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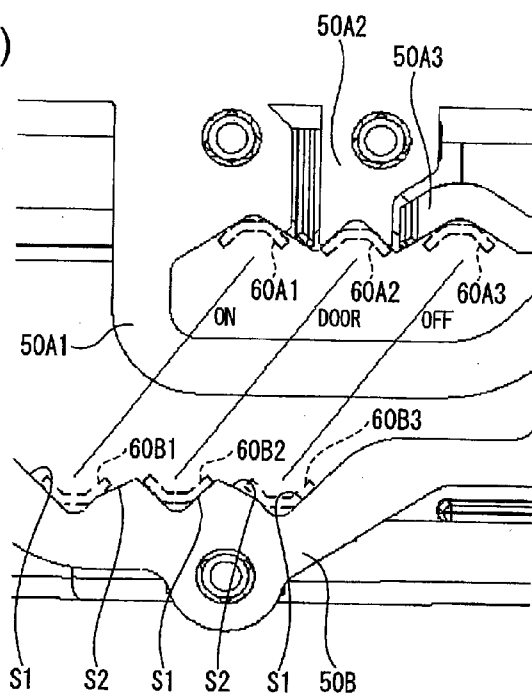
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(54) Title: SEESAW TYPE SWITCH

Fig.9(A)



(57) Abstract: There is provided a seesaw type switch for a motor vehicle interior illumination lamp assembly which includes a seesaw type switch knob, two contact portions 60A, 60B extended from the switch knob, and two bus-bars 50A, 50B which contact the two contact portions 60A, 60B, respectively, wherein surfaces of the bus-bars 50A, 50B with which the contact portions 60A, 60B are brought into contact each have a waveform shape made up of a first click-stopping ridge ML, a second click-stopping ridge MH, and groove portions which are provided at ends of the first click-stopping ridge ML and the second click-stopping ridge MH, and wherein a height of the first click-stopping ridge ML and a height of the second click-stopping ridge MH are made to differ from each other.

DESCRIPTION

SEESAW TYPE SWITCH

Technical Field

The present invention relates to a seesaw type switch and more particularly to bus-bar contacts of a seesaw type switch which includes a single-pole triple-throw or three-contact switch and which is embedded in a lens of a motor vehicle interior lamp.

Background Art

In general, an interior lamp or dome lamp is provided in a ceiling of a vehicle such as a motor vehicle. As an interior lamp of this type, there is known an interior lamp which includes a functional unit and a design unit. The functional unit is mounted on a vehicle so as to be fixed to a ceiling of the vehicle with part thereof exposed from an opening portion in a ceiling panel which is an interior material. The design unit is a cover lens which is fitted in the opening portion in the ceiling from an inside of a passenger compartment so as to be assembled to the functional unit. The functional unit has a switch, and the design unit has a slidable switch knob. When assembling the design unit to the functional unit, a slider of the switch is brought into engagement with an engagement portion which is formed on the switch knob as a recess portion. In the lamp so built up, the switch can be operated as the switch knob slides.

However, when assembling the design unit to the functional unit, the slider of the switch and the engagement portion of the switch knob need to be registered with each other in an accurate fashion, this making the assembling

work troublesome. PTL 1 describes a switch with an intention of solving the problem.

Citation List

Patent Literature

[PTL 1] JP-A-2005-329884

<Switch Proposed in PTL 1>

A switch described in PTL 1 is a seesaw switch intended to improve the assemblage of constituent parts. This motor vehicle interior dome lamp includes a light source, a functional unit having a switch which breaks and makes a conducting path for an electric current supplying electric power to the light source, and a design unit having a cover lens which covers the functional unit and a switch knob with which a switch lever is operated. The switch lever is mounted in the functional unit so as to rock, and the switch knob is mounted in the design unit so as to rock. Thus, with the functional unit and the design unit assembled together, a rocking shaft of the switch lever is made to coincide with a rocking shaft of the switch knob.

<Advantage and Disadvantage of Switch Described in PTL 1>

According to the seesaw switch of PTL 1, the workability in assemblage of the constituent parts is improved since the rocking shaft of the switch lever and the rocking shaft of the switch knob are made to coincide with each other in such a state that the functional unit and the design unit are assembled together.

In the seesaw switch of PTL 1, however, the number of constituent

parts is increased, and this triggers a possibility in that the costs and labor hours are increased.

Summary of Invention

Technical Problem

The invention has been made in view of the situations that are described above. A first object of the invention is to reduce the number of labor hours involved in assemblage with a reduced number of constituent parts so as to improve the workability in assemblage of the parts and to realize an ensured switch operation and an improved switch operation feeling. In the case of a single-pole triple-throw or three-contact switch including an ON contact, a DOOR contact and an OFF contact, a second object of the invention is to prevent an over-travel of an actuator in which in a DOOR mode in which the actuator travels from the ON contact to the DOOR contact, the actuator fails to stay in its operating position to travel to the OFF contact beyond the DOOR contact, or in contrast, in a DOOR mode in which the actuator travels from the OFF contact to the DOOR contact, the actuator fails to stay in its operating position to travel to the ON contact beyond the DOOR contact.

Solution to Problem

According to a first aspect of the invention, there is provided a seesaw type switch, comprising a seesaw type switch knob, two contacts extended from the seesaw type switch knob, a first bus-bar with which one contact of the two contacts is brought into contact, and a second bus-bar with which the other contact of the two contacts is brought into contact, wherein surfaces of the first

bus-bar and the second bus-bar with which the two contacts are respectively brought into contact are each formed into a waveform shape which includes three groove portions and click-stopping ridges which are individually situated between any adjacent groove portions of the three groove portions, by depressing lightly one end or the other end of the seesaw type switch knob, each of the two contacts moves from a groove portion of the three groove portions of corresponding bus-bar among the first and second bus-bars that is situated at one extremity to a middle groove portion through riding over a first click-stopping ridge and stops, by successively heavily depressing, each of the two contacts moves from the middle groove portion to a groove portion of the three groove portions of the corresponding bus-bar that is situated at the other extremity through riding over a second click-stopping ridge and stops; and heights of the first click-stopping ridge and the second click-stopping ridge which are formed in each of the first and second bus-bars are made to differ from each other.

According to a second aspect of the invention, there is provided a seesaw type switch as set forth in the first aspect of the invention, wherein the taller click-stopping ridges and the shorter click-stopping ridges are formed in the first bus-bar and the second bus-bar such that when the one contact of the two contacts moves from the groove portion situated at the one extremity of the three groove portions which are formed in the first bus-bar to the middle groove portion through riding over the shorter click-stopping ridge, the other contact of the two contacts moves to the middle groove portion through riding over the taller click-stopping ridge formed in the second bus-bar, and when the one contact of the two contacts moves from the groove portion situated at the other

extremity of the three groove portions which are formed in the first bus-bar to the middle groove portion through riding over the taller click-stopping ridge, the other contact moves to the middle groove portion through riding over the shorter click-stopping ridge.

Advantageous Effects of Invention

Thus, according to the first aspect of the invention, the seesaw type switch includes the seesaw type switch knob, the two contacts extended from the seesaw type switch knob, the first bus-bar with which the one contact of the two contacts is brought into contact, and the second bus-bar with which the other contact of the two contacts is brought into contact. The surfaces of the first bus-bar and the second bus-bar with which the two contacts are brought into contact are each formed into the waveform shape which includes the three groove portions and the click-stopping ridges which are individually situated between any adjacent groove portions of the three groove portions. Thus, by depressing lightly the one end or the other end of the seesaw type switch knob, each of the two contacts moves from the groove portion of the three groove portions of corresponding bus-bar among the first and second bus-bars which is situated at the one extremity to the middle groove portion through riding over the first click-stopping ridge and stops, and by successively heavily depressing, each of the two contacts moves from the middle groove portion to the groove portion of the three groove portions of the corresponding bus-bar which is situated at the other extremity through riding over the second click-stopping ridge and stops. Therefore, an expensive ball and spring like those used in the conventional seesaw switch can be eliminated, which can reduce the costs.

In addition, a good switching feeling can be ensured by the spring properties of the contacts and the waveform shape of the bus-bars which includes the click-stopping ridges and the groove portions.

Further, the heights of the first click-stopping ridge and the second click-stopping ridge which are formed in each bus-bar are made to differ from each other. Therefore, even in the event that the contact attempts to ride over the following click-stopping ridge after it has forcefully ridden the shorter click-stopping ridge, since the following click-stopping ridge is formed into the taller click-stopping ridge, the contact comes into abutment with a middle slope portion of the taller click-stopping ridge and is then forced to slide down into the middle groove portion, thereby making it possible to prevent the over-travel of the contact.

According to the second aspect of the invention, when the one contact moves to the middle groove portion after riding over the taller click-stopping ridge, even in the event that the one contact attempts to ride over the shorter click-stopping ridge after having forcefully ridden over the taller click-stopping ridge, the one contact cannot ride over the shorter click-stopping ridge since the other contact which makes a pair with the one contact moves towards the taller click-stopping ridge after having ridden over the shorter click-stopping ridge. Thus, the one contact comes into the middle slope portion of the shorter click-stopping ridge and is caused to slide down into the middle groove portion. After all, the one contact, which makes a pair with the other contact, cannot travel over the second click-stopping ridge.

Brief Description of Drawings

Figs. 1 (A) and 1(B) show perspective views of a motor vehicle interior illumination lamp assembly to which the invention is applied, of which Fig. 1(A) is a perspective view seen from a front side, and Fig. 1(B) is a perspective view seen from a rear side.

Fig. 2 is an exploded perspective view of the motor vehicle interior illumination lamp assembly in the state shown in Fig. 1(B).

Figs. 3 (A) and 3(B) show perspective views showing states before and after a contact is press fitted in a switch knob, of which Fig. 3(A) shows the state before and Fig. 3(B) shows the state after the contact is press fitted in the switch knob.

Fig. 4(A) is a perspective view showing a state before a bus-bar and metallic clips are assembled to a housing, and Fig. 4(B) is a perspective view showing a state after they are assembled to the housing.

Fig. 5(A) is a perspective view showing a state before switch knobs are assembled to the housing, and Fig. 5(B) is a perspective view showing a state before bulbs are installed after the switch knobs have been assembled to the housing.

Fig. 6 is a perspective view showing a state before a lens is assembled to the housing after the bulbs have been installed in the housing.

Fig. 7 shows a circuit diagram of the motor vehicle interior illumination lamp assembly shown in Fig. 1.

Fig. 8(A) is a plan view of the motor vehicle interior illumination lamp assembly as seen from a housing side thereof, and Fig. 8(B) is an enlarged view of a portion of the bus-bar in Fig. 8(A) where the contact (Fig. 3(B)) which is press fitted in the switch knob (Fig. 5(A)) comes into contact therewith.

Figs. 9(A) and 9(B) show enlarged plan views of portions of bus-bars where Example 2 is embodied, of which Fig. 9(A) is an enlarged view of the bus-bars and portions of the bus-bars with which contact portions of a switch knob are brought into contact, and Fig. 9(B) is a further enlarged view of the contact and the portions of the bus-bars.

Fig. 10 shows an enlarged plan view explaining a problem of Example 2 by referring to a difference in height between two click-stopping ridges of an upper bus-bar and a difference in height between two click-stopping ridges of a lower bus-bar.

Fig. 11 shows an enlarged plan view explaining Example 3 by referring to a difference in height between two click-stopping ridges of an upper bus-bar and two click-stopping ridges of a lower bus-bar.

Figs. 12 (A)(1), 12(A)(2), 12(B)(1), and 12(B)(2) show enlarged plan views explaining a difference between Example 2 and Example 3, in which Figs. 12(A)(1) explains a reason that no over-travel occurs in the two click-stopping ridges of the upper bus-bar of Example 3, Fig. 12(A)(2) explains a reason that no over-travel occurs in the two click-stopping ridges of the lower bus-bar of Example 3, Fig. 12(B)(1) explains a reason that an over-travel occurs in the two click-stopping ridges of the upper bus-bar of Example 2, and Fig. 12(B)(2) explains a reason that an over-travel occurs in the two click-stopping ridges of the lower bus-bar of Example 2.

Description of Embodiments

Hereinafter, a seesaw switch according to the invention will be described in which the number of labor hours involved in assemblage with a

reduced number of constituent parts so as to improve the workability in assemblage of the constituent parts and which realizes an ensured switching operation and an improved switch operation feeling and which prevents the occurrence of an over-travel of contacts.

<Motor Vehicle Interior Illumination Lamp Assembly to which the Invention is to be Applied>

Figs. 1(A) and 1(B) show perspective views of a motor vehicle interior illumination lamp assembly to which the invention is to be applied, of which Fig. 1(A) is a perspective view as seen from a front side, and Fig. 1(B) is a perspective view as seen from a rear side.

A motor vehicle interior illumination lamp assembly 10 includes a lens 20 (refer to Fig. 2) and a housing 40 (refer to Fig. 2). The lens 20 and the housing 40 are integrated into the interior illumination lamp assembly 10 by bringing locking projections 40K (Fig. 2) of the housing 40 (Fig. 2) into engagement with locking holes 20K (Fig. 2) formed in the lens 20.

<Configuration of Motor Vehicle Interior Illumination Lamp>

Fig. 2 is an exploded perspective view of the motor vehicle interior illumination lamp assembly in the state shown in Fig. 1(B).

In Fig. 2, the motor vehicle interior illumination lamp assembly 10 is made up, sequentially in the following order from the top, of metallic clips 70, a bus-bar 50, a housing 40, bulbs 80, contacts 60, switch knobs 30 and a lens 20.

Then, configurations of these constituent parts will be described as follows.

<Lens 20>

In Fig. 2, the lens 20 (Fig. 6) is a rectangular resin member which functions to transmit light from the bulbs 80 (Fig. 6). The lens 20 includes plural (six in this embodiment) locking members 20L which are provided along a full circumferential edge thereof, and each locking member 20L includes a locking hole 20K. Additionally, plural (three in this embodiment) insertion openings 20N are opened in the lens 20, so that the switch knobs 30 are individually inserted into the insertion openings 20N. In Fig. 2, a designee surface is formed on a rear side of the lens 20.

<Housing 40>

In Fig. 2, the housing 40 is a resin member which accommodates the constituent parts excluding the lens 20, that is, the switch knobs 30, the bus-bar 50, the contacts 60, the metallic clips 70 and the bulbs 80. A surface of the housing 40 which faces the lens 20 has a substantially rectangular shape. Plural (six in this embodiment) locking projections 40K are provided on the lens facing surface of the housing 40 along a full circumferential edge of the rectangular shape so as to project further outwards than a vertical surface of the housing 40.

<Switch Knob 30>

In Fig. 2, the switch knob 30 is a seesaw switch into which the contact 60 is press fitted. When one of depressing portions of the switch knob 30 is depressed, a distal end of the contact 60 is brought into contact with a mating terminal through a seesaw motion, whereas when the other depressing portion

is depressed, the distal end of the contact 60 is moved away from the mating terminal to be brought into contact with the other terminal. Figs. 3 (A) and 3(B) show perspective views showing states before and after the contact 60 is press fitted into the switch knob 30, of which Fig. 3(A) shows a state before and Fig. 3(B) shows a state after the contact 60 is press fitted into the switch knob 30.

In Fig. 3(A), the switch knob 30 is formed by a depressing portion 30N which takes the form of a flat, narrow elongated lid, two accommodating portions 30S which are erected vertically upwards as viewed in the figure in a post-like fashion from the depressing portion 30 with an interval defined therebetween, a shaft hole 30H which is formed in the midst of the two accommodating portions 30S so as to constitute a center of a seesaw motion, and press-fit grooves 30P which are formed in facing surfaces of the two post-like accommodating portions 30S so that a press-fit portion 60P of the contact 60 is to be press fitted therein.

When the press-fit portion 60P of the contact 60 is press fitted into the press-fit grooves 30P of the two post-like accommodating portions 30S of the switch knob 30 which is configured as described above, as shown in Fig. 3(B), the press-fit portion 60P of the contact 60 is accommodated in the switch knob 30. Then, two leg portions 60S project, which extend in opposite directions from the press-fit portion 60P of the contact 60, project from the switch knob 30.

Then, when the switch knob 30 performs a seesaw motion about the shaft hole 30H in the switch knob 30, the two leg portions 60S which project from the switch knob 30 turn about the shaft hole 30H.

<Bus-bar 50>

In Fig. 2, the bus-bar 50 is a metallic long plate which connects portions to be connected electrically of the switch knobs 30, the contacts 60 and the bulbs 80 which are mounted in the housing 40 and includes plural bus-bars. In Figs. 4(A) and 4(B), the bus-bars 50 constitute a functional unit by being fitted in the housing 40 from above.

<Contact 60>

In Fig. 2, as is seen from the enlarged view of Fig. 3(A), the contact 60 includes integrally the press-fit portion 60P which is press fitted between the two accommodating portions 30S of the switch knob 30, the leg portions 60S, 60S which extend obliquely upwards in the opposite directions to each other from two points on the same side of the press-fit portion 60P which lie equidistance from the center thereof, and contact portions (contacts) 60A, 60B which are situated at respective distal ends of the leg portions 60S, 60S.

<Metallic Clip 70>

In Fig. 2, the metallic clip 70 is formed by bending an elastic metallic plate into a U-shape, and a locking piece 70H (also refer to Fig. 4(A)) is formed on one of legs of the U-shape.

On the other hand, a locking hole 40H (also refer to Fig. 4(A)) is formed in a clip locking portion 40C on an outer circumferential side of the housing 40, and therefore, as shown in Fig. 4(B) the metallic clip 70 is assembled to the housing 40 by bringing the locking piece 70H on the metallic clip 70 into engagement with the locking hole 40H in the clip locking portion 40C of the housing 40.

<Bulb 80>

In Fig. 2, the bulb 80 constitutes a light source and is turned on and off by signals from the vehicle. The bulb 80 is accommodated in a bottom portion of a frustum or cup-shaped bulb accommodating portion 40L (Fig. 5(B)) in the housing 40. Light emitted from the bulbs 80 which are accommodated in the bottom portion as shown in Fig. 6 is directed towards the lens 20.

<Assembling Procedure for Motor Vehicle Interior Illumination Lamp Assembly>

Next, an assembling procedure for the motor vehicle interior illumination lamp assembly which employs the parts described heretofore will be described.

Step 1) The contacts 60 are press fitted in the switch knobs 30.

In Figs. 3(A) and 3(B), firstly, the press-fit portion 60P of the contact 60 is press fitted in the press-fit grooves 30P in the two post-like accommodating portions 30S of the switch knob 30 from above as viewed in the figure, so that the contact 60 is mounted in the switch knob 30 as shown in Fig. 3(B).

Step 2) The bus-bars 50 and the metallic clips 70 are assembled to the housing 40.

Next, the plural bus-bars 50 are mounted in a predetermined position in the housing 40 as shown in Fig. 4(A). Pin insertion holes are opened in predetermined locations of the bus-bars 50. On the other hand, pins 40P are erected in predetermined locations on the housing 40. Then, when the bus-bars 50 are mounted in the predetermined position in the housing 40, the pins 40P on the housing 40 are inserted into the corresponding pin holes in the bus-bars 50. A rectangular balloon portion in Fig. 4(B) shows a state in which

the pin 40P on the housing 40 is inserted through the pin hole in the bus-bar 50. After the pins 40P on the housing 40 have been inserted through the pin holes in the bus-bars 50 in the way described above, the pins 40P are thermally fused, whereby the bus-bars 50 are fixed to the housing 40.

Further, the locking pieces 70H (Fig. 4(A)) on the metallic clips 70 are brought into engagement with the locking holes 40H in the clip locking portions 40C of the housing 40, whereby the metallic clips 70 are assembled to the housing 40 as shown in Fig. 4(B).

Step 3) The switch knobs 30 are assembled to the housing 40.

Next, the switch knobs 30 (Fig. 3(B)) in which the press-fit portions 60P of the contacts 60 have been press fitted in step 1 above are assembled to the housing 40 (Fig. 4(B)) to which the bus-bars 50 and the metallic clips 70 have been assembled in step 2 above in positions indicated by arrows in Fig. 5(A).

Step 4) The bulbs 80 are assembled to the housing 40.

Further, the contact 60 assemblies and the bulbs 80 are assembled to the housing 40 in positions indicated by arrows in Fig. 5(B).

Step 5) The lens 20 is assembled to the housing 40.

Finally, the lens 20 (Fig. 2) is assembled to the housing 40 (Fig. 6) to which the contact 60 assemblies and the bulbs 80 are assembled in step 4. To assemble the lens 20 to the housing 40, the locking projections 40K (Fig. 2) on the housing 40 may only have to be brought into engagement with the locking holes 20K (Fig. 2) in the locking members 20L (Fig. 2) of the lens 20.

When all the constituent parts have been mounted in the housing 40 in the ways described heretofore, the motor vehicle interior illumination lamp assembly 10 shown in Figs. 1 (A) and 1(B) is completed.

<Circuit Diagram of Motor Vehicle Interior Illumination Lamp Assembly 10 shown in Figs. 1 (A) and (B)>

Fig. 7 is a circuit diagram of the motor vehicle interior illumination lamp assembly 10 shown in Fig. 1.

In Fig. 7, since there are three switch knobs 30, they are referred sequentially in the following order from the right to as 30R (right), 30M (center) and 30L (left). In these three, the switch knob 30R and the switch knob 30L adopts a sing-pole single throw or two-contact switch, and the switch knob 30M adopts a single-pole triple-throw or three-contact switch.

1) Operation of Switch Knob 30L:

1-1) The switch knob 30M is a switch which is opened to turn off a bulb B1 when the door is closed with its contact lying in a DOOR position and is closed to turn on the bulb B1 when the door is opened. However, even with the switch knob 30M lying in the DOOR position, in order to turn on the bulb B1 whether the door is opened or closed, the contact of the switch knob 30L is switched into an ON position.

Then, the circuit is closed in the order of Battery → Bulb B1 → ON position → Ground line, and the bulb B1 is turned on.

1-2) In addition, in order to turn off the bulb B1 which is now on, the contact of the switch knob 30L is switched into an OFF position. Then, the circuit of Battery → Bulb B1 → OFF position → Ground line is not made, and the bulb B1 is turned off.

2) Operation of Switch Knob 30R:

2-1) In order to turn on a bulb B2 whether the door is opened or closed with the switch knob 30M lying in the DOOR position, the contact of the switch

knob 30R is switched into an ON position.

Then, the circuit of Battery → Bulb B2 → ON position → Ground line is closed, and the bulb B2 is turned on.

2-2) In addition, in order to turn off the bulb B2 which is now on, the contact of the switch knob 30R is switched into an OFF position. Then, the circuit of Battery → Bulb B1 → OFF position → Ground line is not made, and the bulb B2 is turned off.

3) Operation of Switch Knob 30M:

3-1) A DOOR position of the switch knob 30M is connected to a courtesy line C, and the courtesy line C is connected to a door ajar switch which is provided at a portion on a vehicle body which faces the door. The door ajar switch is off when the door is closed, whereas when the door is opened, the door ajar switch becomes on. Consequently, even in the event that the contact of the switch knob 30L for the bulb B1 is in the OFF position, or even in the event that the slide of the switch knob 30R for the bulb B2 is in the OFF position, when the contact of the switch knob 30M is in the DOOR position, since the courtesy line C is connected to the DOOR position of the switch knob 30, the door ajar switch is off when the door is closed. Thus, the bulbs B1, B2 are kept turned off. However, when the door is opened, the door ajar switch becomes on, whereby the bulbs B1, B2 are turned on.

3-2) When the contact of the switch knob 30M is switched into an ON position, the bulbs which are kept turned off with the contacts of the corresponding switch knobs lying in the OFF positions are turned on whether the door is opened or closed.

3-3) When the contact of the switch knob 30M is switched into the OFF

position, the bulbs whose corresponding contacts are in the OFF positions are turned off whether the door is opened or closed.

<Method for Bringing Distal Ends of Contact Portions into Contact with Bus-bars>

Fig. 8(A) is a plan view of the motor vehicle interior illumination lamp assembly 10 is seen from a housing 40's side thereof, and Fig. 8(B) is an enlarged view of portions of the bus-bars 50 in Fig. 8(A) in a case where the contact 60 (Fig. 3(B)) press fitted in the switch knob 30M (Fig. 5(A)) is brought into contact therewith. In Figs. 8(A) and 8(B), the contact portion 60A and the contact portion 60B which line respectively at the distal ends of the two leg portions 60S, 60S which extends in the opposite directions from the contact 60 of the switch knob 30M are brought into contact with the bus-bar 50A and the bus-bar 50B, respectively. Since the two leg portions 60S, 60S are elastic, a strong reaction force is acting on the contact portion 60A and the contact portion 60B which lie at the distal ends of the leg portions 60S, 60S in directions indicated by arrows in which the bus-bar 50A and the bus-bar 50B are expanded individually.

<Example 1: Bus-bars are formed into waveform shape>

Contact areas of the bus-bar 50A and the bus-bar 50B with which the contact portions 60A and 60B of the contacts 60 of the invention are brought into contact are formed not into a straight line but into a waveform which includes ridges and grooves. Then, when the contact portion 60A stays still in a rightmost groove portion of the bus-bar 50A, the contact portion 60B also

stays still in a rightmost groove portion of the bus-bar 50B. Similarly, when the contact portion 60A stays still in a leftmost groove portion of the bus-bar 50A, the contact portion 60B also stays still in a leftmost groove portion of the bus-bar 50B. In addition, when the contact portion 60A stays still in a middle groove portion of the bus-bar 50A, the contact portion 60B also stays still in a middle groove portion of the bus-bar 50B.

Fig. 8(B) shows a state in which the contact portion 60A (Fig. 5(A)) of the contact 60 of the switch knob 30M (Fig. 5(A)) stays still in the middle groove portion of the bus-bar 50A, and the contact portion 60B (Fig. 5(A)) also stays still in the middle groove portion of the bus-bar 50B.

In addition, when the contact portion 60A slides down along a right-hand side ridge of the bus-bar 50A, the contact portion 60B also slides down along a right-hand side ridge of the bus-bar 50B in the same direction. This will also be true with the other ridges.

In this way, according to the invention, the switch is formed by the contact 60 and the waveform shapes of the bus-bars 50 which are each made up of the ridges and the grooves, and therefore, an expensive ball and spring like those used in the conventional seesaw switch can be eliminated, this reducing the costs.

Additionally, a good switching feeling can be ensured by the spring properties of the contact 60 and the waveform shapes of the bus-bars 50 which are each made up of the ridges and the grooves.

<Example 2: Inclination angles of ridge portions of bus-bars are changed>

Example 2 is characterized in that in a bus-bar 50A and a bus-bar 50B

with which a contact portion 60A and a contact portion 60B of a contact 60 are brought into contact, an inclination angle of slopes of a middle groove portion is made steep, while an inclination angle of slopes of groove portions which lie at both extremities are made moderate.

Figs. 9 (A) and 9(B) show enlarged plan views of portions of bus-bars where Example 2 is embodied, of which Fig. 9(A) is an enlarged view showing portions of bus-bars 50A1, 50A2, 50A3 and the bus-bar 50B with which the contact portion 60A (Fig. 5(A)) and the contact portion 60B of the switch knob 30M (Fig. 5(A)) are brought into contact, and Fig. 9(B) is a further enlarged view of the contact portion 60A and the portions of the bus-bars 50A1, 50A2, 50A3.

In Figs. 9(A) and 9(B), the contact portions 60A and 60B are referred to as 60A1 and 60B1 when the contact portions 60A and 60B stay still in leftmost (ON) groove portions of the bus-bar 50A1, 50B, respectively. The contact portions 60A and 60B are referred to as 60A2 and 60B2 when the contact portions 60A and 60B stay still in middle (DOOR) groove portions of the bus-bars 50A2, 50B, respectively. The contact portions 60A and 60B are referred to as 60A3 and 60B3 when the contact portions 60A and 60B stay still in rightmost (OFF) groove portions of the bus-bars 50A3, 50B, respectively. Then, slopes of the groove portions of the bus-bars in which the contact portions 60A1 and 60B1 and the contact portions 60A3 and 60B3 stay still are made into slopes S2 whose inclination angle is moderate (Fig. 9(B)), and slopes of the groove portions of the bus-bars in which the contact portions 60A2 and 60B2 stay still are made into slopes S1 whose inclination angle is steep (Fig. 9(B)).

By adopting this configuration, the operation load with which the

contacts are moved can be changed so that when the contact portions 60A2 (Fig. 9(A)) and 60B2 (Fig. 9(A)) move in Dout directions (Fig. 9(B)) indicated by arrows (that is, the contact portions 60A2 and 60B2 which stay in the middle groove portions move to either the left or right groove portions), the operation load becomes high or heavy, whereas when the contact portions 60A1 (Fig. 9(A)) and 60B1 or the contact portions 60A3 and 60B3 move in Din directions indicated by arrows (that is, the contacts staying in the left or right groove portions move to the middle groove portions), the operation load becomes small or light.

<Example 3: Seesaw switch free from over-travel of contacts>

Example 3 relates to a seesaw switch which is free from an over-travel of the contacts.

<<Problem inherent in the seesaw switch of Example 2>>

Fig. 10 shows an enlarged plan view explaining a problem of Example 2 by referring to a difference in height between two click-stopping ridges of an upper bus-bar and a difference in height between two click-stopping ridges of a lower bus-bar. In Fig. 10, in the upper and lower bus-bars, the shapes of two click-stopping ridges are the same, and therefore, the lower bus-bar will be described here. However, what will be described below as to the lower bus-bar will also be true with the upper bus-bar.

A surface of the lower bus-bar with which the contact 60B is brought into contact has a waveform shape which is made up of three groove portions which function as an ON contact, a DOOR contact and an OFF contact, a click-stopping ridge M1 which is situated between the groove portions which

function as the ON contact and the DOOR contact, and a click-stopping ridge M2 which is situated between the groove portions which function as the DOOR contact and the OFF contact.

When one end of the seesaw type switch knob is depressed lightly, the contact moves from the groove portion (ON) which lies at one extremity of the three groove portions of the bus-bar to the middle groove portion (DOOR) through riding over the first click-stopping ridge M1 to stay still thereat. Following this, when the one end of the seesaw type switch knob is depressed heavily, the contact moves from the middle groove portion (DOOR) to the groove portion which lies at the other extremity of the three groove portions of the bus-bar through riding over the second click-stopping ridge M2 to stay still thereat. In Fig. 10, the height of the first click-stopping ridge M1 is the same as the height of the second click-stopping ridge M2. With the click-stopping ridges having the same heights, it is found out that the following problem occurs.

Fig. 12(B)(2) is an enlarged plan view of a bus-bar which explains the problem inherent in the seesaw switch shown in Fig. 10. In Fig. 12(B)(2), in a DOOR mode in which the contact portion 60B1 moves from the ON contact to the DOOR contact, in the event that the contact portion 60B1 which stays in the groove portion which functions as the ON contact moves out of the groove portion forcefully, the contact portion 60B1 rides over the first click-stopping ridge M1 and strikes an apex portion of the following second click-stopping ridge M2 to ride over the second click-stopping ridge M2, falling in the groove portion which functions as the OFF contact to stay still thereat. Thus, the contact portion 60B1 becomes the contact portion 60B3. Because of this,

there is caused a problem that in the DOOR mode, the contact portion 60B1 cannot stay still in the groove portion which functions as the DOOR contact after it has moved thereto.

<<Configuration of Seesaw Switch of Example 3>>

Fig. 11 is an enlarged plan view which explains a seesaw switch of Example 3 which solves the problem inherent in Example 2 by referring to a difference in height between a click-stopping ridge MH and a click-stopping ridge ML of a lower bus-bar. In the lower bus-bar of Fig. 11, a surface with which the contact portion 60B is brought into contact has a waveform shape which is made up of three groove portions which function as an ON contact, a DOOR contact and an OFF contact, a click-stopping ridge ML which is situated between the groove portions which function as the ON contact and the DOOR contact, and a click-stopping ridge MH which is situated between the groove portions which function as the DOOR contact and the OFF contact. Additionally, the heights of the click-stopping ridge MH and the click-stopping ridge ML of the bus-bar are set so that the click-stopping ridge MH is taller than the click-stopping ridge ML or $MH > ML$.

<<Advantage of Seesaw Switch of Example 3>>

Fig. 12(A)(2) is an enlarged plan view of the bus-bar which illustrates the seesaw switch shown in Fig. 11. In Fig. 12(A)(2), in the DOOR mode in which the contact portion 60B1 moves from the ON contact to the DOOR contact, when the contact portion 60B1 staying in the groove portion which functions as the ON contact moves out forcefully therefrom, the contact portion

60B rides over the first click-stopping ridge M1 to strike the following second click-stopping ridge M2. However, since the second click-stopping ridge M2 is taller, the contact portion 60B1 strikes near the middle slope portion of the second click-stopping ridge M2 and is then caused to slide down into the groove portion which functions as the DOOR contact, thereby an over-travel of the contact portion 60B1 being prevented.

<<Example 4: Combined Technique Applied to Configuration of Two Pairs of Bus-bars and Contacts>>

<<Configuration of Seesaw Switch of Example 4>>

Example 4 relates to a combined technique which can be applied to a configuration of two pairs of bus-bars and contacts. Fig. 11 is the enlarged plan view which also illustrates Example 4 which is an invention which provides a combined technique of the click-stopping ridges MH, ML of the upper bus-bar and the click-stopping ridges MH, ML of the lower bus-bar.

In Fig. 11, the surface of the upper bus-bar with which the contact portion 60A is brought into contact has the waveform shape made up of the three groove portions which function as the ON contact, the DOOR contact and the OFF contact, the click-stopping ridge MH which is situated between the groove portion which functions as the ON contact and the groove portion which functions as the DOOR contact, and the click-stopping ridge ML which is situated between the groove portion which functions as the DOOR contact and the groove portion which functions as the OFF contact. In addition, the surface of the lower bus-bar with which the contact portion 60B is brought into contact has the waveform shape made up of the three groove portions which

function as the ON contact, the DOOR contact and the OFF contact, the click-stopping ridge ML which is situated between the groove portion which functions as the ON contact and the groove portion which functions as the DOOR contact, and the click-stopping ridge MH which is situated between the groove portion which functions as the DOOR contact and the groove portion which functions as the OFF contact. Additionally, the heights of the click-stopping ridge MH and the click-stopping ridge ML of the bus-bar are set so that the click-stopping ridge MH is taller than the click-stopping ridge ML or $MH > ML$.

<<Advantage of Seesaw Switch of Example 4>>

Figs. 12(A)(1) and (A)(2) are enlarged plan views which illustrate the advantage of the seesaw switch of Example 4 shown in Fig. 11. In Fig. 12(A)(2), in the DOOR mode in which the contact portion 60B1 moves from the ON contact to the DOOR contact as described above, when the contact portion 60B1 staying in the groove portion which functions as the ON contact moves out forcefully therefrom, the contact portion 60B rides over the first click-stopping ridge M1 to strike the following second click-stopping ridge M2. However, since the second click-stopping ridge M2 is taller, the contact portion 60B1 strikes near the middle slope portion of the second click-stopping ridge M2 and is then caused to slide down into the groove portion which functions as the DOOR contact, thereby an over-travel of the contact portion 60B1 being prevented.

In addition, in Fig. 12(A)(1), similarly, in the DOOR mode in which the contact portion 60A moves from the ON contact to the DOOR contact, when the

contact portion 60A3 staying in the groove portion which functions as the OFF contact moves out forcefully therefrom, the contact portion 60A3 rides over the shorter click-stopping ridge ML to strike the following taller click-stopping ridge MH. However, since the taller click-stopping ridge M2 is taller in height, the contact portion 60A3 strikes near the middle slope portion of the taller click-stopping ridge MH and is then caused to slide down into the groove portion which functions as the DOOR contact, thereby an over-travel of the contact portion 60B1 being prevented.

In this way, the relation between the click-stopping ridge MH and the click-stopping ridge ML of the upper bus-bar and the click-stopping ridge MH and the click-stopping ridge ML of the lower bus-bar is set so that when one of the pair of contacts rides over the click-stopping ridge ML, the other contact rides over the click-stopping ridge MH, while when the other of the pair of contacts rides over the click-stopping ridge ML, the one contact rides over the click-stopping ridge MH. Thus, not only in the DOOR mode in which the contact moves from the ON contact to the DOOR contact but also in the DOOR mode in which the contact moves from the OFF contact to the DOOR contact, no over-travel of the contact and even occurs.

This application is based upon and claims the benefit of priority of Japanese Patent Application No. 2011-068355 filed on March 25, 2011, the contents of which are incorporated herein by reference.

Industrial Applicability

Thus, according to the present invention, the seesaw type switch

includes the seesaw type switch knob, the two contacts extended from the seesaw type switch knob, the first bus-bar with which the one contact of the two contacts is brought into contact, and the second bus-bar with which the other contact of the two contacts is brought into contact. The surfaces of the first bus-bar and the second bus-bar with which the two contacts are brought into contact are each formed into the waveform shape which includes the three groove portions and the click-stopping ridges which are individually situated between any adjacent groove portions of the three groove portions. Thus, by depressing lightly the one end or the other end of the seesaw type switch knob, each of the two contacts moves from the groove portion of the three groove portions of corresponding bus-bar among the first and second bus-bars which is situated at the one extremity to the middle groove portion through riding over the first click-stopping ridge and stops, and by successively heavily depressing, each of the two contacts moves from the middle groove portion to the groove portion of the three groove portions of the corresponding bus-bar which is situated at the other extremity through riding over the second click-stopping ridge and stops. Therefore, an expensive ball and spring like those used in the conventional seesaw switch can be eliminated, which can reduce the costs. In addition, a good switching feeling can be ensured by the spring properties of the contacts and the waveform shape of the bus-bars which includes the click-stopping ridges and the groove portions.

Further, the heights of the first click-stopping ridge and the second click-stopping ridge which are formed in each bus-bar are made to differ from each other. Therefore, even in the event that the contact attempts to ride over the following click-stopping ridge after it has forcefully ridden the shorter

click-stopping ridge, since the following click-stopping ridge is formed into the taller click-stopping ridge, the contact comes into abutment with a middle slope portion of the taller click-stopping ridge and is then forced to slide down into the middle groove portion, thereby making it possible to prevent the over-travel of the contact.

Further, According to the present invention, when the one contact moves to the middle groove portion after riding over the taller click-stopping ridge, even in the event that the one contact attempts to ride over the shorter click-stopping ridge after having forcefully ridden over the taller click-stopping ridge, the one contact cannot ride over the shorter click-stopping ridge since the other contact which makes a pair with the one contact moves towards the taller click-stopping ridge after having ridden over the shorter click-stopping ridge. Thus, the one contact comes into the middle slope portion of the shorter click-stopping ridge and is caused to slide down into the middle groove portion. After all, the one contact, which makes a pair with the other contact, cannot travel over the second click-stopping ridge.

Reference Signs List

10 Motor vehicle interior illumination lamp assembly;

20 Lens; 20K Locking hole;

20L Locking member;

20N Insertion opening;

30 Switch knob;

30R Right switch knob;

30M Middle switch knob;

30L Left switch knob;
30H Shaft hole;
30N Depressing portion;
30S Accommodating portion;
30P Press-fit groove;
40 Housing;
40C Clip locking portion;
40H Locking hole;
40K Locking projection;
40L Bulb accommodating portion;
40P Pin;
50 Bus-bar;
60 Contact;
60A, 60B Contact portion (Contact);
60P Press-fit portion;
60S Leg portion;
70 Metallic clip;
70H Locking piece;
80 Bulb; B1, B2 Bulb;
S1, S2 Slope;
M1, M2 Click-stopping ridge;
ML Shorter click-stopping ridge;
MH Taller click-stopping ridge.

CLAIMS

1. A seesaw type switch, comprising:
 - a seesaw type switch knob;
 - two contacts extended from the seesaw type switch knob;
 - a first bus-bar with which one contact of the two contacts is brought into contact; and
 - a second bus-bar with which the other contact of the two contacts is brought into contact;

wherein surfaces of the first bus-bar and the second bus-bar with which the two contacts are respectively brought into contact are each formed into a waveform shape which includes three groove portions and click-stopping ridges which are individually situated between any adjacent groove portions of the three groove portions;

by depressing lightly one end or the other end of the seesaw type switch knob, each of the two contacts moves from a groove portion of the three groove portions of corresponding bus-bar among the first and second bus-bars that is situated at one extremity to a middle groove portion through riding over a first click-stopping ridge and stops;

by successively heavily depressing, each of the two contacts moves from the middle groove portion to a groove portion of the three groove portions of the corresponding bus-bar that is situated at the other extremity through riding over a second click-stopping ridge and stops; and

heights of the first click-stopping ridge and the second click-stopping ridge which are formed in each of the first and second bus-bars are made to

differ from each other.

2. The seesaw type switch as set forth in Claim 1, wherein the taller click-stopping ridges and shorter click-stopping ridges are formed in the first bus-bar and the second bus-bar such that:

when the one contact of the two contacts moves from the groove portion situated at the one extremity of the three groove portions which are formed in the first bus-bar to the middle groove portion through riding over the shorter click-stopping ridge, the other contact of the two contacts moves to the middle groove portion through riding over the taller click-stopping ridge formed in the second bus-bar, and

when the one contact of the two contacts moves from the groove portion situated at the other extremity of the three groove portions which are formed in the first bus-bar to the middle groove portion through riding over the taller click-stopping ridge, the other contact moves to the middle groove portion through riding over the shorter click-stopping ridge.

Fig.1(A)

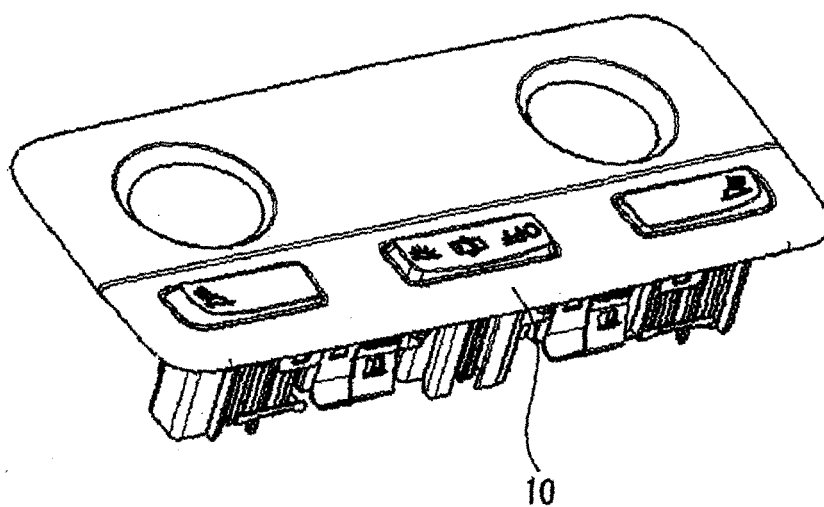


Fig.1(B)

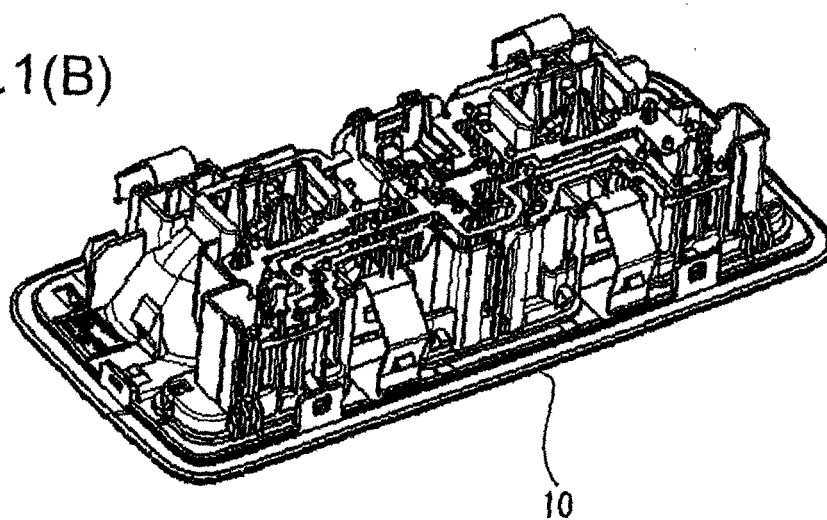
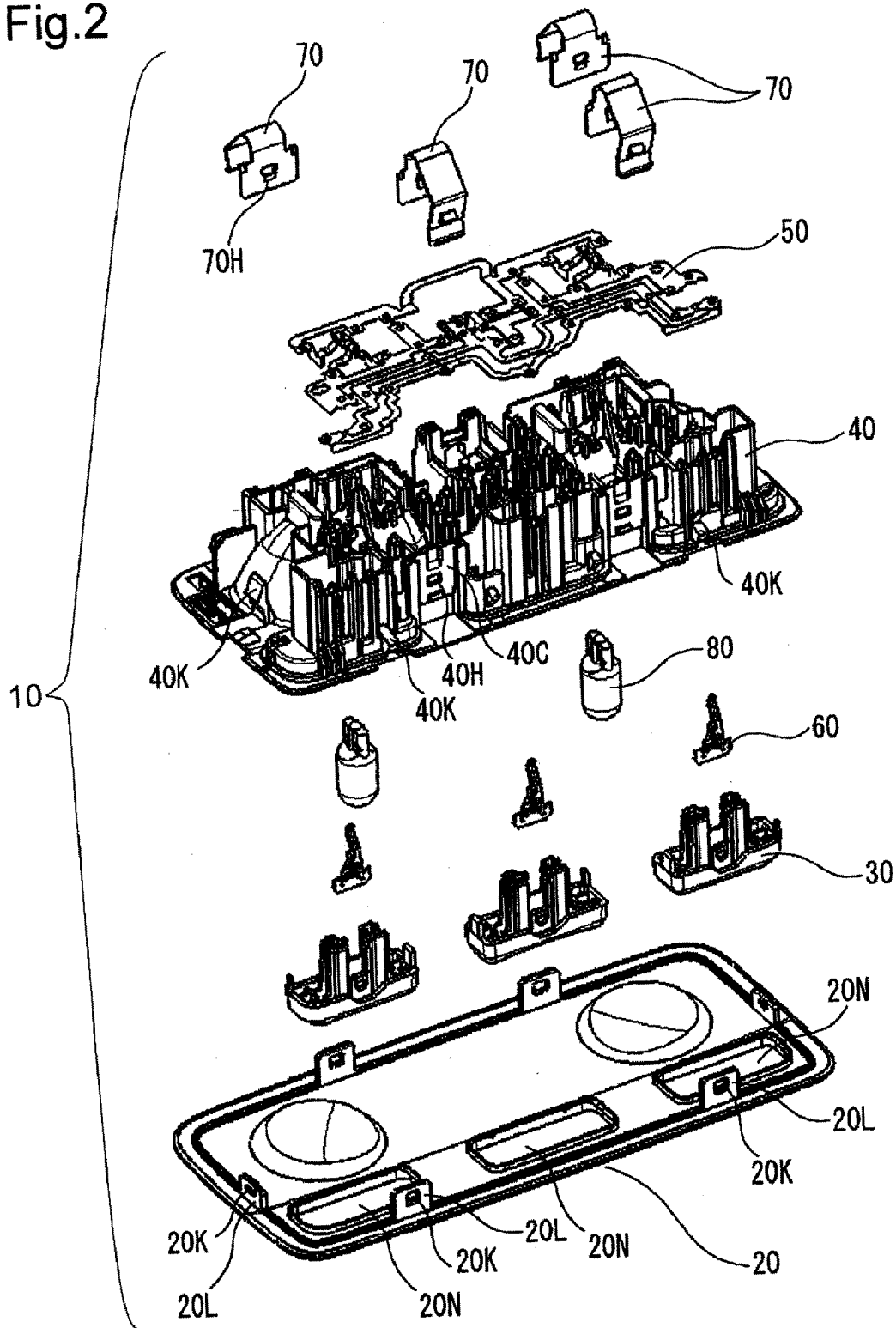


Fig.2



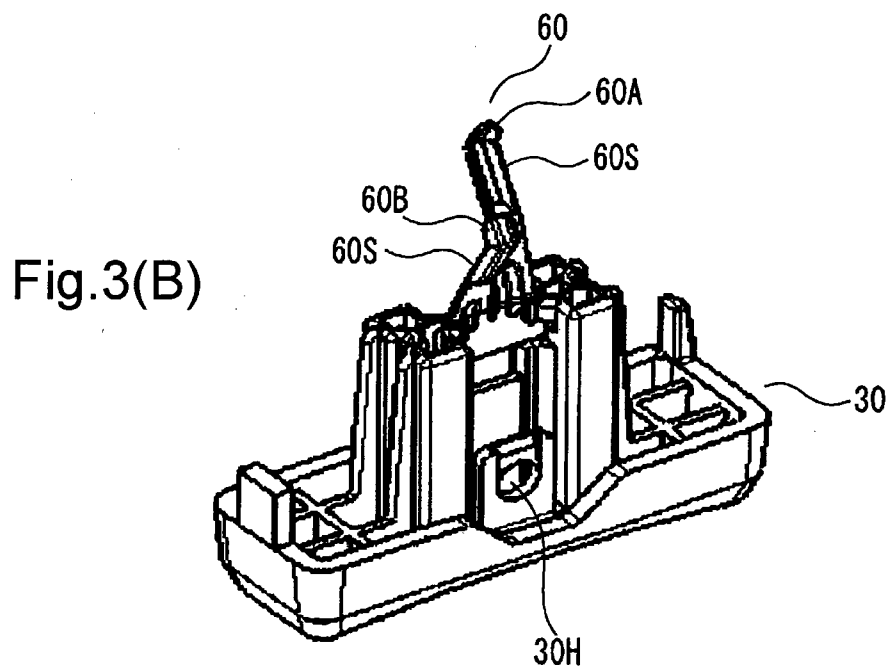
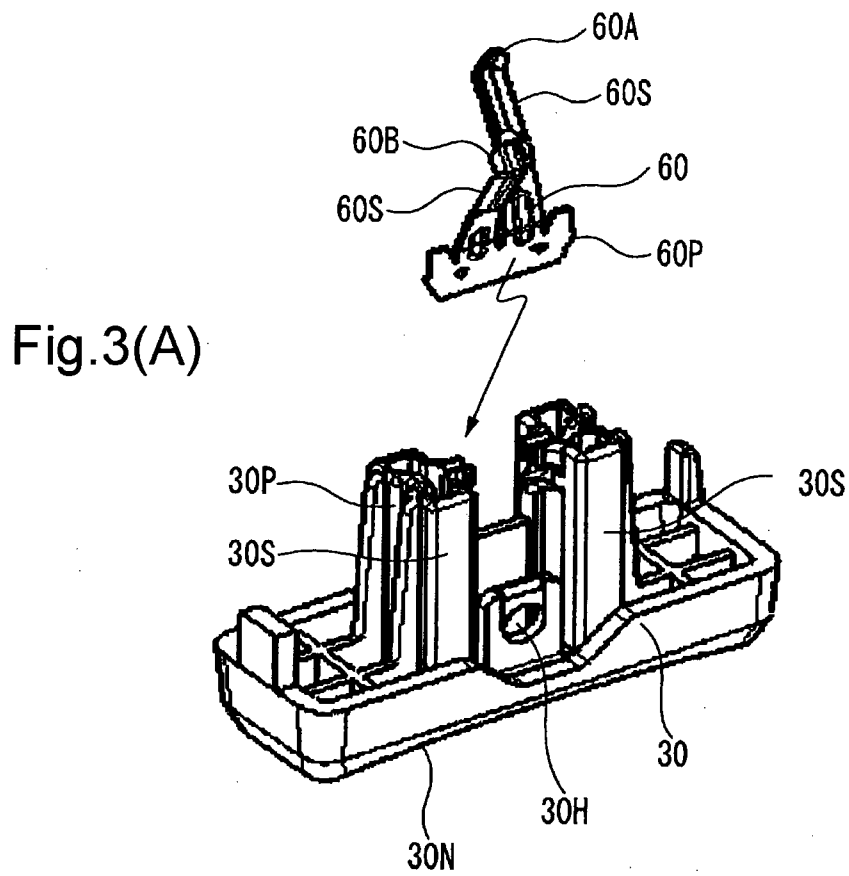


Fig.4(A)

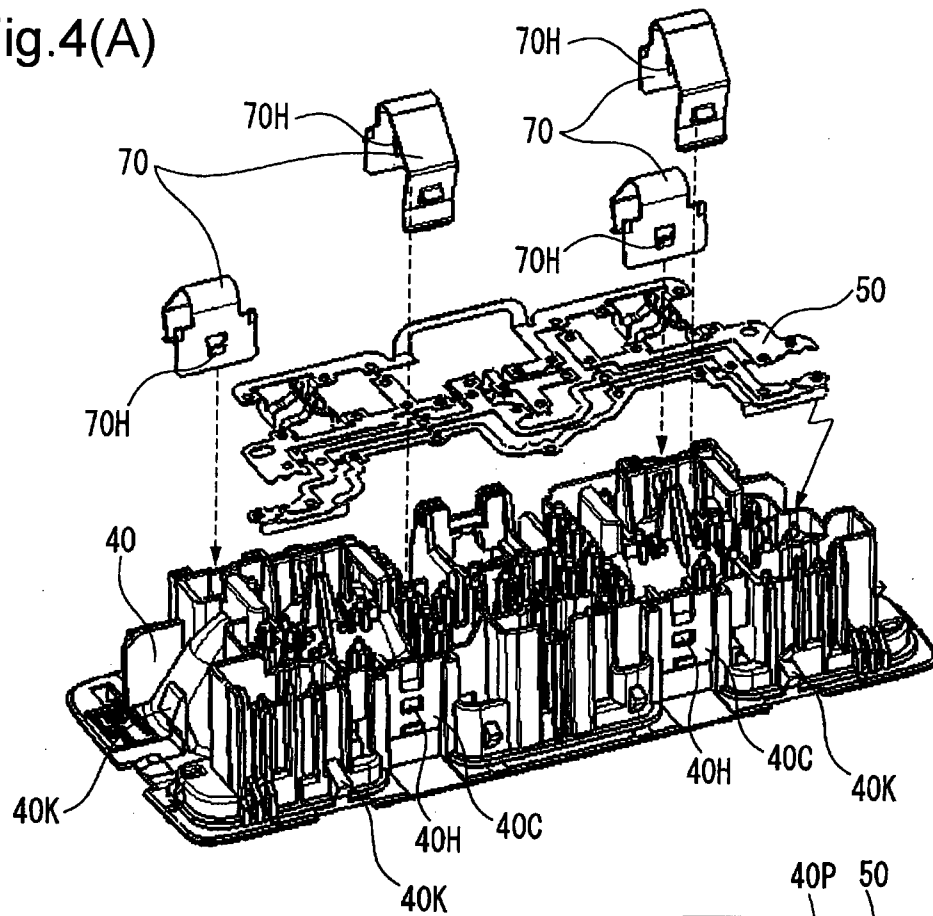


Fig.4(B)

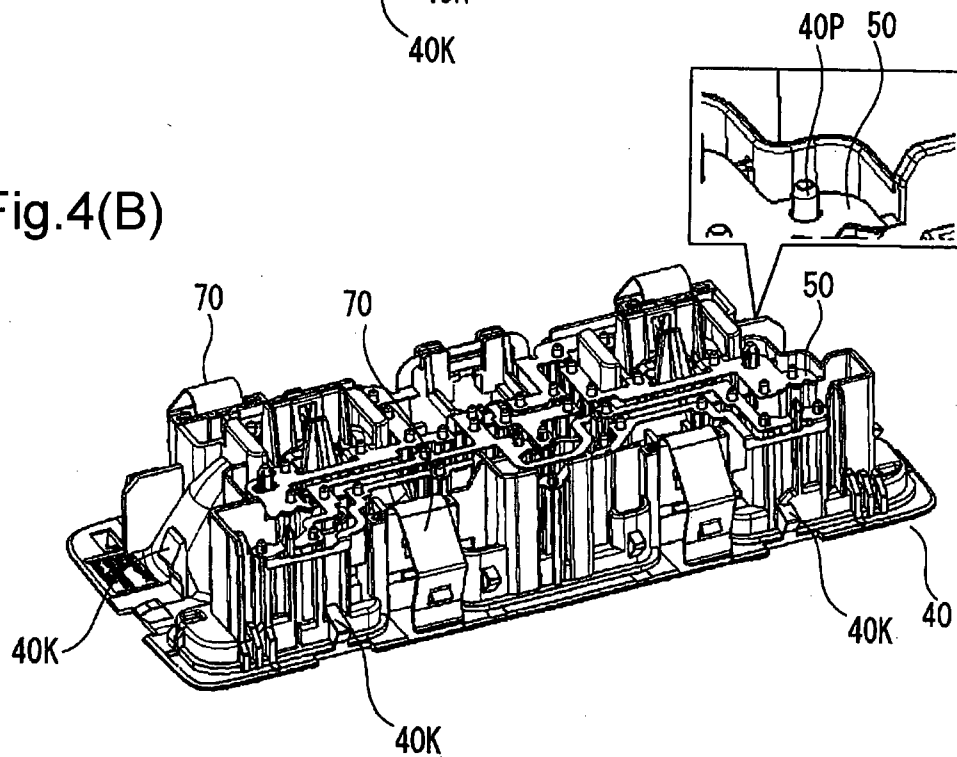


Fig.5(A)

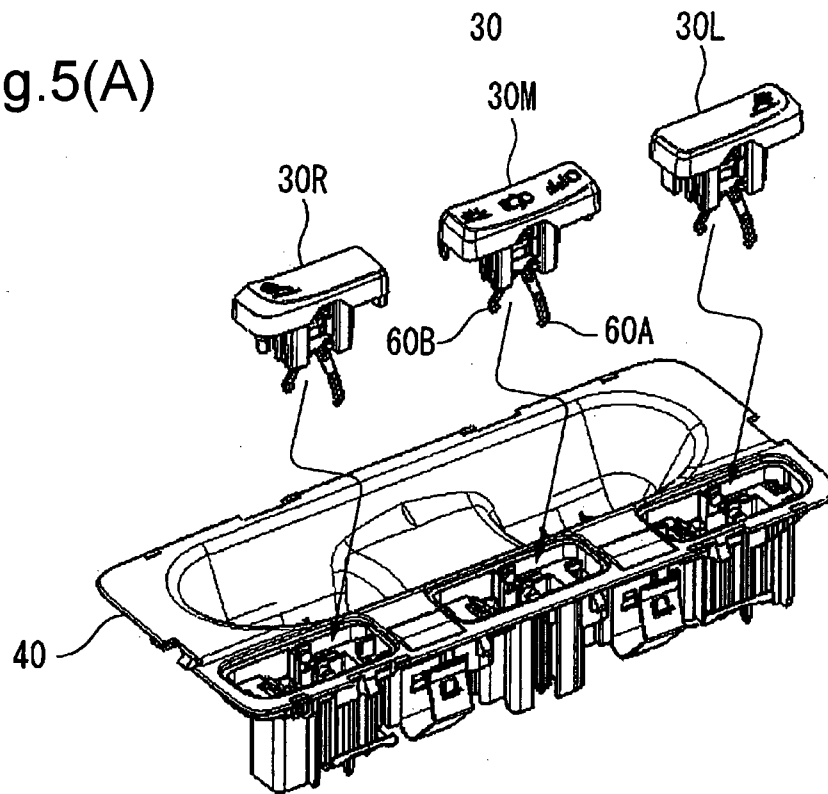


Fig.5(B)

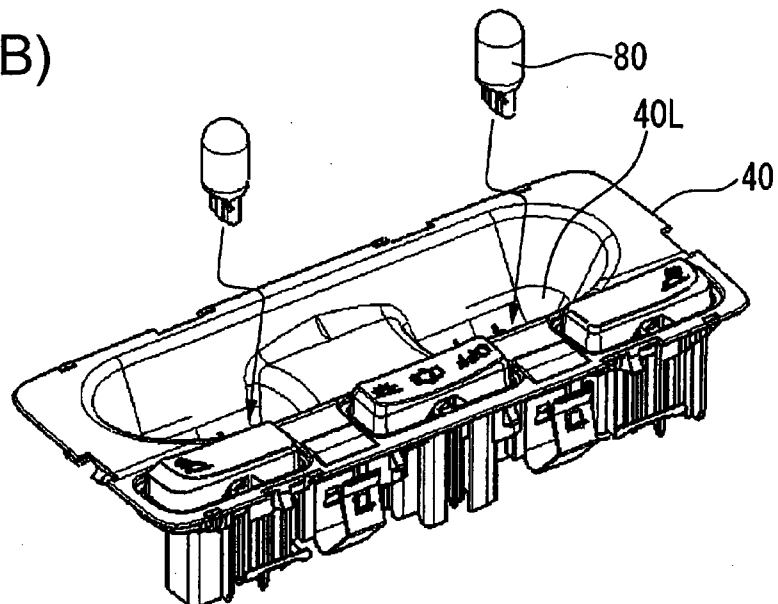


Fig.6

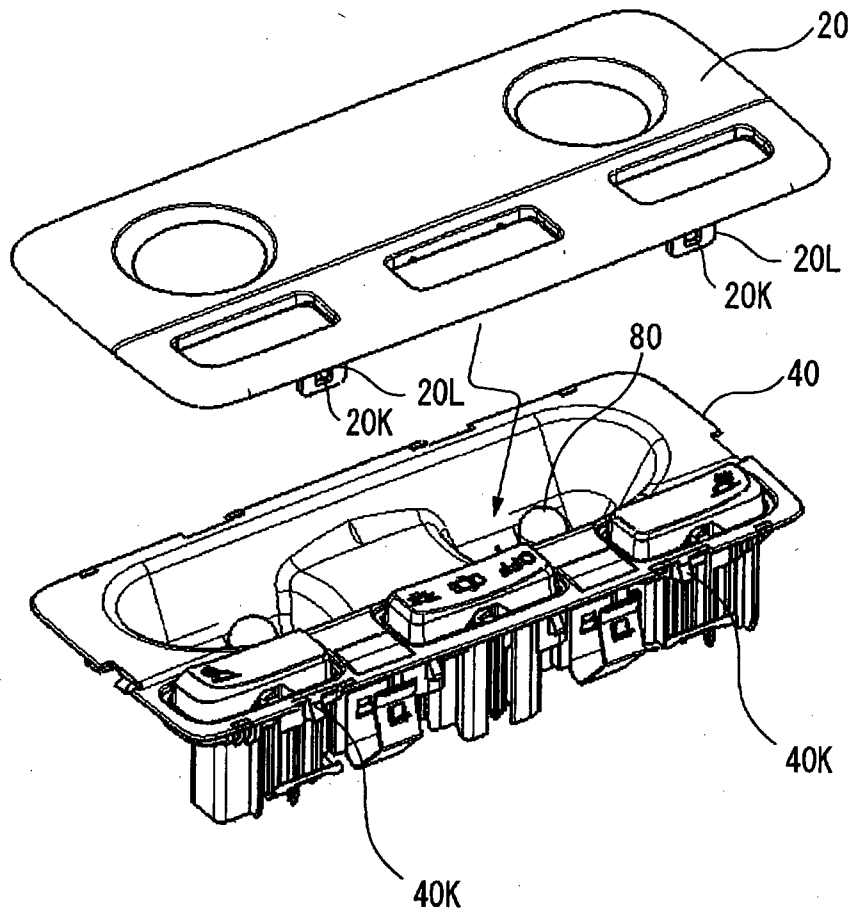


Fig.7

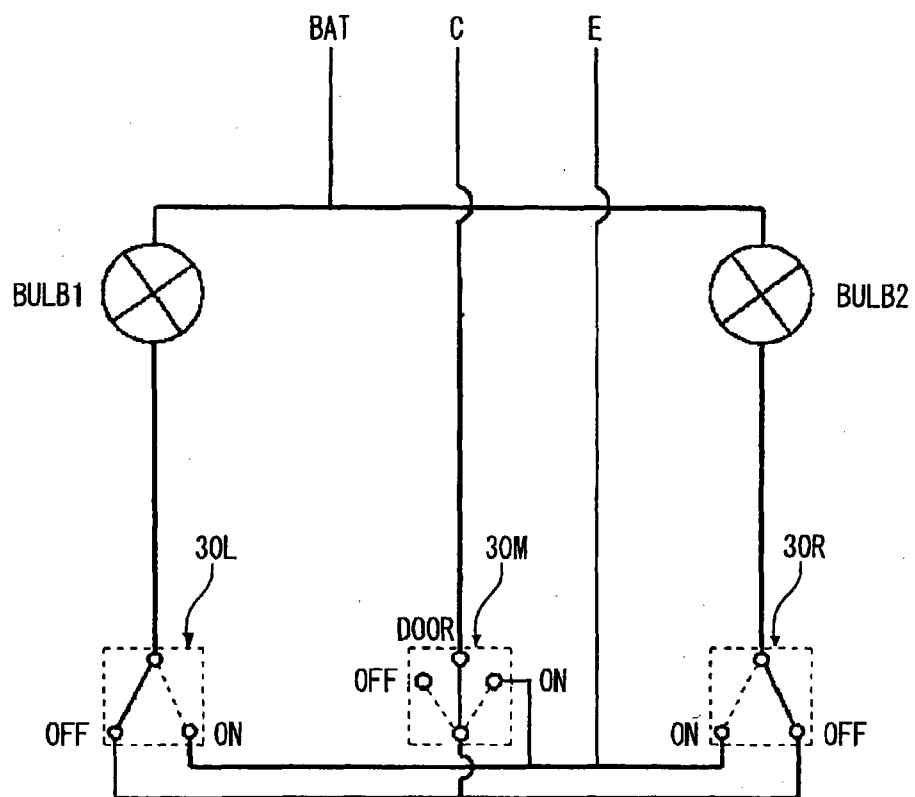


Fig.8(A)

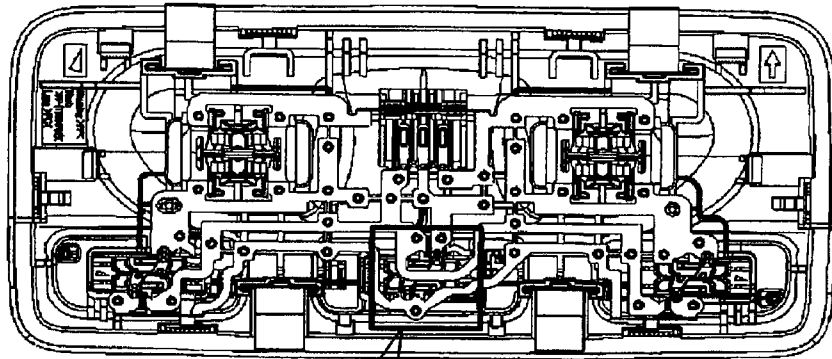


Fig.8(B)

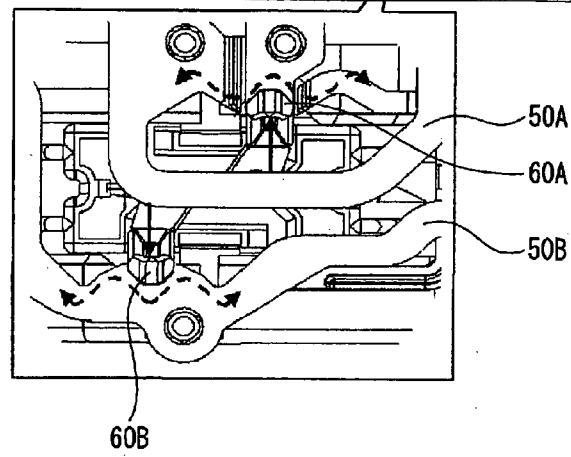


Fig.9(A)

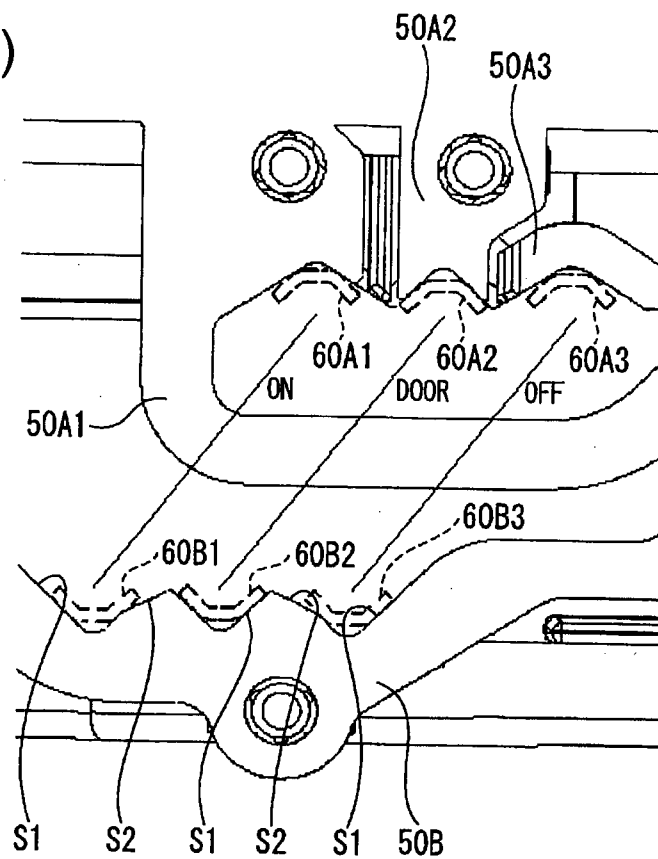


Fig.9(B)

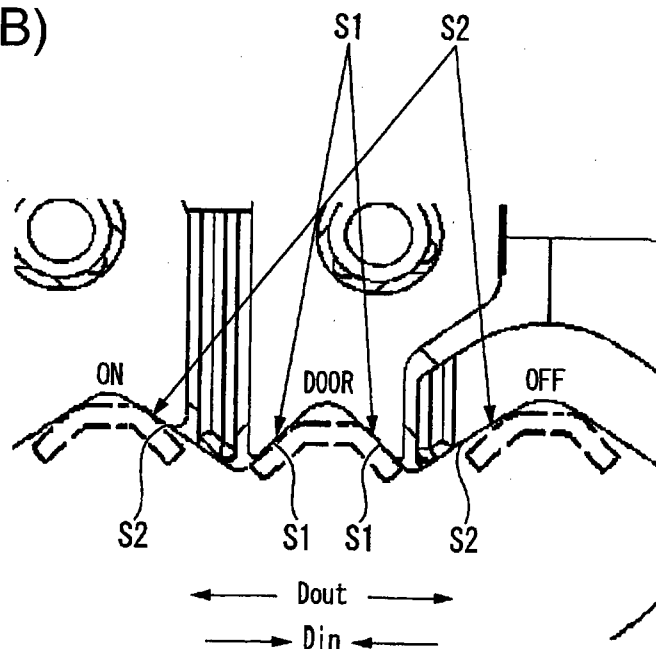


Fig.10

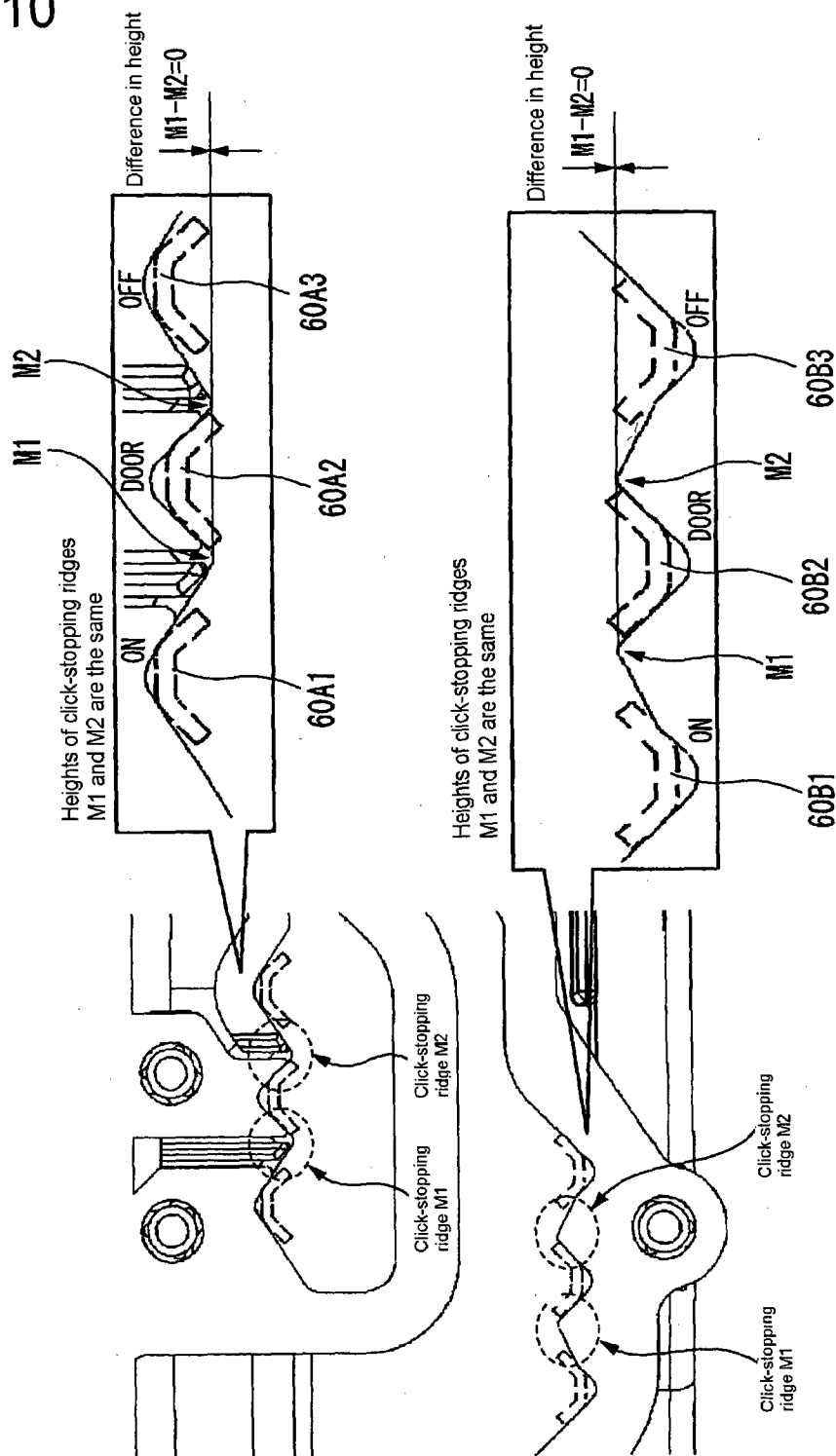


Fig.11

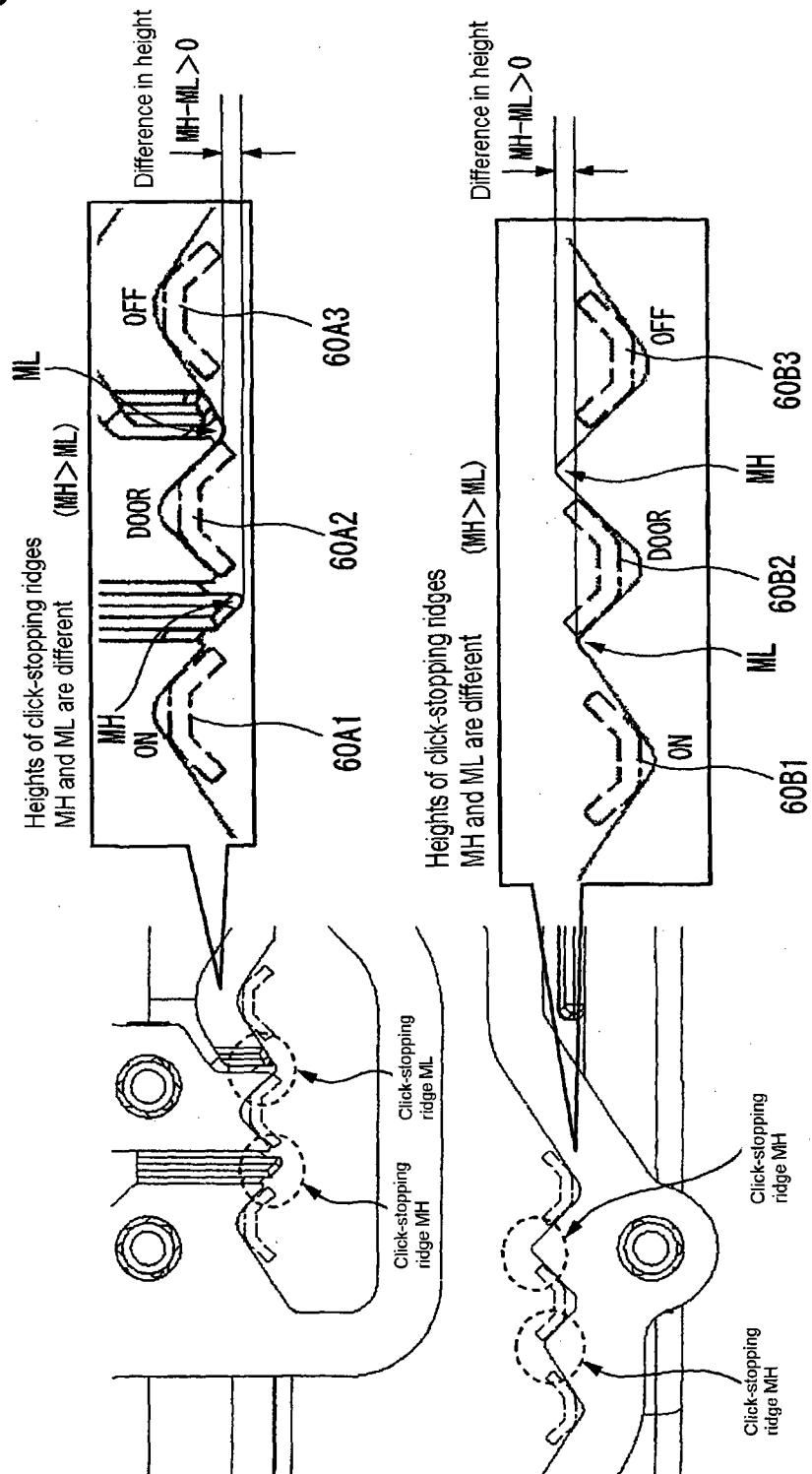


Fig.12(A)(1)

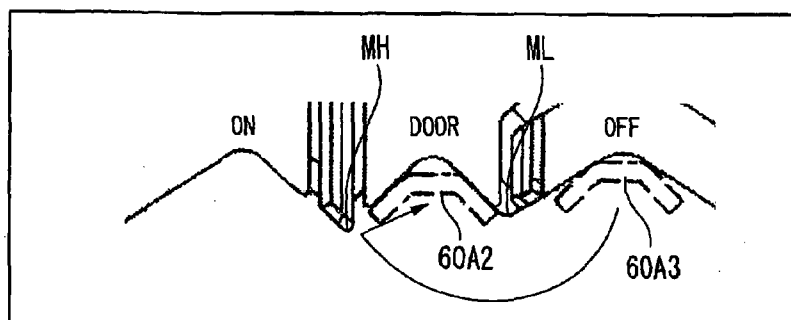


Fig.12(A)(2)

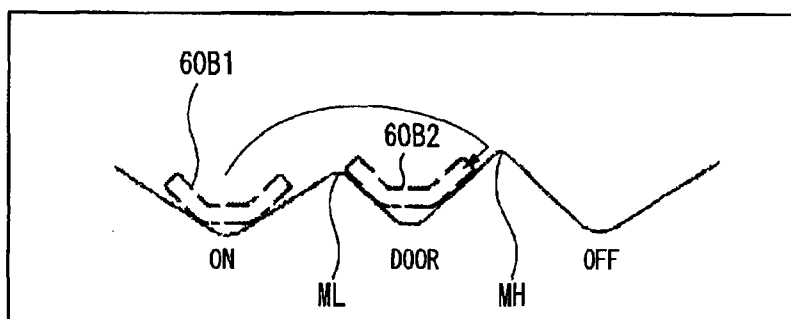


Fig.12(B)(1)

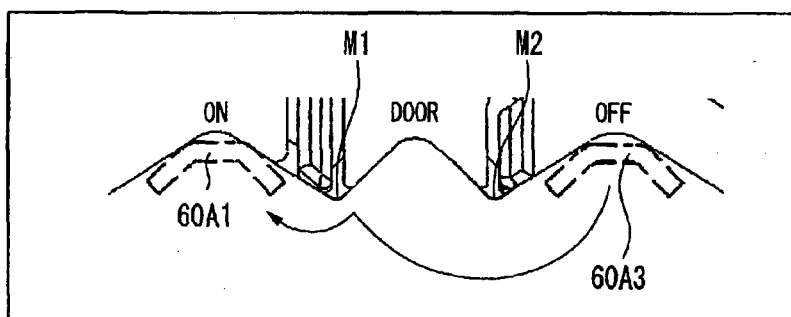
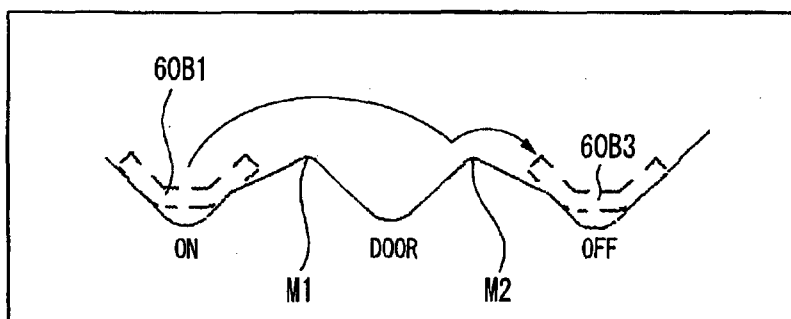


Fig.12(B)(2)



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. H01H23/28

ADD. H01H3/50 H01H23/14 H01H23/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008/302646 A1 (NAGAI KENTAROU [JP] ET AL) 11 December 2008 (2008-12-11) paragraph [0038]; figure 5 -----	1,2
A	EP 0 001 208 A1 (MIYAMOTO MOTOMU) 4 April 1979 (1979-04-04) abstract; figures 4,6 -----	1



Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

20 June 2012

Date of mailing of the international search report

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Simonini, Stefano

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2012/058494

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