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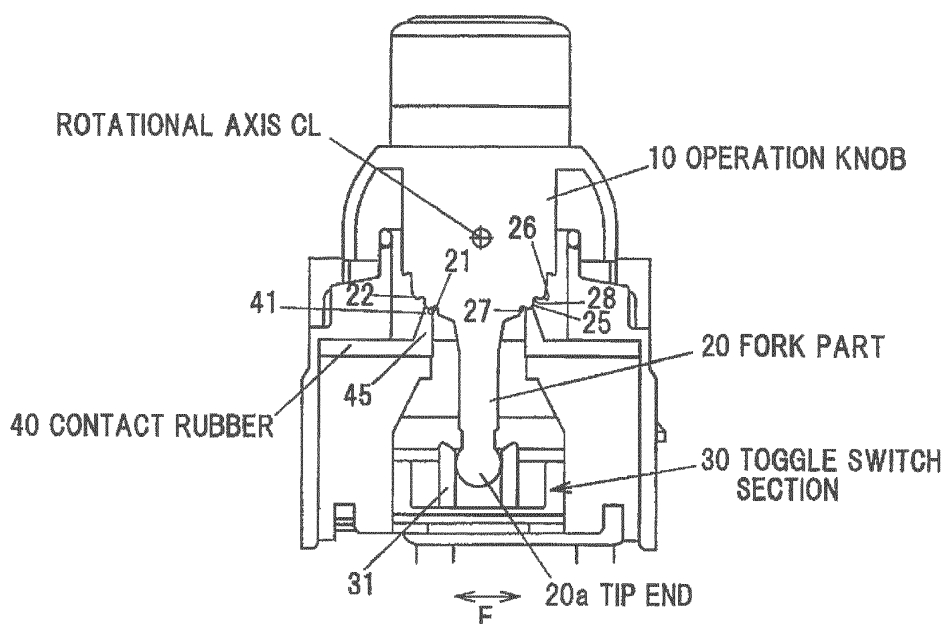
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(54) **SWITCH DEVICE**

(57) A switch device is provided that has a low operation resistance during the operation and an excellent waterproofness. A toggle switch 1 as the switch device includes an operation knob 10 that is operable between a first operating position and a second operating position, a fork part 20 that is activated by an operation of the

operation knob, a switch section 30 that is switched by the fork part, and a contact rubber 40 that contacts and seals an outer periphery of the fork part at the first operating position and the second operating position of the fork part.

FIG.3A



Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The invention relates to a switch device.

2. DESCRIPTION OF THE RELATED ART

[0002] A switch device is known that has a waterproof and dustproof structure and suitable operation feeling (see e.g. Japanese Utility Model registration No. 3192676). The switch device is provided with a rubber seal arranged in a compressed state at the whole periphery of abutting surface between an insulator and a body, the insulator on which a central terminal and fixed contacts disposed individually are arranged, a conductive plate having a movable contact and supported by the central terminal at almost intermediate part in the longitudinal direction, a holder which is swung around the central terminal as the supporting point and swingably supported along the longitudinal direction of the conductive board, and a knob which swings integrally with the holder. The switch device is a rocker switch of which a rubber boot as an elastic body is attached to the periphery of the holder, one end of the rubber boot is crimped to the bottom surface of the knob, and the other end of the rubber boot is crimped to the circular body receiving surface. The switch device can prevent the penetration of water or dust into a contact room by the rubber seal and the rubber boot.

[0003] According to the switch device, the rocker switch with the waterproof and dustproof structure can be provided which can be downsized as compared to a waterproof and dustproof packing and improved in assembly workability.

SUMMARY OF THE INVENTION

[0004] The switch device disclosed in Japanese Utility Model registration No.3192676 is constructed such that the switch device is provided with the holder which is swingably supported and the knob which swings integrally with the holder. Since the rubber boot as the elastic body is attached to the periphery of the holder, one end of the rubber boot is crimped to the bottom surface of the knob and the other end of the rubber boot is crimped on the circular body receiving surface, and thus the penetration of water or dust into the contact space can be prevented by the rubber seal and the rubber boots. At this time, a resistance upon tilt operation may be caused by the rubber seal and the rubber boot. As a result, the operation feeling is degraded. On the other hand, if in the above structure the operation resistance caused by the rubber seal and the rubber boot is reduced, the sealing performance is instead reduced. Thereby, electrical leak may be caused by water etc. penetrated into the

contact surface. If the electrical leak occurs, a migration in the contact surface or a malfunction may be caused.

[0005] It is an object of the present invention to provide a switch device that has a low operation resistance during the operation and an excellent waterproofness.

[1] According to an embodiment of the present invention, a switch device comprises:

an operation knob that is operable between a first operating position and a second operating position;
a fork part that is activated by an operation of the operation knob;
a switch section that is switched by the fork part; and
a contact rubber that contacts and seals an outer periphery of the fork part at the first operating position and the second operating position of the fork part.

[2] The switch device according to [1] may be redefined by that the fork part does not contact the contact rubber partly at an operating position between the first operating position and the second operating position.

[3] The switch device according to [1] or [2] may be redefined by that the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein an abutting part of the fork part and the contact rubber is set to be at a position nearer to the rotational axis than a tip end of the fork part.

[4] The switch device according to any one of [1] to [3] may be redefined by that the contact rubber is formed integrally with a contact rubber used for a switch section that is different from the switch section.

[5] The switch device according to any one of [1] to [4], may be redefined by that the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein an abutting part of the fork part and the contact rubber is formed at both sides of the fork part in a direction along the swing direction.

[6] The switch device according to any one of [1] to [5] may be redefined by that the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein the contact rubber comprises projecting seals that are formed at both sides of the fork part in a direction along a direction orthogonal to the swing direction and that contact the fork part.

[7] The switch device according to any one of [1] to [6] may be redefined by that the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein the contact rubber is formed so as to cover the switch section below an abutting part of the fork part and the contact rubber.

[0006] According to an embodiment of the present invention, a switch device can be provided that has a low operation resistance during the operation and an excellent waterproofness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Next, the present invention will be explained in conjunction with appended drawings, wherein:

FIG.1 is a perspective view showing a composite switch including a switch device according to an embodiment of the present invention;

FIG.2A is a cross sectional view showing the switch device shown in **FIG.1** along a line A-A;

FIG.2B is a partial enlarged view of the part B shown in **FIG.2A**;

FIG.3A is a cross sectional view showing an abutting state of an operation knob and a fork part, and a contact rubber when the operation knob is located in the neutral position along a line C-C shown in **FIG. 2A**;

FIG.3B is a cross sectional view showing the abutting state of the operation knob and the fork part, and the contact rubber when the operation knob is tilt operated along the line C-C;

FIG.4A is a cross sectional view showing a state of a click piece when the operation knob shown in **FIG. 3A** is located in the neutral position along a line D-D shown in **FIG.2A**;

FIG.4B is a cross sectional view showing the state of the click piece when the operation knob shown in **FIG.3B** is tilt operated along the line D-D shown in **FIG.2A**;

FIG.5A is a cross sectional view showing an abutting state of the fork part and a contact rubber when the operation knob is located at the neutral position shown in **FIG.3A**;

FIG.5B is a cross sectional view showing the abutting state of the fork part and the contact rubber when the operation knob is located in the process of changing from the neutral position to tilt operation; and

FIG.5C is a cross sectional view showing the abutting state of the fork part and the contact rubber when the operation knob is tilt operated as shown in **FIG. 3B**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Embodiment of the present invention)

[0008] **FIG.1** is a perspective view showing a composite switch including a switch device according to an embodiment of the present invention. **FIG.2A** is a cross sectional view showing the composite switch shown in **FIG. 1** along a line A-A. **FIG.2B** is a partial enlarged view of the part B shown in **FIG.2A**.

[0009] **FIG.1** shows the composite switch which integrates a toggle switch **1** that is a switch device according to the embodiment of the present invention with a mirror control switch **100** in a body **35**. The mirror control switch **100** is provided with a mirror control switch section **90** which is different from a toggle switch section **30** of the toggle switch **1**. That is, the perspective view (**FIG.1**) shows the composite switch which configures a completed product provided with the toggle switch **1** that is the switch device according to the embodiment of the present invention and the mirror control switch **100** provided with the other switch section **90** by covering with a cover **50**.

[0010] The toggle switch **1** that is the switch device according to the embodiment of the present invention is provided with an operation knob **10** which includes a first operating position and a second operating position, a fork part **20** which is operated by the operation knob **10**, the toggle switch section **30** which is switched by the fork part **20**, and a contact rubber **40** which abuts on and seals a periphery of the fork part **20** at the first operating position and the second operating position.

(Configuration of the toggle switch **1**)

[0011] As shown in **FIG.1**, the toggle switch **1** can rotational operate (swing operate) the operation knob **10** around a rotational axis CL. The fork part **20** is arranged in bottom of the operation knob **10**.

[0012] **FIG.3A** is a cross sectional view showing an abutting state of the operation knob and the fork part, and the contact rubber when the operation knob is located in the neutral position along a line C-C shown in **FIG. 2A**. **FIG.3B** is a cross sectional view showing the abutting state of the operation knob and the fork part, and the contact rubber when the operation knob is tilt operated along the line C-C.

[0013] As shown in **FIGS.3A** and **3B**, the operation knob **10** and the fork part **20** are formed integrally. When the operation knob **10** is rotational operated (toggle operated or swing operated) around the rotational axis CL, a tip end **20a** of the fork part **20** shifts forward the direction E shown in **FIGS.3A** and **3B**. Thus, when the operation knob **10** is toggle operated, the sliding contact **31** of the toggle switch section **30** is driven by the tip end **20a** of the fork part **20**. As a result, the toggle switch can be switched.

[0014] The operation knob **10** can be located in each of operating positions such as a neutral position shown in **FIG.3A**, or an operating position shown in **FIG.3B** and an operating position which is tilted to the opposite side of the operating position shown in **FIG.3B** in the toggle operation described above. The neutral position shown in **FIG.3A** is defined as the first operating position. The operating position shown in **FIG.3B** is defined as the second operating position. Moreover, the operating position of which the operation knob **10** is tilted to the opposite side of the second operating position is also defined as the second operating position.

[0015] FIG.4A is a cross sectional view showing a state of a click piece when the operation knob shown in FIG. 3A is located in the neutral position along a line D-D shown in FIG.2A. FIG.4B is a cross sectional view showing the state of the click piece when the operation knob shown in FIG.3B is located in the tilt operated along the line D-D shown in FIG.2A.

[0016] As shown in FIGS.2A, 4A, and 4B, a click piece 60 is biased from the operation knob 10 to the body 35 by the coil spring 62. When the operation knob 10 is located in the first operating position shown in FIG.3A, as shown in FIG.4A, a tip end 61 of the click piece 60 is entered into a click groove 36 of the body 35. Also, when the operation knob 10 is located in the second operating position shown in FIG.3B, as shown in FIG.4B, the tip end 61 of the click piece 60 is entered into a click groove 37 of the body 35. Since the click piece 60 is entered into any one of click grooves 36, 37, 38 of the body 35, the operation knob 10 is located in the neutral position (the first operating position) shown in FIG.3A, or a tilt position (the second operating position) shown in FIG.3B. However, the click piece 60 may be entered into the click groove 38 at the tilt position (the second operating position) in case of the tilt direction.

[0017] FIG.5A is a cross sectional view showing an abutting state of the fork part and the contact rubber when the operation knob shown in FIG.3A is located at the neutral position. FIG.5B is a cross sectional view showing the abutting state of the fork part and the contact rubber when the operation knob is located in the process of changing from the neutral position to tilt operation. FIG. 5C is a cross sectional view showing the abutting state of the fork part and the contact rubber when the operation knob shown in FIG.3B is tilt operated.

[0018] As shown in FIGS.3A and 5A, a tip end projection 41 of the contact rubber 40 contacts slidably a first projection 21 which is formed in an intermediate area between the operation knob 10 and the fork part 20 with a predetermined crushing margin when the operation knob 10 is located at the first operating position.

[0019] The first projection 21 of the operation knob 10 abuts on the tip end projection 41 of the contact rubber 40 when the operation knob 10 is located at the first operating position. The abutting surface of the first projection 21 is almost plane surface. Meanwhile, as shown in FIG.5B, the tip end projection 41 of the contact rubber 40 is Round chamfered. Thus, adhesion and waterproofness are improved by abutting between the first projection 21 and the tip end projection 41 of the contact rubber 40.

[0020] As shown in FIG.5B, the first projection 21 and the second projection 22 do not abut on the tip end projection 41 of the contact rubber 40 when the operation knob is located at an operating position (the operating state). Grooves 23, 24 are formed at both sides of the first projection 21 and the intermediate area between the first projection 21 and the second projection 22 have. Thus, since the tip end projection 41 is opposite to the

groove 24, the sliding resistance between the operation knob 10 and the contact rubber 40 does not occur at the operating position (the operating state) of the operation knob 10, and the toggle switch 1 has less operation resistance in operating and excellent operation feeling.

[0021] As shown in FIGS.3B and 5C, the tip end projection 41 of the contact rubber 40 contacts slidably a second projection 22 which is formed in the intermediate area between the operation knob 10 and the fork part 20 with a predetermined crushing margin when the operation knob 10 is located at the second operating position.

[0022] The second projection 22 of the operation knob 10 abuts on the tip end projection 41 of the contact rubber 40 when the operation knob 10 is located at the second operating position. The abutting surface of the second projection 22 is almost plane surface. Meanwhile, the tip end projection 41 of the contact rubber 40 is Round chamfered. Thus, the toggle switch 1 has good adhesion, waterproofness, and sealing effect by abutting of the second projection 22 and the tip end projection 41 of the contact rubber 40.

[0023] Meanwhile, as shown in FIG.3A, projections 25, 26 and grooves 27, 28 are also formed at the opposite side of the first projection 21 and the second projection 22. The same operation described above will be operated when the operation knob 10 is toggle operated forward the opposite side.

[0024] FIG.2A shows the contact rubber 40 with a detailed hatching. The contact rubber 40 is formed by an elastomer (rubber) such as silicon, and forms a standing portion 45 which stands so as to surround the fork part 20 as shown in FIGS.2A, 3A, and 3B. The tip end projection 41 is formed at the tip end of the standing portion 45 in the cross sections shown in FIGS.3A and 3B. And the projecting seal 43 is formed in the cross section shown in FIG.2A as the detail of the part B show in FIG. 2B.

[0025] As shown in FIGS.2A and 2B, the projecting seal 43 of the contact rubber 40 contacts constantly slidably the fork part 20 with the predetermined crushing margin regardless of the operating position of the operation knob 10. That is, whether any operating positions of the operation knob 10 explained in FIGS.3A, 3B, 5A to 5C, the projecting seal 43 of the contact rubber 40 contacts slidably the fork part 20 with the predetermined crushing margin. And the projecting seal 43 has waterproofness and sealing effect.

[0026] As described above, the contact rubber 40 can abut on and seal the periphery of the fork part 20. Also, as described in FIGS.5A to 5C, the contact rubber 40 abuts on the fork part 20 when the operation knob 10 is located at the first or second operating position. However, the contact rubber 40 does not abut on the fork part 20 when the operation knob 10 is located at the operating position (the operating state). Thus, the contact rubber 40 abuts on the periphery of the fork part 20 when the operation knob 10 is located at the first or second operating position. And, as shown in FIGS.2A and 2B, only

the projecting seal **43** of the contact rubber **40** abuts on the fork part **20** when the operation knob **10** is located at the operating position (the operating state).

[0027] That is, the fork part **20** partly does not abut on the contact rubber **40** at the intermediate positions between the first operating position and the second operating position. Thus, the resistance feeling caused by the sliding resistance in operating the operation knob **10** can be reduced. As a result, the configuration according to the embodiment can reduce the operation resistance in operating and has excellent waterproofness.

[0028] Accordingly, the contact rubber **40** is provided with the standing portion **45**, and the tip end projection **41** and the projecting seal **43** are arranged in the tip end of the standing portion **45**. That is, as shown in **FIGS.2A**, **3A**, and **3B**, the abutting part of the fork part **20** and the contact rubber **40** is set to be at the position near to the rotational axis CL. Thus, the sealing position can be set at the position higher than the toggle switch section **30**, so that the waterproofness can be further improved.

[0029] As shown in **FIG.2A**, the contact rubber **40** covers completely the toggle switch section **30** under the standing portion **45**. Also, the contact rubber **40** is formed integrally with contact rubber used for the mirror control switch section **90** that is different from the toggle switch section **30**.

[0030] As shown in **FIGS.1** and **2A**, the composite switch is provided with the toggle switch **1** and the mirror control switch **100** by covering with the cover **50**. The contact rubber **40** is formed so as to cover integrally the toggle switch section **30** for the toggle switch **1** and the mirror control switch section **90** for the mirror control switch **100**.

[0031] The mirror control switch **100** chooses a right mirror or a left mirror by the rotational operation of the knob **111** and drives the chosen mirror by the tilt operation of the knob **111**. The behavior of the mirror control switch **100** will be explained simply below.

[0032] For example, the knob **111** is rotated and set to be at the position of the chosen mirror (the left mirror or the right mirror). A rod **114** and a rotor **116** rotate in association with the rotation of the knob **111**. The rotation of this rotor **16** causes the cam portion **116h** of the rotor **116** to move the switching pusher **120** downward. As a result, the mirror is chosen by a contact plate **40e** of the contact rubber **40** corresponding to the switching pusher **120** coming into contact with the contact, bringing the contact into conduction.

[0033] The tilt operation of the knob **11** tilts the chosen mirror that is either the left mirror or the right mirror.

[0034] The tilt operation of the knob **111** causes a spherical surface portion **114b** of the rod **114** to rotate on a receiving surface portion **116f** of the rotor **116**. As a result, the knob **111**, the actuator **113**, and the rod **114** integrally tilt. This tilt operation causes a push projection **113b** at the tilted position of the actuator **113** to move the corresponding tilting pusher **130** downward. As a result, the contact plate **40e** of the contact rubber **40** corre-

sponding to the tilting pusher **130** comes into contact with the contact, bringing the contact into conduction. Further, for example, the chosen mirror (the left mirror or the right mirror) is driven by bringing a mirror driving motor into conduction.

(Behavior and waterproofness of the toggle switch **1**)

[0035] The tilt operation of the operation knob **10** of the toggle switch **1** shown in **FIG.3B** from the neutral position shown in **FIG.3A** will be explained. At the neutral position shown in **FIG.3A**, as shown in **FIGS.3A** and **5A**, the operation knob **10** is located at the first operating position, and the tip end projection **41** of the contact rubber **40** contacts slidably the first projection **21** which is formed in the intermediate area between the operation knob **10** and the fork part **20** with the predetermined crushing margin. The first projection **21** of the operation knob **10** abuts on the tip end projection **41** of the contact rubber **40** when the operation knob **10** is located at the first operating position. The abutting surface of the first projection **21** is almost plane surface. Meanwhile, the tip end projection **41** of the contact rubber **40** is Round chamfered. Thus, the first projection **21** abuts on the tip end projection **41** of the contact rubber **40**. Moreover, as shown in **FIGS.2A** and **2B**, the projecting seal **43** of the contact rubber **40** contacts constantly slidably the fork part **20** with the predetermined crushing margin. As a result, the contact rubber **40** abuts on the periphery of the fork part **20** at the first operating position of the fork part **20** and exhibits the sealing effect.

[0036] Meanwhile, at the tilt position shown in **FIG.3B**, as shown in **FIGS.3B** and **5C**, the operation knob **10** is located at the second operating position, and the tip end projection **41** of the contact rubber **40** contacts slidably the second projection **22** which is formed in the intermediate area between the operation knob **10** and the fork part **20** with the predetermined crushing margin. The second projection **22** of the operation knob **10** abuts on the tip end projection **41** of the contact rubber **40** when the operation knob **10** is located at the second operating position. The abutting surface of the second projection **22** is almost plane surface. Meanwhile the tip end projection **41** of the contact rubber **40** is Round chamfered. Thus, the second projection **22** abuts on the tip end projection **41** of the contact rubber **40**. Moreover, as shown in **FIGS.2A** and **2B**, the projecting seal **43** of the contact rubber **40** contacts constantly slidably the fork part **20** with the predetermined crushing margin. As a result, the contact rubber **40** abuts on the periphery of the fork part **20** at the second operating position of the fork part **20** and exhibits the sealing effect.

[0037] When the operation knob **10** of the toggle switch **1** described above is located at the neutral position or the tilt position, the toggle switch section **30** can be waterproofed by the contact rubber **40** described above, even if water penetrates through a space **200** between the cover **50** and the operation knob **10** shown in **FIG.**

2A. Thus, the penetration of water from the fork part **20** into the toggle switch section **30** can be prevented. Also, since the abutting part of the fork part **20** and the contact rubber **40** is set to be at the position near to the rotational axis CL and the sealing position can be set to be at the position higher than the toggle switch section **30**, the penetration of water in the toggle switch section **30** can be controlled effectively.

[0038] Meanwhile, the contact rubber **40** is formed so as to cover integrally the mirror control switch section **90** of the mirror control switch **10** and cover whole of a board **95** of the mirror control switch section **90** from above. As a result, one contact rubber **40** can waterproof the mirror control switch section **90** which is different from the toggle switch section **30** of the toggle switch **1**.

(Functions and advantageous effects of the embodiment of the present invention)

[0039] The switch device according to the embodiment of the present invention has effects described below.

(1) The fork part of the switch device according to the embodiment is sealed by the contact rubber. The switch device is configured such that the tip end projection of the contact rubber contacts the projection of the operation knob so as to minimize a resistance of the contact rubber at a stopping position of the operation knob (the first operating position, the second operating position) even if the fork part shifts. As a result, the switch device which the operation resistance in operating is minimized and has excellent waterproofness can be provided.

(2) Also, the contact rubber is configured integrally so as to share with the contact rubber for the other switch section. As a result, whole of the switch sections can be sealed and the manufacturing cost can be reduced.

(3) According to the switch device of the embodiment, water does not penetrate into the contact rubber from the fork part even if water enters from above of the cover which is the designed surface. As a result, the switch device can be waterproofed completely.

[0040] In the structure described above, members that are not specifically referred to can be used from materials such as popular resin and metal.

[0041] Although several embodiments of the present invention have been described above, these embodiments are merely examples and the invention according to the claims is not to be limited thereto. Such novel embodiments may be implemented in various other forms, and various omissions, substitutions, changes, and the like can be made without departing from the spirit and scope of the present invention. In addition, all the combinations of the features described in these embodiments are not necessarily needed to solve the technical

problem. Further, these embodiments are included within the spirit and scope of the invention and also within the invention described in the claims and the scope of equivalents thereof.

Claims

1. A switch device, comprising:

an operation knob that is operable between a first operating position and a second operating position;
a fork part that is activated by an operation of the operation knob;
a switch section that is switched by the fork part; and
a contact rubber that contacts and seals an outer periphery of the fork part at the first operating position and the second operating position of the fork part.

2. The switch device according to claim **1**, wherein the fork part partly does not contact the contact rubber at an operating position between the first operating position and the second operating position.

3. The switch device according to claim **1** or **2**, wherein the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein an abutting part of the fork part and the contact rubber is set to be at a position nearer to the rotational axis than a tip end of the fork part.

4. The switch device according to any one of claims **1** to **3**, wherein the contact rubber is formed integrally with a contact rubber used for a switch section that is different from the switch section.

5. The switch device according to any one of claims **1** to **4**, wherein the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein an abutting part of the fork part and the contact rubber is formed at both sides of the fork part in a direction along the swing direction.

6. The switch device according to any one of claims **1** to **5**, wherein the fork part or the operation knob swings around a rotational center as a rotational axis, and wherein the contact rubber comprises projecting seals that are formed at both sides of the fork part in a direction along a direction orthogonal to the swing direction and that contact the fork part.

7. The switch device according to any one of claims **1** to **6**, wherein the fork part or the operation knob

swings around a rotational center as a rotational axis,
and
wherein the contact rubber is formed so as to cover
the switch section below an abutting part of the fork
part and the contact rubber.

5

10

15

20

25

30

35

40

45

50

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FIG.1

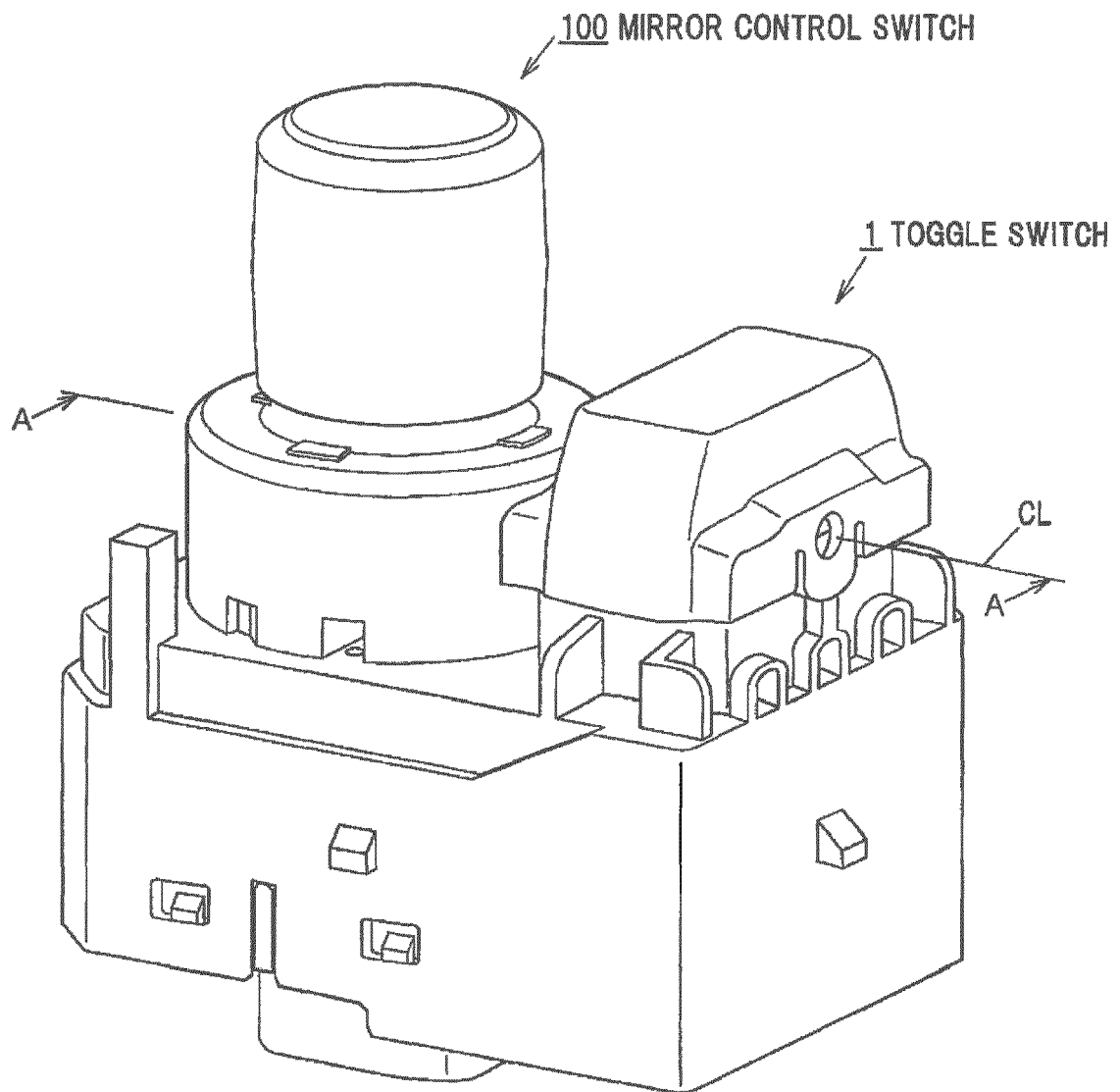


FIG.2A

CROSS SECTIONAL VIEW
ALONG A LINE A-A

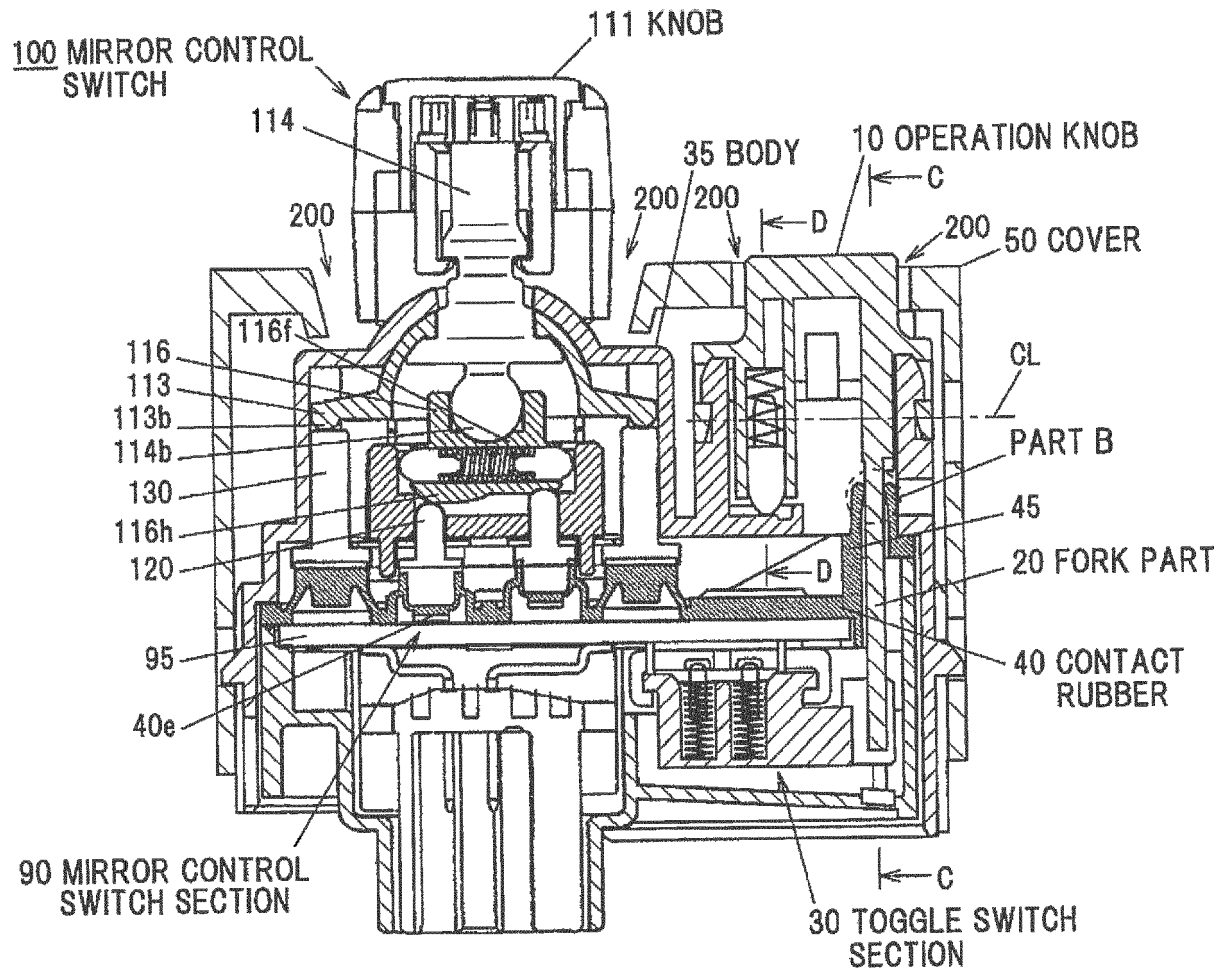


FIG.2B

DETAIL OF PART B

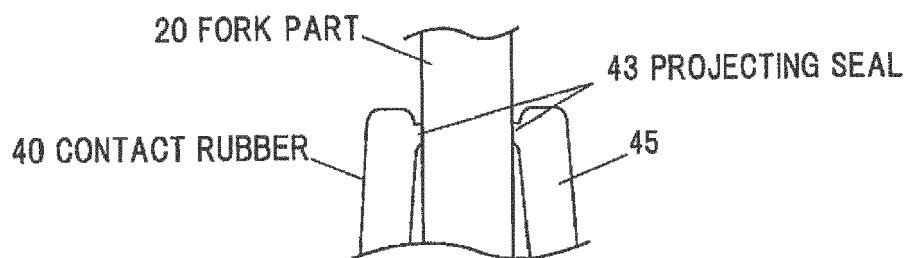


FIG.3A

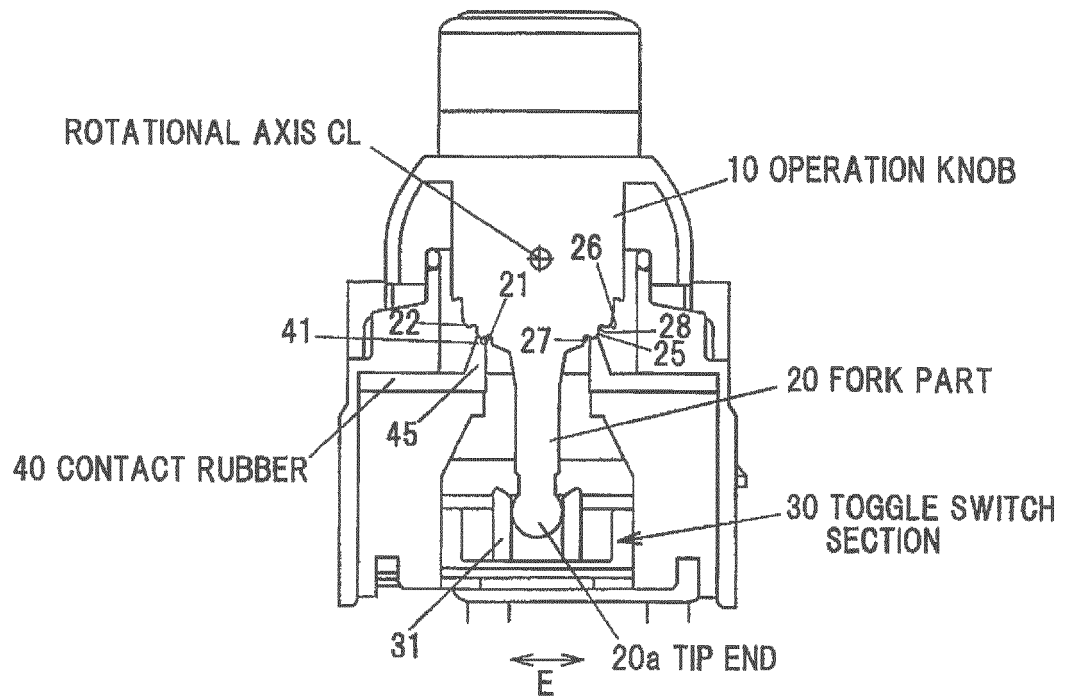


FIG.3B

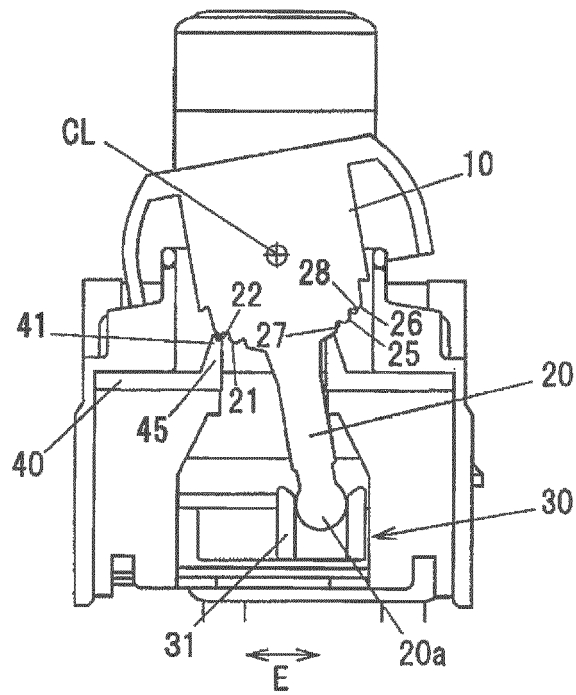


FIG.4A

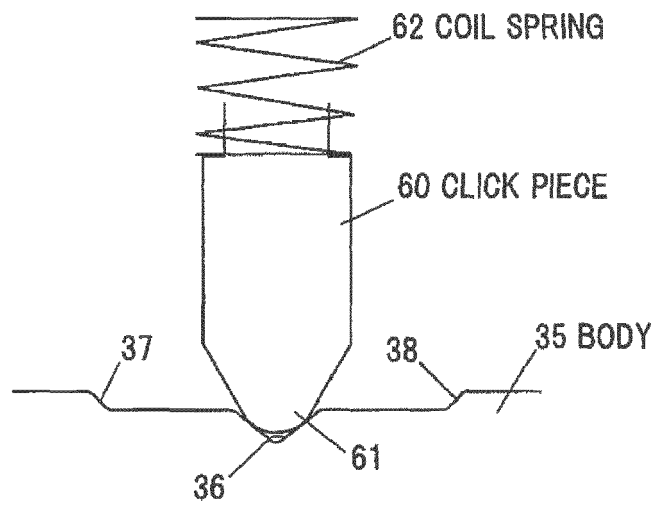


FIG.4B

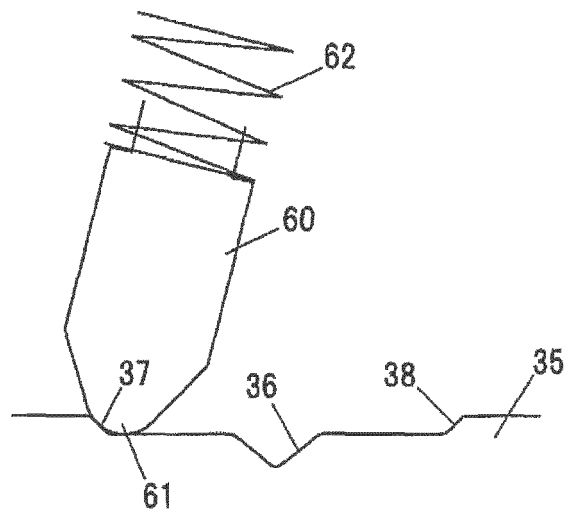


FIG.5A

NEUTRAL POSITION

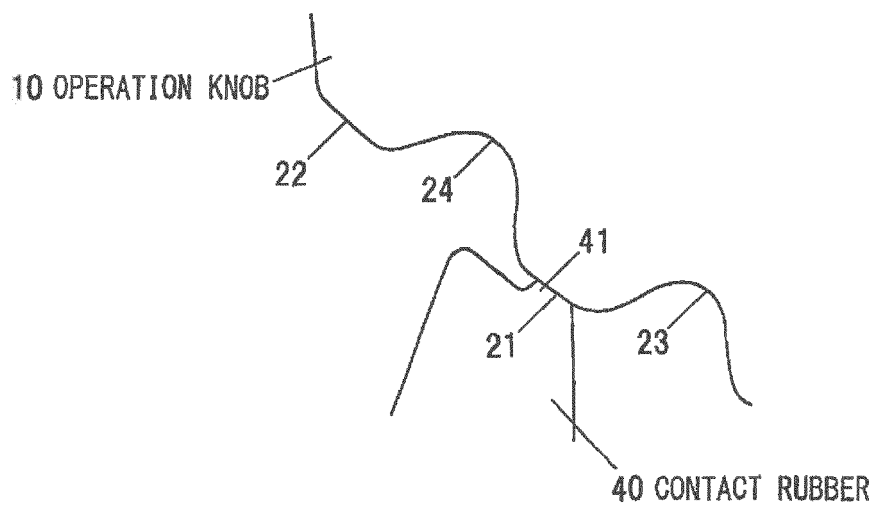


FIG.5B

OPERATING POSITION

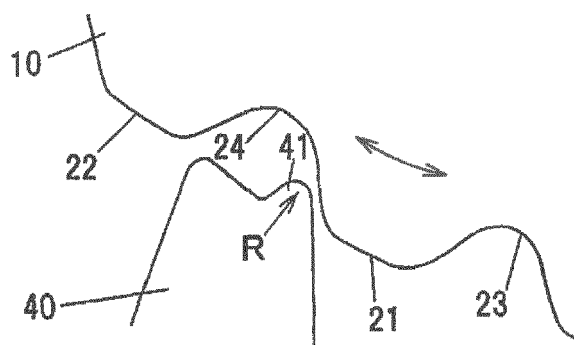
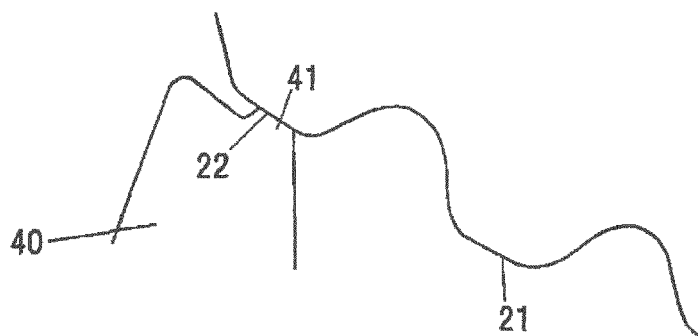


FIG.5C

TILT POSITION





EUROPEAN SEARCH REPORT

Application Number
EP 17 15 3861

5

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	JP H08 167349 A (ICHIKOH INDUSTRIES LTD) 25 June 1996 (1996-06-25) * the whole document *	1,3-7	
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