement thereof is restricted. In addition, while the first guide protrusion 131a on the left of the holder 130 is moved along the path of the shape of the first guide groove 112a on the left of the upper case 110, the precise turning motion of the holder 130 including the slider 140 in the counterclockwise direction is performed. Furthermore, according to the turning mechanism of the holder 130 as described above, the user presses the accurate left part of the wheel button 150 such that the turning action of the holder 130 is performed and the contact switch can make contact. Therefore, the malfunction of the wheel button 150 by user's mistake can be prevented.

**[0047]** In addition, as illustrated in Fig. 11C, in a case where the user presses the upper right end of the wheel button 150 for the right pushing operation, the operation principles are the same as those of the case of Fig. 11B described above except that the turning direction of the slider 140 and the holder 130 is changed from the left to the right, and accordingly, the contact switch 175 positioned on the inclined side is pressed to implement electrical connection of the corresponding electrode 173. Therefore, overlapping description of the operations will be omitted.

**[0048]** As described above, the combined operation type switch device 100 according to the embodiment of the present invention is configured so that the 360-degree unlimited rotating operation and the three-way (center, left, and right) pushing operation can be per-

formed by the single wheel button 150, and thus a series of continuous button operations desired by the user can be quickly and promptly performed using only the single button.

**[0049]** In addition, unlike the switch device according to the related art, there is no need to provide a plurality of buttons having individual switch functions in the switch body in order to implement various buttons functions. Therefore, the internal structure of the switch device can be simply implemented, the number of components provided can be reduced, assembly characteristics can be improved, and the manufacturing cost can be reduced. Furthermore, a contribution to the implementation of a reduction in the size of the switch device can be made.

**[0050]** While the exemplary embodiments of the present invention have been described, the scope of the present invention is not limited to the specific embodiments, and appropriate modifications can be made by those skilled in the art without departing from the scope of the appended claims of the present invention.

**[0051]** It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims of the equivalents thereof.

## Claims

1. A combined operation type switch device (100), comprising:

   an upper case (110) in which a pair of first guide grooves (112a and 112b) having symmetrical shapes are formed in opposing inner surfaces thereof;
   a lower case (120) which is joined to a lower portion of the upper case (110);
   a holder (130) in which a pair of first guide protrusions (131a and 131b) respectively inserted into the first guide grooves (112a and 112b) are formed in opposing outer surfaces thereof and second guide grooves (132) disposed in a vertical direction are formed in opposing inner surfaces thereof, and which is held inside the upper case (110) via the first guide protrusions (131a and 131b) inserted into the first guide grooves (112a and 112b) so as to rotate left and right;
   a slider (140) which is accommodated inside the holder (130), has second guide protrusions (144) inserted into the second guide grooves (132) formed in opposing outer surfaces thereof to slide in the vertical direction with respect to the holder (130), and is provided to rotate in left and right directions;
   a wheel button (150) which is accommodated inside the slider (140) and is rotatably held, and of which a part penetrates through the upper case (110) to be exposed to an upper portion so as to enable a user to perform a three-way (center, left, and right) pushing operation and a rotating operation;
   an encoder (160) which is joined to a drive shaft (156) of the wheel button (150), detects a rotational direction and a rotational amount of the drive shaft (156) during rotation of the wheel button (150), and outputs an electrical signal corresponding thereto; and
   a circuit board (170) which is fixed to the lower case (120), includes a plurality of electrodes (173) in an upper surface thereof, and includes a plurality of contact switches (175) at positions where the electrodes (173) are respectively provided so as to allow the electrodes (173) to be selectively connected by a vertical sliding motion of the slider (140) interlinked with the three-way pushing operation of the wheel button (150) and a left and right rotating motion of the slider (140) and the holder (130).

2. The combined operation type switch device (100) according to claim 1,
   wherein, in the slider (140), a first accommodation portion (141) which accommodates the encoder (160) and a second accommodation portion (142) which accommodates the wheel button (150) are formed, and holding portions (143a and 143b) which hold both rotating shafts (154 and 155) of the wheel button (150) are formed in opposing short side parts of the second accommodation portion (142).

3. The combined operation type switch device (100) according to claim 2,
   wherein, in the lower case (120), a vertical shaft (121) which vertically penetrates through the circuit board (170) is formed, and at the center of a bottom surface of the second accommodation portion (142) of the slider (140), a stopper protrusion (146) which interferes with a bottom surface of a concave groove (121a) formed at an upper end of the vertical shaft (121) and restricts a downward motion of the slider (140) during a left and right pushing operation by the wheel button (150) is formed.

4. The combined operation type switch device (100) according to claim 2 or 3,
   wherein, in a bottom surface of the second accommodation portion (142) of the slider (140), a pair of first pressing protrusions (147a and 147b) which press the contact switches (175) of the circuit board (170) during a center pushing operation by the wheel button (150) to allow the electrodes (173) to be connected are formed, and the first pressing protrusions (147a and 147b) are arranged at symmetrical positions in a diagonal direction on the left and the right

with respect to the stopper protrusion (146).

**5.** The combined operation type switch device (100) according to claim 4,
wherein, in a bottom surface of the holder (130), a pair of second pressing protrusions (135a and 135b) which press the contact switches (175) of the circuit board (170) along with the first pressing protrusions (147a and 147b) formed in the bottom surface of the slider (140) to allow the electrodes (173) to be selectively connected during the left and right pushing operation by the wheel button (150) are formed.

**6.** The combined operation type switch device (100) according to claim 5,
wherein the first pressing protrusions (147a and 147b) and the second pressing protrusions (135a and 135b) are arranged on the same plane in a state where the slider (140) and the holder (130) are assembled with each other and have a 2x2 matrix arrangement structure.

**7.** The combined operation type switch device (100) according to any of claims 1 to 6,
wherein the contact switch (175) includes a movable body (175a) having a contact (175b) made of a conductive material and formed in a surface facing the electrode (173), and
the movable body (175a) having the contact (175b) has an elastic restoring force in such a direction to be separated from the electrode (173) on the circuit board (170) by an elastic connection body (175c) which connects the circuit board (170) and the movable body (175a).

**8.** The combined operation type switch device (100) according to claim 7,
wherein, in an upper portion of the contact switch (175), a pressing member (180) having a concave groove protrusion (182) that protrudes downward to be engaged with a concave groove (175d) formed at an upper end of the movable body (175a) of the contact switch (175) is further provided.

**9.** The combined operation type switch device (100) according to any of claims 1 to 8,
wherein pivot protrusions (133a and 133b) are formed at upper ends of opposing side surface portions of the holder (130), and pivot grooves (118a and 118b) in which the pivot protrusions (133a and 133b) are held are formed at upper ends of opposing inner surfaces of the upper case (110).

FIG. 1

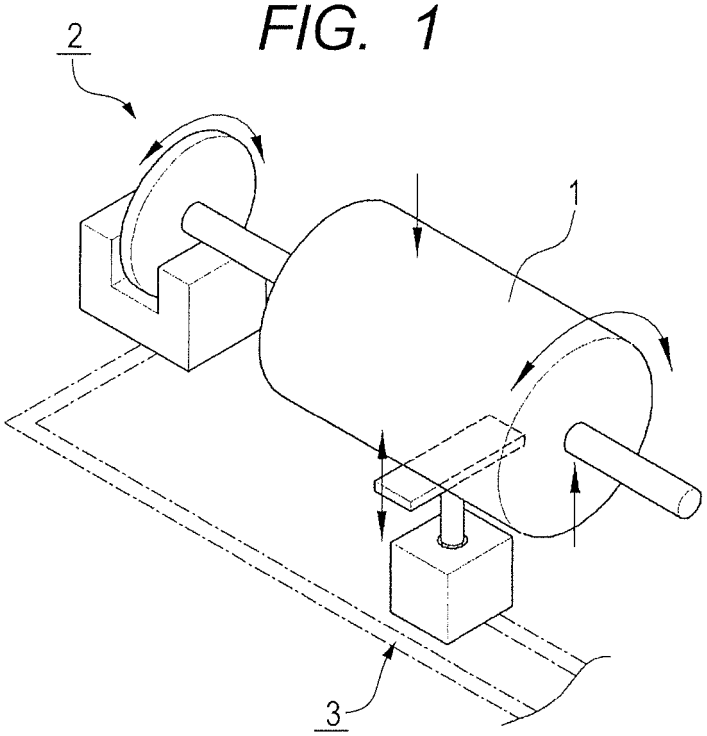



FIG. 2

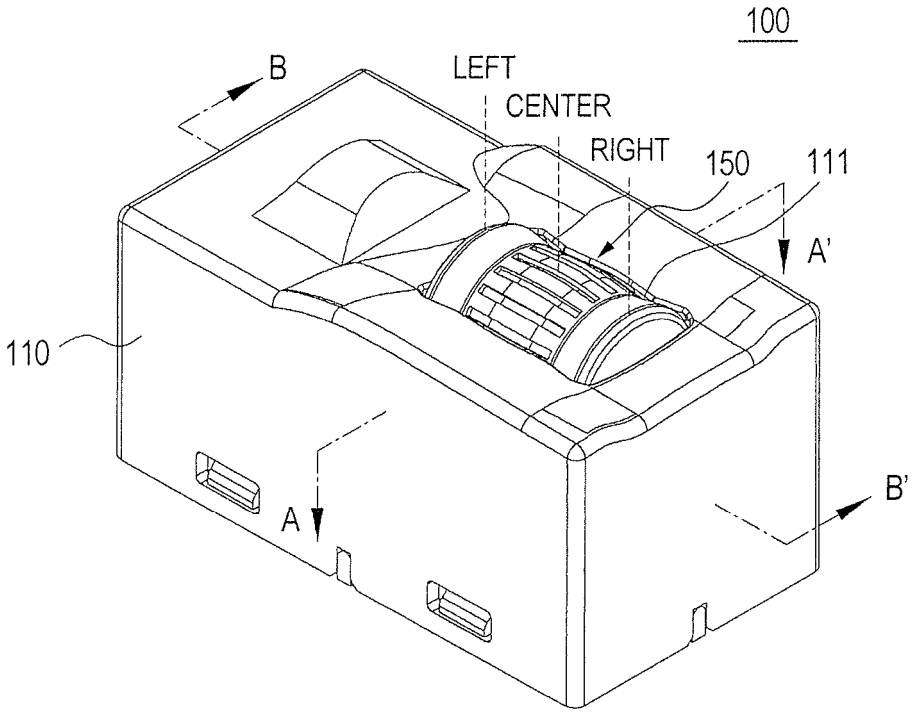


FIG. 3

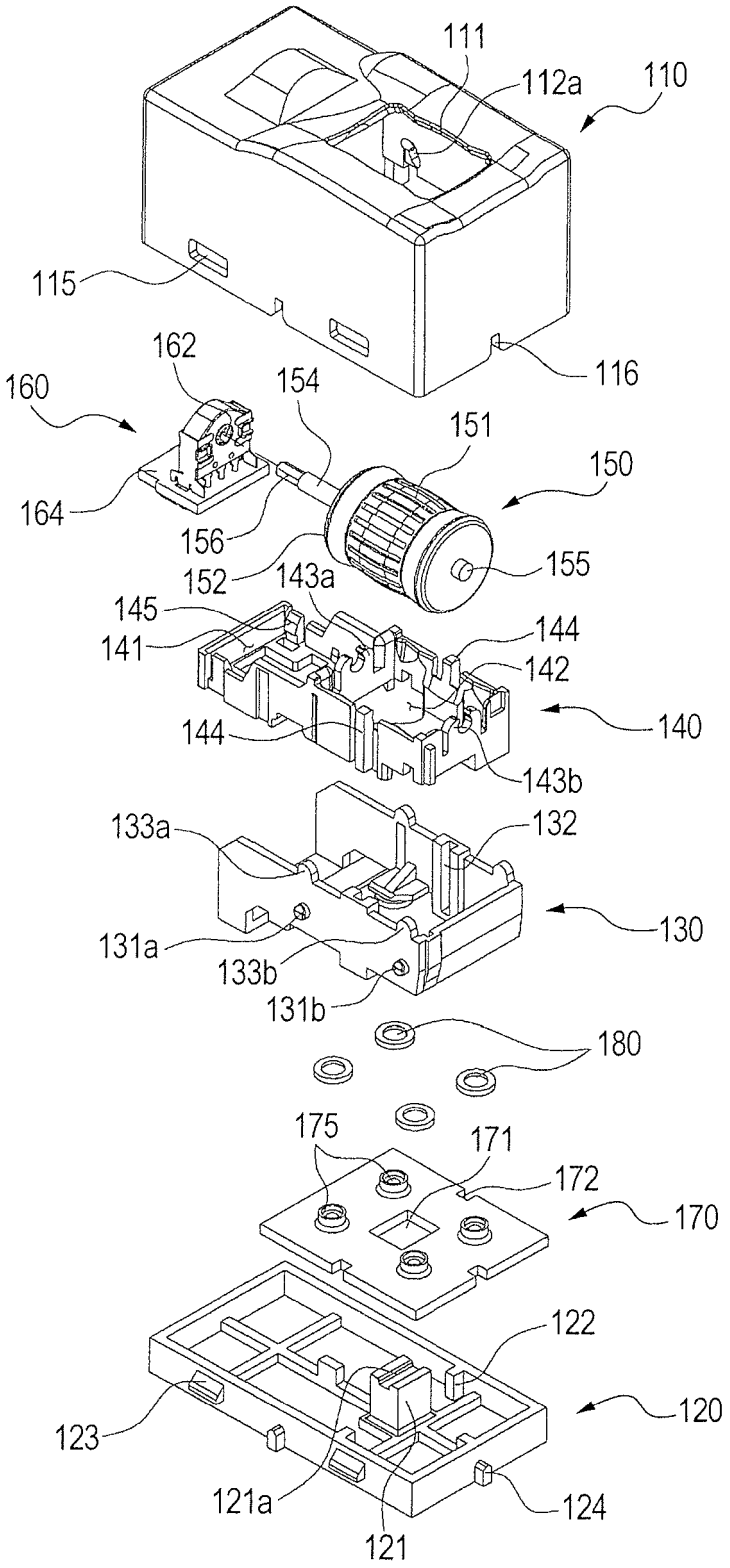

111
112a
110
115
116
162
160
154
151
150
164
156
155
152
143a
145
141
144
142
140
144
143b
133a
132
130
131a
133b
131b
180
175
171
172
170
122
120
123
121a
124
121

FIG. 4

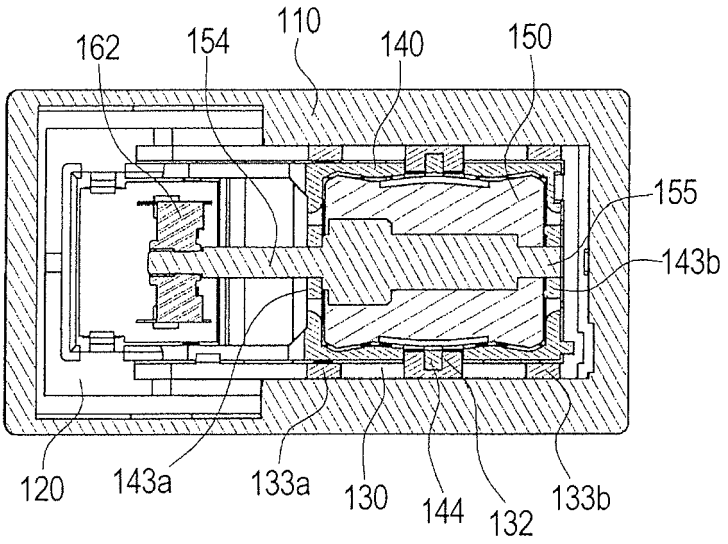

162
154
110
140
150
155
143b
120
143a
133a
130
144
132
133b

FIG. 5

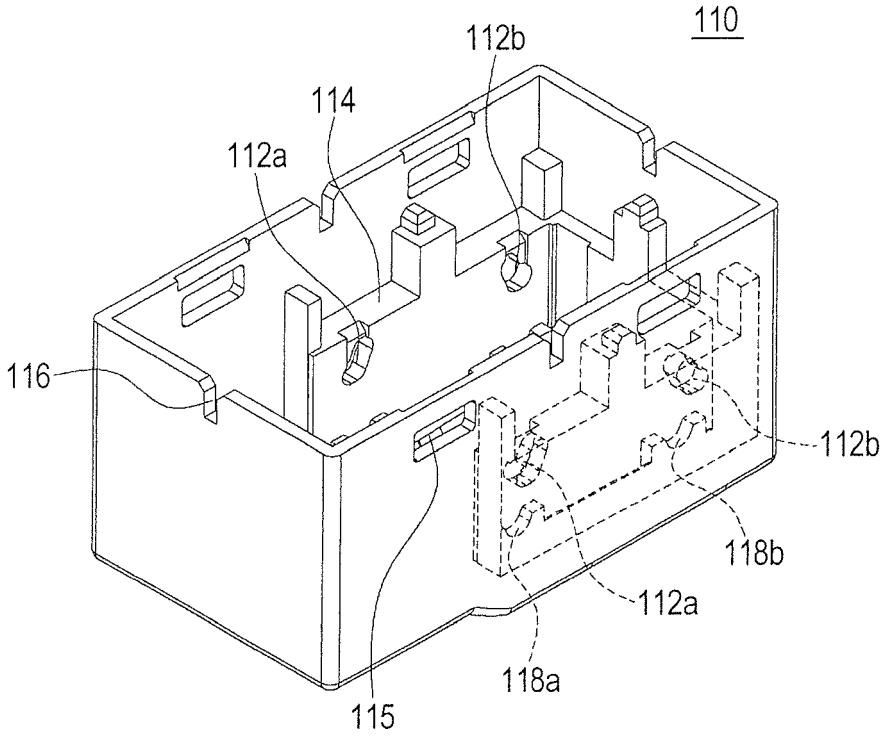

110
112b
114
112a
116
112b
118b
112a
118a
115

FIG. 6

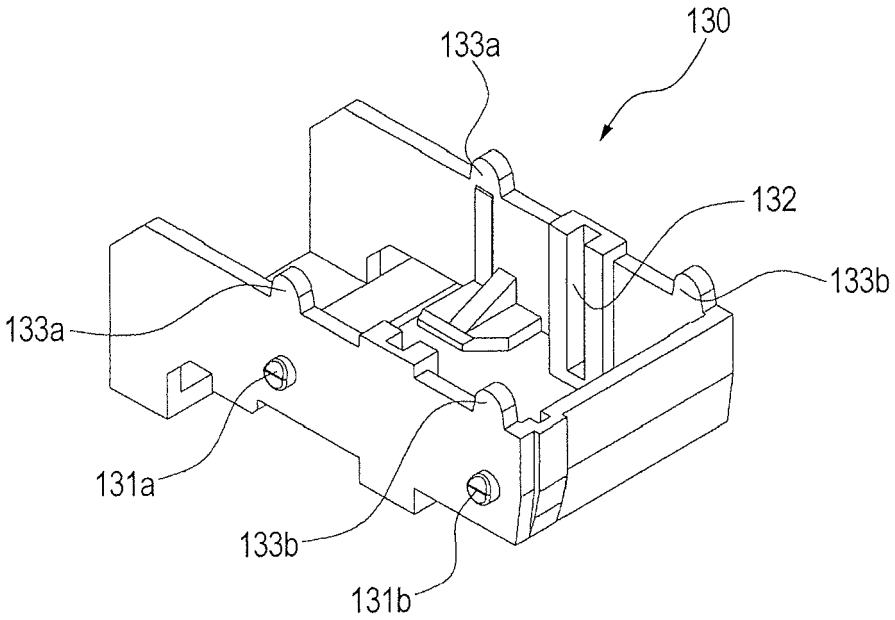

130
133a
132
133b
133a
131a
133b
131b

FIG. 7

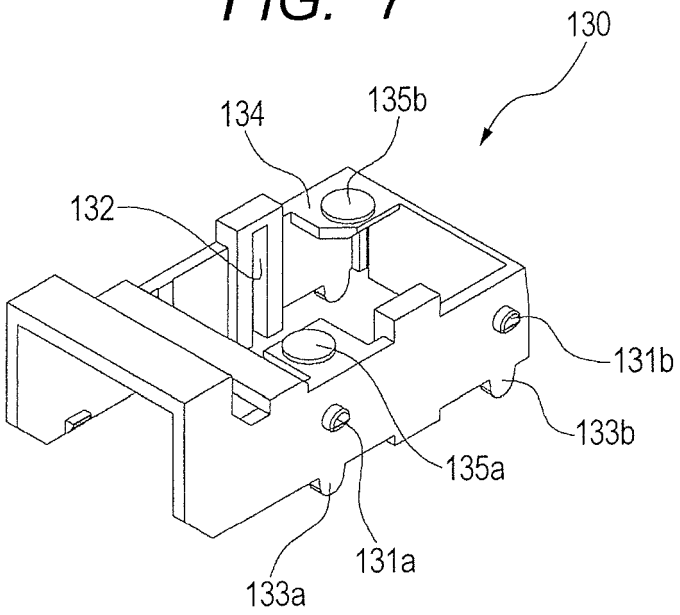

130
134
135b
132
131b
133b
135a
131a
133a

FIG. 8

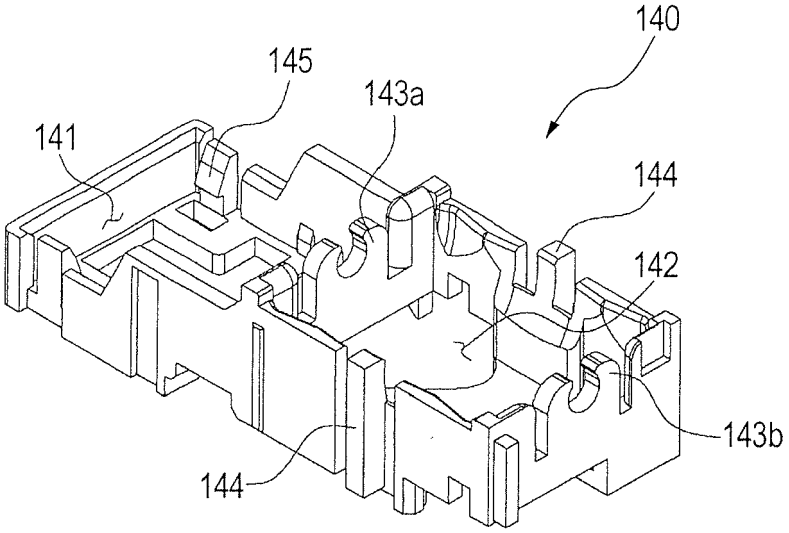



FIG. 9

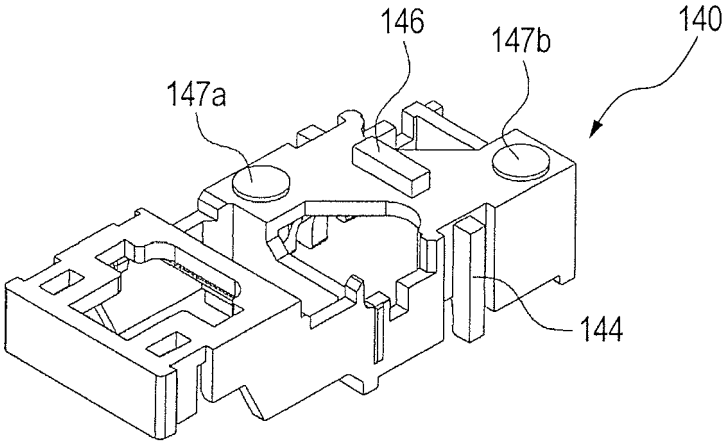


FIG. 10

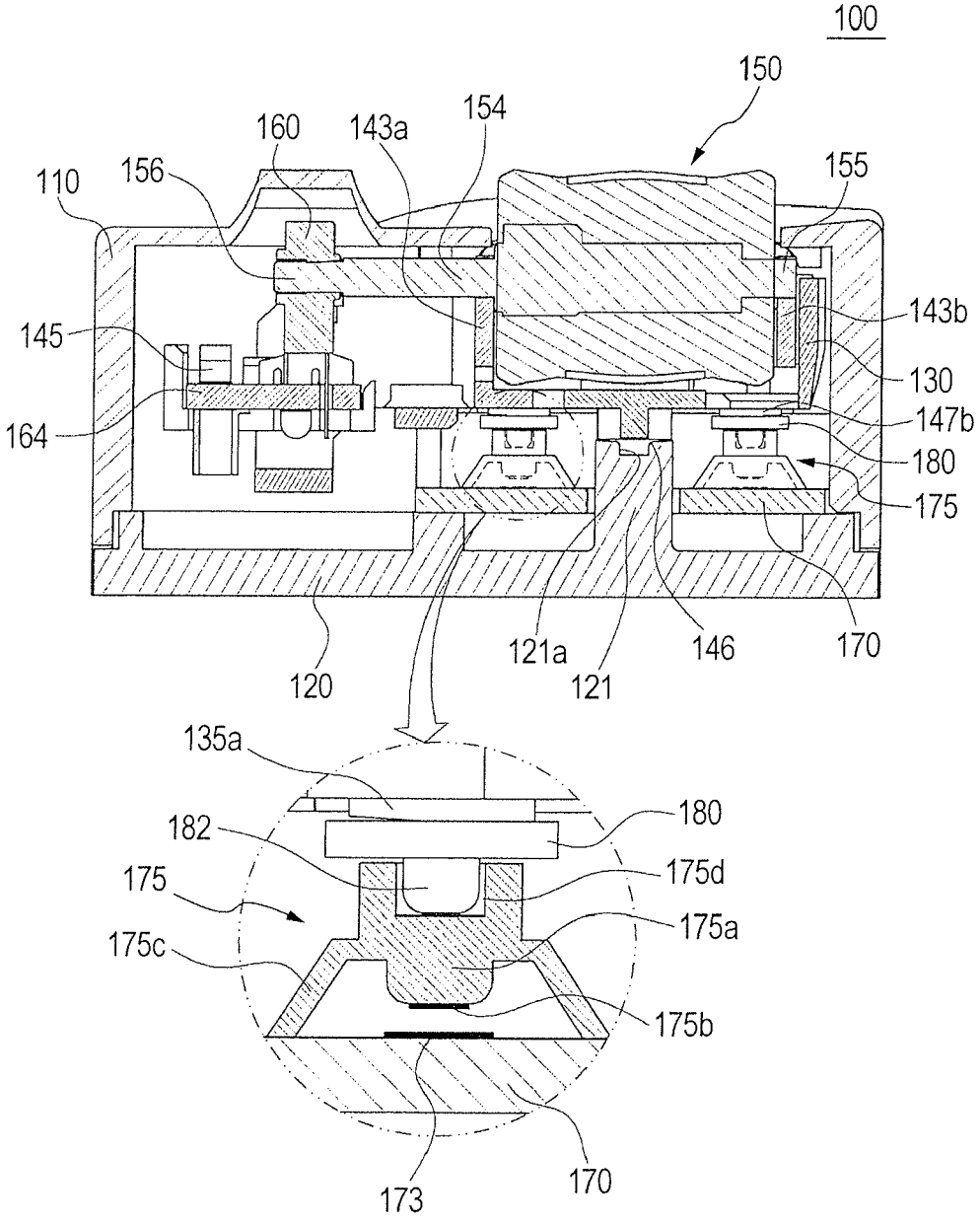

100
150
160
143a
154
110
156
155
143b
145
130
147b
164
180
175
120
121a
121
146
170
135a
180
182
175d
175
175a
175c
175b
173
170

FIG. 11A

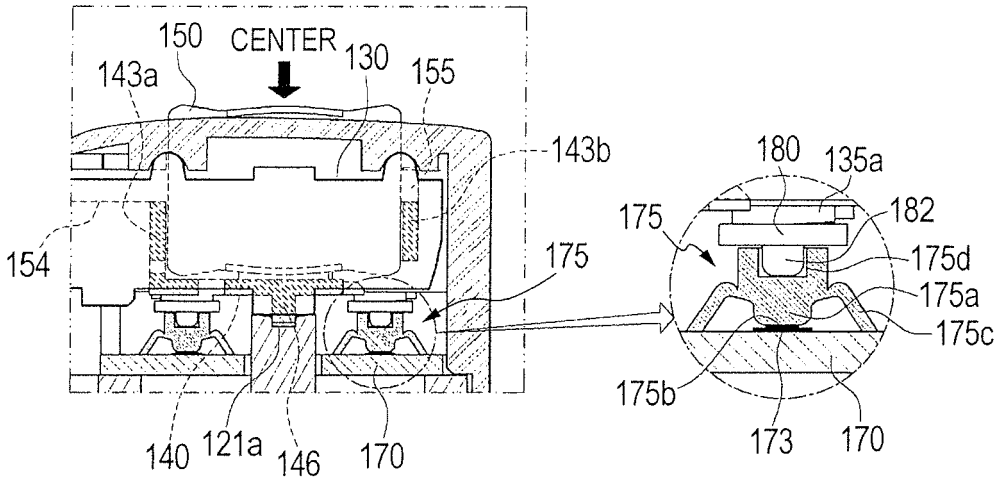



FIG. 11B

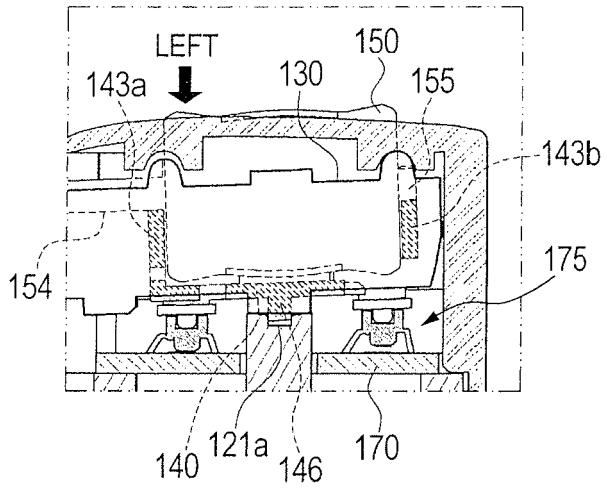



FIG. 11C

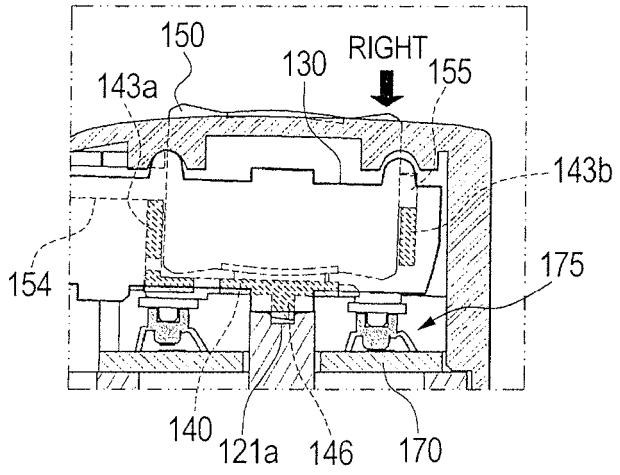
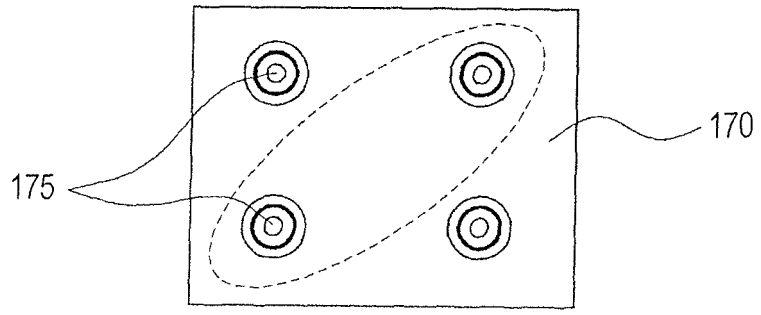
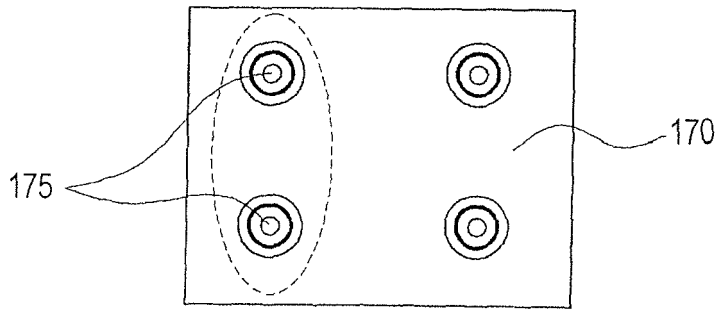


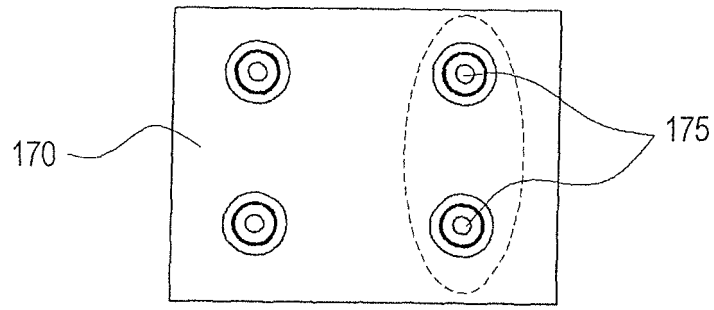
FIG. 12




(a) CENTER PUSH




(b) LEFT PUSH




(c) RIGHT PUSH

FIG. 13A

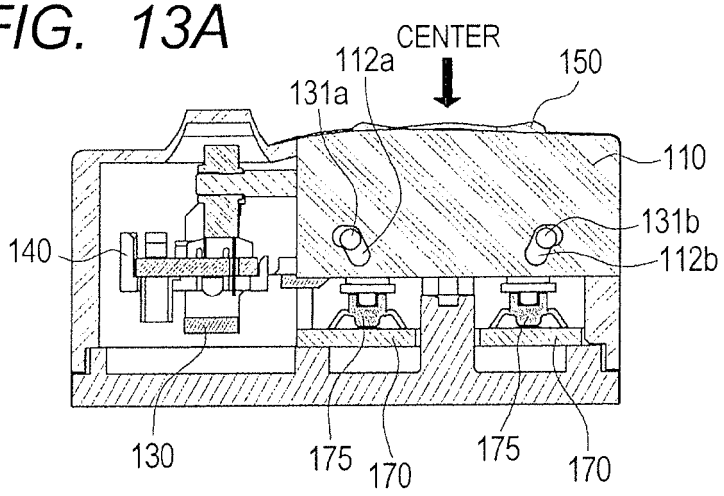



FIG. 13B

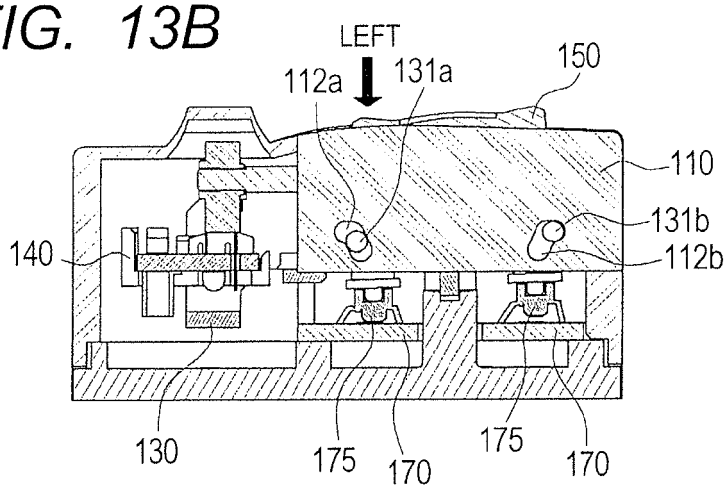
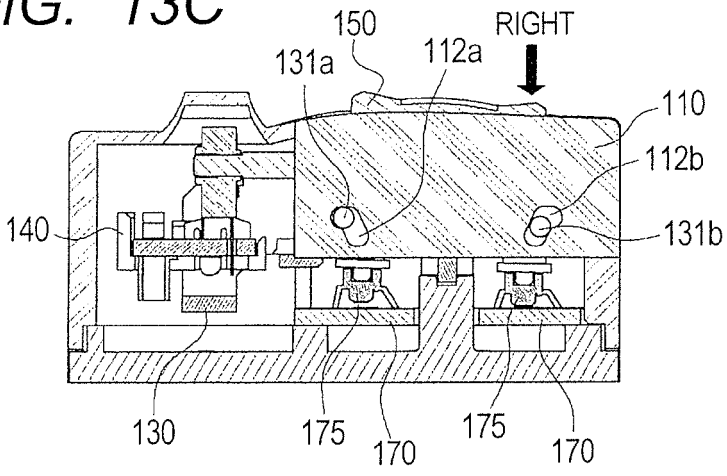



FIG. 13C



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# EUROPEAN SEARCH REPORT

Application Number
EP 14 15 0811

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| A | WO 01/52292 A1 (MICROTRONIC AS [DK]; DERUGINSKY MICHAEL [DK]; RAVNKILDE SOEREN [DK]) 19 July 2001 (2001-07-19)<br>* page 9, line 3 - line 21; figure 1 *<br>* page 10, line 21 - page 14, line 6; figure 3 * | 1-9 | |
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| A | EP 1 632 968 A1 (ITT MFG ENTERPRISES INC [US]) 8 March 2006 (2006-03-08)<br>* paragraph [0029] - paragraph [0053]; figures 1,2 * | 1-9 | TECHNICAL FIELDS SEARCHED (IPC)<br>H01H<br>G05G |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 9 April 2014 | Dobbs, Harvey |

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09-04-2014

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