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(54) **SWITCH DEVICE**

(71) Applicant: **KABUSHIKI KAISHA TOKAI RIKA DENKI SEISAKUSHO**, Aichi (JP)

(72) Inventors: **Nobuyuki Ishigure**, Aichi (JP); **Yoshio Chiba**, Aichi (JP); **Akio Nishiyama**, Aichi (JP)

(73) Assignee: **KABUSHIKI KAISHA TOKAI RIKA DENKI SEISAKUSHO**, Aichi (JP)

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(Continued)

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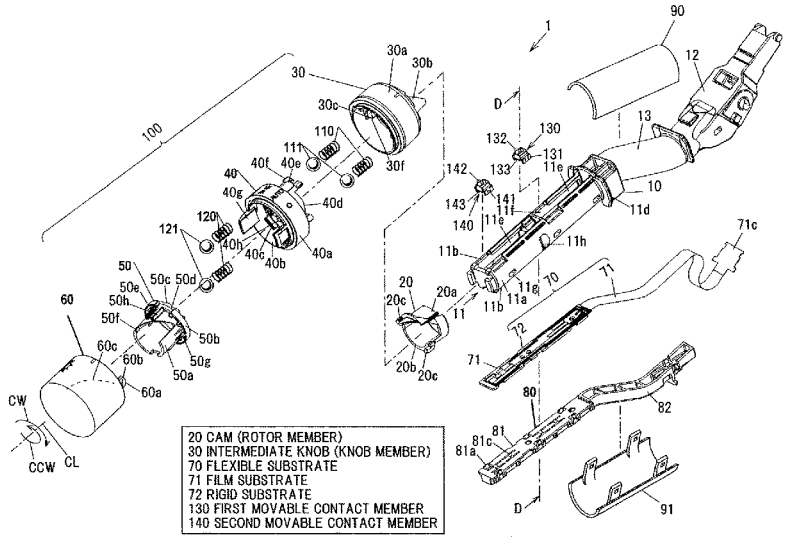
Primary Examiner — Edwin A. Leon
Assistant Examiner — Lheiren Mae A Caroc
(74) *Attorney, Agent, or Firm* — Thomas W. Cole; Roberts Mlotkowski Safran Cole & Calderon P.C.

(57) **ABSTRACT**

A subassembly includes an intermediate knob serving as a first knob rotatably fitted to and supported by a middle serving as a fixing portion, a first spring and a first ball for giving a detent feeling upon a rotary movement between the middle serving as the fixing portion and the intermediate knob, a distal end knob serving as a second knob rotatably fitted to and supported by the middle serving as the fixing portion, and a second spring and a second ball for giving a detent feeling upon a rotary movement between the middle serving as the fixing portion and the distal end knob. In such a subassembly, the intermediate knob, the first spring and the first ball, and the distal end knob, the second spring and the second ball are integrally assembled as a subassembly.

7 Claims, 4 Drawing Sheets



(51) **Int. Cl.**

H01H 19/56	(2006.01)
B60Q 1/14	(2006.01)
H01H 11/00	(2006.01)
H01H 25/04	(2006.01)

(52) **U.S. Cl.**
CPC ***H01H 25/04*** (2013.01); *H01H 2235/01* (2013.01)

(58) **Field of Classification Search**
USPC 200/61.27–61.39, 61.54
See application file for complete search history.

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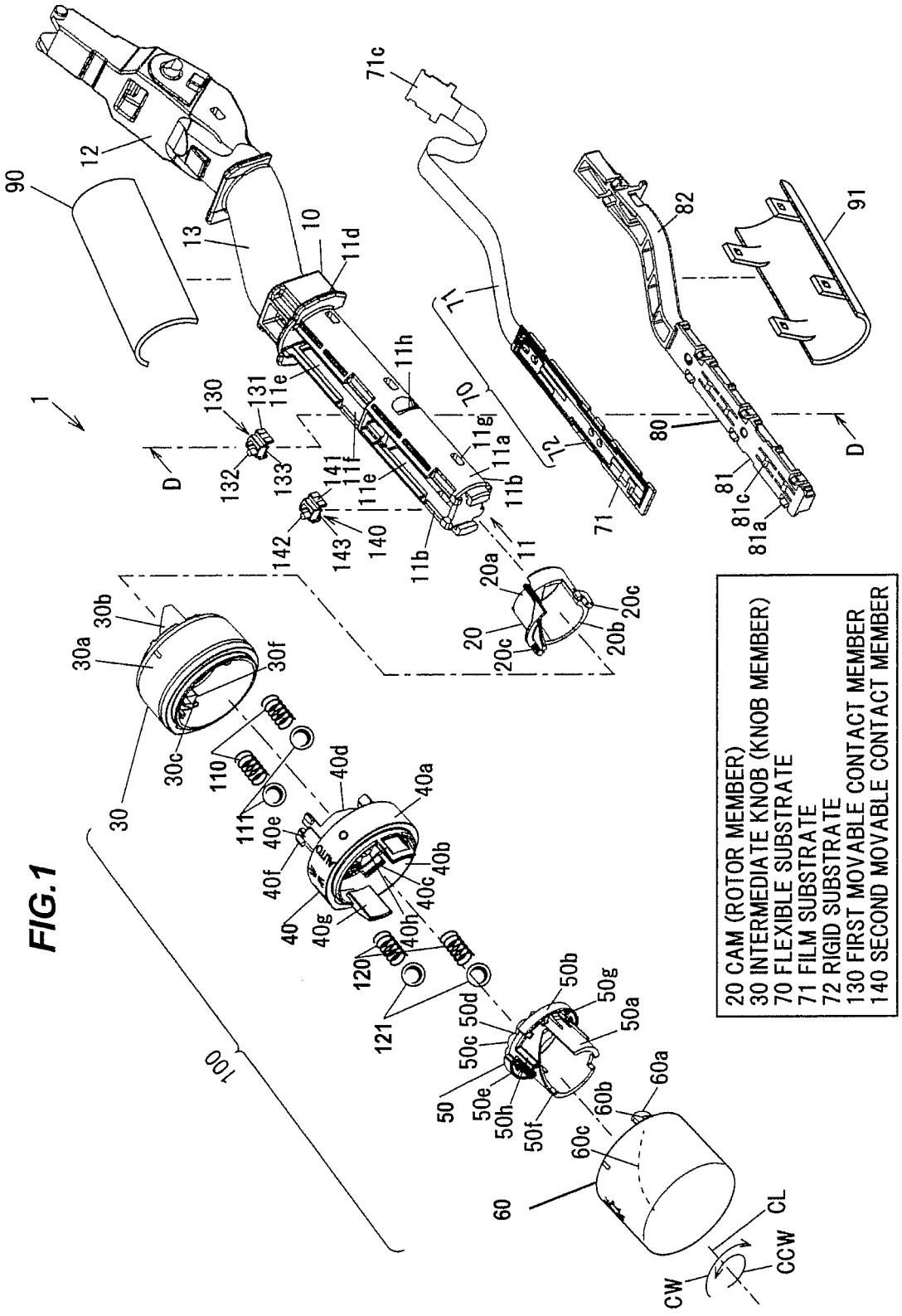

20 CAM (ROTOR MEMBER)
30 INTERMEDIATE KNOB (KNOB MEMBER)
70 FLEXIBLE SUBSTRATE
71 FILM SUBSTRATE
72 RIGID SUBSTRATE
130 FIRST MOVABLE CONTACT MEMBER
140 SECOND MOVABLE CONTACT MEMBER
CW
CCW
CL

FIG.1

FIG.2A

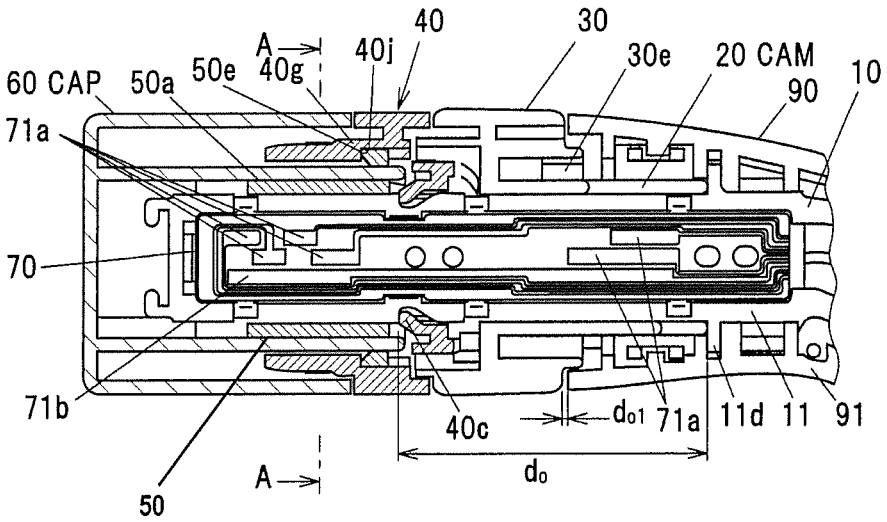

A
40
40j
30
30e
20 CAM
10
90
60 CAP
50a
50e
40g
71a
70
71b
50
A
40c
d_{01}
71a
11d
11
91
d_0

FIG.2B

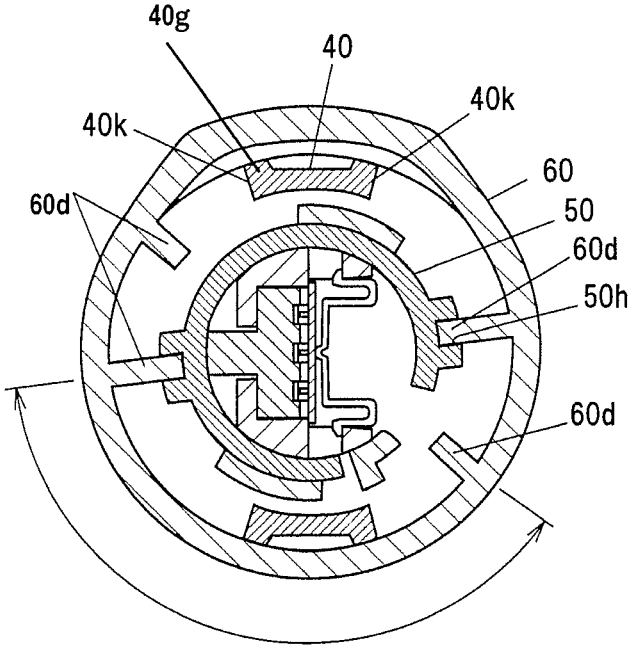

40g
40
40k
40k
60
60d
50
60d
50h
60d

FIG.3

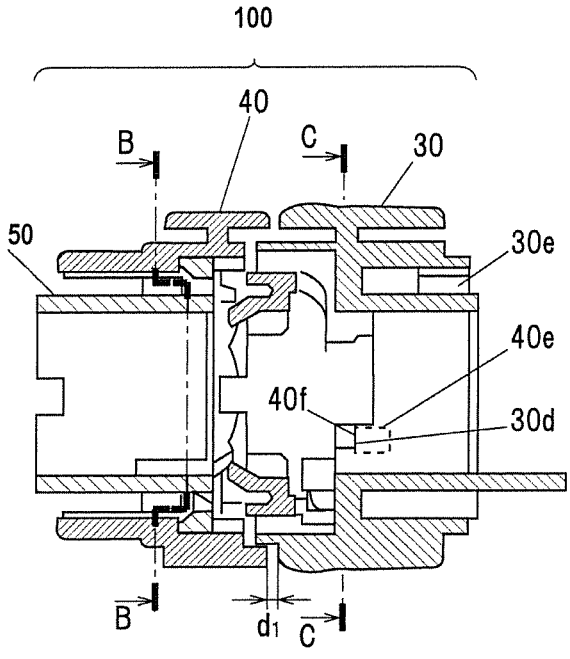


FIG.4A

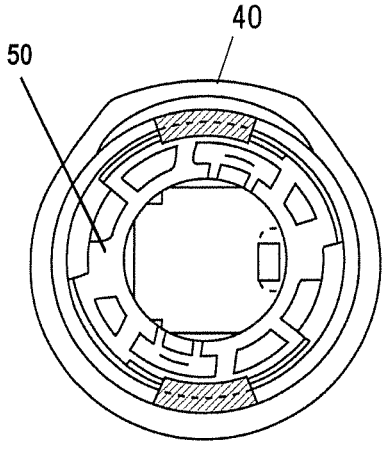


FIG.4B

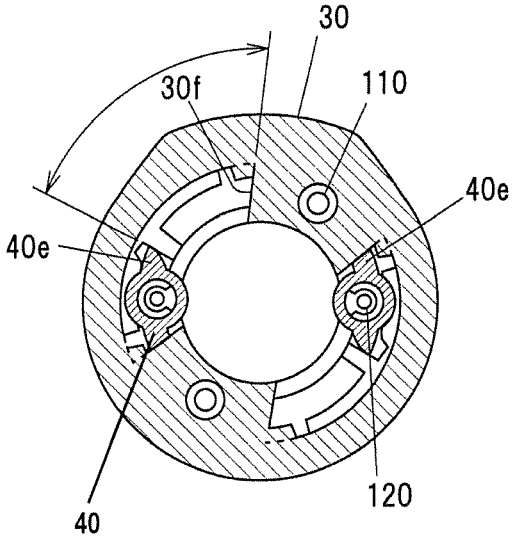


FIG.5

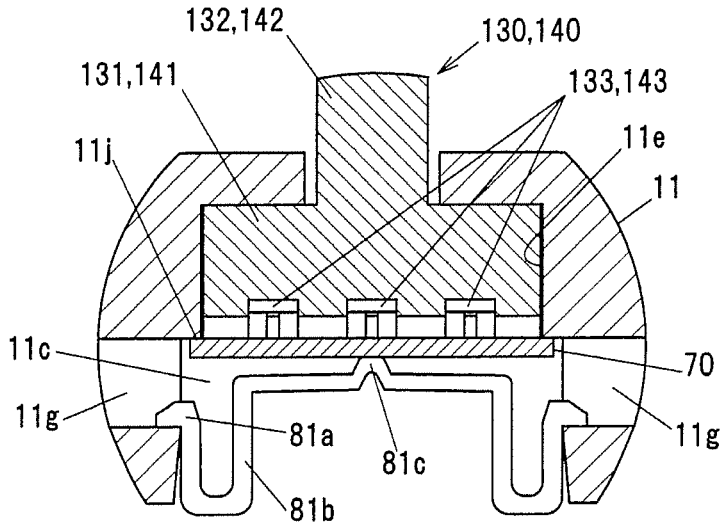
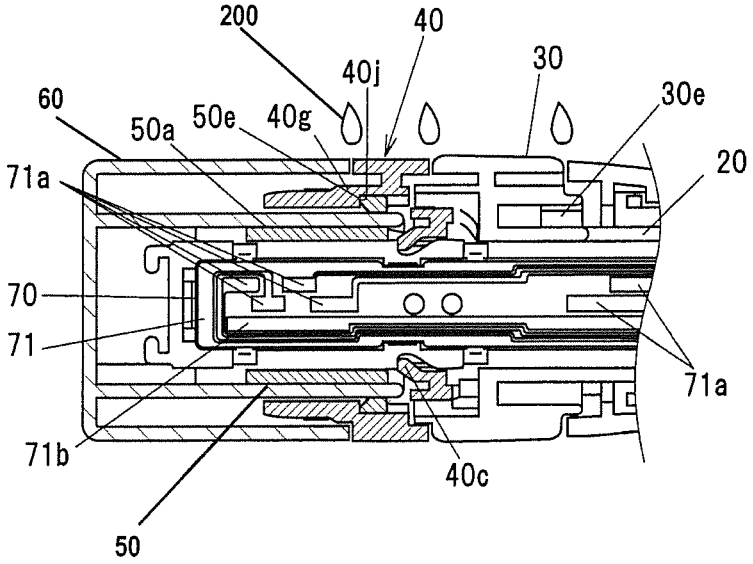

132,142
130,140
131,141
133,143
11j
11e
11
11c
70
11g
81a
81c
11g
81b

FIG.6


200
40
40j
30
60
50a
50e
40g
30e
71a
20
70
71
71a
71b
40c
50

SWITCH DEVICE

The present application is based on Japanese patent application No. 2015-035193 filed on Feb. 25, 2015, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a switch device.

2. Description of the Related Art

Conventional switch devices include a composite switch device for an automobile provided to a steering column of a vehicle. In such a device, a rotary light switch knob driven to switch a light switch, and a rotary fog switch knob driven to turn on a fog light switch are rotatably supported on a lever shaft and an outer cylindrical shaft, respectively (Patent Document 1, for example).

According to the switch device of Patent Document 1, when the fog switch knob is assembled with a fixing knob, a coil spring that has been loaded protruding from the end surface of the fog switch knob resiliently presses against a click locking ball toward a detent locking structure that is formed in the fixing knob by sawtooth detent peaks being arranged in a circular-arc shape. Furthermore, when the light switch knob is assembled with a fixing knob, a coil spring that has been loaded protruding from the end surface of the fixing knob resiliently presses against a click locking ball toward a detent locking structure that is formed in the light switch knob by sawtooth detent peaks being arranged in a circular-arc shape.

CITATION LIST

Patent Literature

Japanese Unexamined Patent Application Publication No. H09-198968A

SUMMARY OF THE INVENTION

In the switch device of Patent Document 1, locations that allow subassembly of components that retain a detent ball and a spring are limited, and a jig for applying detent grease may be required on both a subassembly line and a manufacturing line, resulting in problems of inefficiency.

An object of the present invention is to provide a switch device having a configuration in which grease can be collectively applied to detent parts, and detent components, such as a knob member, a detent ball, and a spring, are subassembled.

[1] According to an embodiment of the invention, provided is a switch device including a first knob rotatably fitted to and supported by a fixing portion, a first spring and a first ball for giving a detent feeling upon a rotary movement between the fixing portion and the first knob, a second knob rotatably fitted to and supported by the fixing portion, and a second spring and a second ball for giving a detent feeling upon a rotary movement between the fixing portion and the second knob. In such a switch device, the first knob, the first spring and the first ball, and the second knob, the second spring and the second ball are integrally assembled as a subassembly.

[2] The switch device may be the device described in [1] above, wherein the subassembly is assembled into the switch device in a temporarily assembled state.

[3] Further, the switch device may be the device described in [1] or [2] above, wherein grease is collectively applied to locations that come into contact with the first ball and the second ball, and subassembly is performed.

[4] Further, the switch device may be the device described in any one of [1] to [3] above, wherein the first knob and the second knob face each other across the fixing portion.

[5] Further, the switch device may be the device described in any one of [1] to [3] above, wherein the fixing portion comprises engaging portions with the first knob and the second knob, respectively.

Advantageous Effects of Invention

According to an embodiment of the present invention, it is possible to provide a switch device that has a configuration in which grease can be collectively applied to detent parts, and detent components, such as a knob member, a detent ball, and a spring, are subassembled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view illustrating an overall configuration of a switch device according to an embodiment of the present invention.

FIG. **2**A is a longitudinal cross-sectional view that includes a longitudinal axis CL of the switch device according to the embodiment of the present invention.

FIG. **2**B is a transverse cross-sectional view illustrating the cross section A-A in FIG. **2**A.

FIG. **3** is a longitudinal cross-sectional view of a subassembled state of a distal end knob, a middle, an intermediate knob, and detent components of the switch device according to the embodiment of the present invention.

FIG. **4**A is a transverse cross-sectional view illustrating the cross section B-B in FIG. **3**.

FIG. **4**B is a transverse cross-sectional view illustrating the cross section C-C in FIG. **3**.

FIG. **5** is a cross-sectional view of the cross-section D-D in FIG. **1**, illustrating an assembled state of a lever main body, a movable contact member, a flexible substrate, and a lever cover.

FIG. **6** is a partial cross-sectional view of the switch device according to the embodiment of the present invention mounted to a vehicle, illustrating water droplets dripping from above.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment(s) of Present Invention

Configuration of Switch Device **1**

FIG. **1** is an exploded perspective view illustrating an overall configuration of a switch device according to an embodiment of the present invention. This switch device **1** is mounted to a steering column of a vehicle and is for operating in-vehicle turn signal lamps, headlamps, and fog lamps. The switch device **1** is configured as follows. This switch device is described in the following as a device applied to a turn lever device of a vehicle, and as a configuration for a left-hand drive vehicle. The switch device **1** configured as illustrated in FIG. **1** is mounted to the steering column, and is pivotable between a neutral position and a right-turn position on an upper side from the neutral position, and between the neutral position and a left-turn position on a lower side from the neutral position. Further,

the switch device **1** is capable of performing control such as turning on the lights on the basis of a rotational operation of a cap **60**, and turning on the fog lights on the basis of a rotational operation of an intermediate knob **30**.

The switch device **1** according to the embodiment of the present invention includes: rotor members (cam **20**, cap **60**) mounted so as to be rotatable about a longitudinal axis CL of a lever main body **10**, the rotor members (cam **20**, cap **60**) including cam surfaces; knob members (intermediate knob **30**, distal end knob **50**) mounted so as to be integrally rotatable with the rotor members (cam **20**, cap **60**), the knob members (intermediate knob **30**, distal end knob **50**) including cam surfaces that face the cam surfaces of the rotor members (cam **20**, cap **60**) with a gap therebetween; movable contact members (first movable contact member **130**, second movable contact member **140**) disposed in the gap between the cam surfaces of the rotor members (cam **20**, cap **60**) and the cam surfaces of the knob members (intermediate knob **30**, distal end knob **50**), the movable contact members (first movable contact member **130**, second movable contact member **140**) being movable in the longitudinal axis CL direction by a rotational operation of the rotor members (cam **20**, cap **60**) and the knob members (intermediate knob **30**, distal end knob **50**) about the longitudinal axis CL; and a flexible substrate **70** linearly disposed in the longitudinal axis CL direction in at least a movable range of the movable contact members (first movable contact member **130**, second movable contact member **140**), the flexible substrate **70** including contact portions (signal contacts **71***a*, ground contact **71***b*), contact terminals (**133**, **143**) of the movable contact members (first movable contact member **130**, second movable contact member **140**) being brought into contact with and separated from the contact portions in association with a movement in the longitudinal axis CL direction of the contact terminals (**133**, **143**).

It should be noted that the intermediate knob **30**, a middle **40**, the distal end knob **50**, as well as first springs **110**, first balls **111**, second springs **120**, and second balls **121** serving as detent components illustrated in FIG. **1** are temporarily integrally assembled in a process before incorporation into the switch device **1**, and incorporated into the switch device **1** as a subassembly **100**.

That is, the subassembly **100** includes the intermediate knob **30** serving as the first knob rotatably fitted to and supported by the middle **40** serving as the fixing portion, the first springs **110** and the first balls **111** for giving a detent feeling upon a rotary movement between the middle **40** serving as the fixing portion and the intermediate knob **30**, the distal end knob **50** serving as the second knob rotatably fitted to and supported by the middle **40** serving as the fixing portion, and the second springs **120** and the second balls **121** for giving a detent feeling upon a rotary movement between the middle **40** serving as the fixing portion and the distal end knob **50**. In such a subassembly **100**, the intermediate knob **30**, the first springs **110** and the first balls **111**, and the distal end knob **50**, the second springs **120** and the second balls **121** are integrally assembled as a subassembly.

Lever Main Body **10**

The lever main body **10**, which serves as a base member into which each member illustrated in FIG. **1** is incorporated, is formed of a synthetic resin, for example. Each member is formed of a synthetic resin unless otherwise limited in the following. The lever main body **10**, as illustrated in FIG. **1**, is formed in a lever shape of a base portion **11** into which the rotor members (cam **20**, cap **60**), the knob members (intermediate knob **30**, distal end knob **50**), and the like are incorporated; a lever shaft portion **12** disposed on the steering column side and including a rotating central shaft for a lever function, and the like formed therein; and an intermediate portion **13**.

The base portion **11** has a substantially cylindrical shape to which the rotor members (cam **20**, cap **60**) and the knob members (intermediate knob **30**, distal end knob **50**) are fitted so as to be rotatable about the longitudinal axis CL. The base portion **11** includes a circumferential portion **11***a* that rotatably supports the rotor members (cam **20**, cap **60**) and the knob members (intermediate knob **30**, distal end knob **50**) on an outer circumferential portion of the cylindrical shape, and a flat portion **11***b* formed in parallel with the longitudinal axis CL. A space portion **11***c*, which is a hollow portion, housing the flexible substrate **70** is formed inside the cylindrical shape (refer to FIG. **5**). Further, a flange portion **11***d* that comes into contact with an end surface of the cam **20** in the longitudinal axis CL direction is formed on the intermediate portion **13** side.

In the space portion **11***c*, a long guide hole **11***e* is formed so as to house the flexible substrate **70** and to allow the signal contacts **71***a* and the ground contact **71***b* of the flexible substrate **70** to be exposed on the first movable contact member **130** and the second movable contact member **140** side. This long guide hole lie is formed at two locations and is capable of supporting the first movable contact member **130** and the second movable contact member **140** so that each is slidable in the longitudinal axis CL direction. Further, to incorporate the first movable contact member **130** and the second movable contact member **140**, an incorporation hole **11***f* having a width larger than the width of the long guide hole **11***e* is formed on an end portion of each of the long guide holes **11***e*.

Further, to press and fix the flexible substrate **70** to the base portion **11**, a locking hole **11***g* for locking a fixing catch portion **81***a* of a lever cover **80** is formed as illustrated in FIGS. **1** and **5**.

Further, a locking hole **11***h* for fixing the middle **40** to the lever main body **10** and mounting a knob structure including the subassembly **100**, the cam **20**, and the cap **60** to the lever main body **10** is formed as illustrated in FIG. **1**.

Cam **20**

The cam **20** is equivalent to the rotor member. The cam **20** is formed in a cylindrical shape having an inner circumference portion that rotatably is fitted to the circumferential portion **11***a* of the base portion **11**. A cam portion **20***b* is formed on an end surface opposite to an end surface **20***a* that comes into contact with the flange portion **11***d* of the base portion **11**. This cam portion **20***b* is formed with an inclined surface that inclines with respect to the longitudinal axis CL. Further, a projection portion **20***c* for fitting and integrating the cam **20** with the intermediate knob **30** is formed at two locations on the cam portion **20***b* side of the cam **20**.

Intermediate Knob **30**

The intermediate knob **30** is equivalent to the knob member. The intermediate knob **30** is formed in a cylindrical shape, integrated with the cam **20** by a fitting recess portion **30***e* being fitted to the projection portion **20***c* of the cam **20**, and rotatably fitted to the circumferential portion **11***a* of the base portion **11** (refer to FIGS. **2**A and **2**B). An outer circumferential portion **30***a* of the intermediate knob **30** serves as a portion gripped by fingers during a knob operation that causes rotation. A cam portion **30***b* corresponding to the cam portion **20***b* of the cam **20** is formed on the cam **20** side of the intermediate knob **30**. With the intermediate knob **30** and the cam **20** fitted together and integrated, a gap between this cam portion **30***b* and the cam portion **20***b* of the cam **20** forms a cam groove having a uniform width. The

cam groove is an inclined groove that inclines with respect to the longitudinal axis CL, and this inclined groove is fitted to a drive pin **132** of the first movable contact member **130**. The first movable contact member **130**, as described later, is guided by the lever main body **10** and movable only in the longitudinal axis CL direction, and therefore is driven in the longitudinal axis CL direction by the rotational operation of the intermediate knob **30**.

Bottomed holes **30***c* that house the first springs **110** are formed inside the intermediate knob **30**. Further, walls **30***f* of these bottomed holes **30***c* function as a regulating portion for restricting a rotational operation range with respect to the middle **40** (refer to FIGS. **4**A and **4**B). The first springs **110** allow the first balls **111** to be resiliently in contact with a detent peak portion of the middle **40**. Further, a temporary assembly surface **30***d* that comes into contact with the middle **40** upon assembly of the subassembly **100** is formed on the middle **40** side of the intermediate knob **30** (refer to FIG. **3**).

Middle **40**

The middle **40** is a fixed member that is fixed to the lever main body **10**, supports the intermediate knob **30** or the cap **60** so that either is rotationally operable about the longitudinal axis CL, and that prevents the subassembly **100** from falling off the lever main body **10**. The middle **40** is formed in a cylindrical shape, and an outer circumferential portion **40***a* thereof has substantially the same diameter as those of the intermediate knob **30** and the cap **60** and displays explanations of functions executed by a rotational operation, such as a light symbol mark, AUTO, and the like. An inner circumference portion **40***b* is fitted to the circumferential portion **11***a* of the base portion **11**, and a fixing catch portion **40***c* is fitted to and locked by the locking hole **11***h* of the lever main body **10**, thereby fixing the middle **40** to the lever main body **10**.

A detent peak portion **40***d* for giving a detent feeling in association with a rotational operation upon contact by the first balls **111** is formed on the intermediate knob **30** side of the middle **40**. Further, a boss portion **40***e* including a temporary assembly surface **40***f* that comes into contact with the intermediate knob **30** upon assembly of the subassembly **100** is formed.

As illustrated in FIG. **4**B, the wall **30***f* of the intermediate knob **30** comes into contact with the boss portion **40***e* of the middle **40** by the rotational operation of the intermediate knob **30**, thereby regulating the rotational operation range of the intermediate knob **30**.

A middle stopper **40***g* for regulating the rotational operation range of the cap **60** is formed protruding on the distal end knob **50** side of the middle **40**. Further, bottomed holes **40***h* that house the second springs **120** are formed inside the middle **40**. This allows the second balls **121** to be resiliently in contact with a detent peak portion of the distal end knob **50**.

Distal End Knob **50**

The distal end knob **50** is equivalent to the knob member. The distal end knob **50** is formed in a cylindrical shape that includes a cylindrical portion **50***a* and a flange portion **50***b* so as to be rotatably fitted to the circumferential portion **11***a* of the base portion **11**. A detent peak portion **50***c* for giving a detent feeling in association with a rotational operation upon contact by the second balls **121** is formed on the middle **40** side of the distal end knob **50**.

The flange portion **50***b* includes a portion formed as a notched portion **50***d*, and this notched portion **50***d* has a width significantly larger than the width of the middle stopper **40***g*. This makes it possible to pass the middle stopper **40***g* through the notched portion **50***d* of the flange portion **50***b*, insert the distal end knob **50** into the middle **40**, and rotate the distal end knob **50** causing a sliding surface **50***e* to come into contact with a sliding surface **40***j* formed on a lower portion of the middle stopper **40***g* illustrated in FIGS. **2**A and **2**B.

A cam portion **50***f* is formed on the cap **60** side of the distal end knob **50**. This cam portion **50***f* is formed with an inclined surface that inclines with respect to the longitudinal axis CL. Further, a locking catch portion **50***g* for integrally fixing the distal end knob **50** with the cap **60** is formed at two locations, and a groove portion **50***h* for fixing the distal end knob **50** so as to prevent relative rotation with the cap **60** is formed at two locations (refer to FIG. **2**B).

Cap **60**

The cap **60** is equivalent to the rotor member. The cap **60** is formed in a bottomed cylindrical cap shape, fitted to the cylindrical portion **50***a* of the distal end knob **50** to be integrated with the distal end knob **50**, and rotatably fitted to the circumferential portion **11***a* of the base portion **11**. A fitting hole **60***b* is formed on a distal end portion of a projection portion **60***a* formed protruding from the inside of the cap **60**, and engages with the locking catch portion **50***g* of the distal end knob **50**, thereby fixing the cap **60** to the distal end knob **50**.

A cam portion **60***c* corresponding to the cam portion **50***f* of the distal end knob **50** is formed on the distal end knob **50** side of the cap **60**. With the cap **60** and the distal end knob **50** integrated, a gap between this cam portion **60***c* and the cam portion **50***f* of the distal end knob **50** forms a cam groove having a uniform width. The cam groove is an inclined groove that inclines with respect to the longitudinal axis CL, and this inclined groove is fitted to a drive pin **142** of the second movable contact member **140**. The second movable contact member **140**, as described later, is guided by the lever main body **10** and movable only in the longitudinal axis CL direction, and therefore is driven in the longitudinal axis CL direction by the rotational operation of the cap **60**.

A cap stopper **60***d* is formed in the cylindrical interior of the cap **60**, as illustrated in FIG. **2**B. This cap stopper **60***d* is fitted to the groove portion **50***h* of the distal end knob **50**, thereby integrally fixing the distal end knob **50** and the cap **60**. Further, the cap stopper **60***d* comes into contact with a middle stopper surface **40***k* serving as an end portion of the middle stopper **40***g* by the rotational operation of the cap **60**, thereby regulating the rotational operation range of the cap **60**.

Flexible Substrate **70**

The flexible substrate **70** includes a film substrate **71** and a rigid substrate **72**. The film substrate **71** is obtained by forming a conductor foil of copper or the like formed in a predetermined circuit pattern on a base insulator of a film of polyimide or the like. Further, the rigid substrate **72** is a rigid substrate such as a glass epoxy substrate.

The film substrate **71** is lined with the rigid substrate **72** on a back side of the film substrate, in the movable range of the movable contact members (first movable contact member **130**, second movable contact member **140**). On the other hand, the flexible substrate **70** on the intermediate portion **13** and lever shaft portion **12** side of the lever main body **10** is only formed of a film substrate **71** that is not lined with the rigid substrate **77**, making it possible to bend and route the flexible substrate **70** in accordance with the shape of the lever main body **10**.

The signal contacts **71***a* and the ground contact **71***b* (common contact) are formed on the front side of the film

substrate **71** so as to come into contact with the contact terminals (**133**, **143**) of the movable contact members. Further, a pattern is exposed on each of the contacts so that the contacts can electrically come into contact with the contact terminals (**133**, **143**). Other patterns and wiring portions, insulated by a coverlay, form patterns up to a connector end portion **71***c*.

While a portion of the film substrate **71** of the flexible substrate **70** is disposed in the base portion **11** of the lever main body **10**, the portion of the film substrate **70**, which is disposed in the base portion **11**, is lined with the rigid substrate **72**, thereby causing the flexible substrate **70** to be linearly disposed, without bending, in the longitudinal axis CL direction in at least the movable range of the movable contact members (first movable contact member **130**, second movable contact member **140**).

As illustrated in FIG. **2**A, the flexible substrate **70** includes a contact structure that becomes conductive or non-conductive by the signal contacts **71***a* and the ground contact **71***b* coming into contact with or separating from the contact terminals (**133**, **143**). The ground contact **71***b* is disposed on the lower side of the lever main body **10**. The contact terminals (**133**, **143**) electrically come into contact with the signal contacts **71***a* or the ground contact **71***b* (common terminal), making it possible to control the turning on and off of lights and the like in accordance with the contact combination.

Lever Cover **80**

The lever cover **80** is inserted into the space portion **11***c* in a direction of the arrow in FIG. **1** and mounted to the lever main body **10**, thereby fixing the flexible substrate **70**. Further, the lever cover **80** presses the film substrate **71** along the intermediate portion **13** and the lever shaft portion **12** of the lever main body **10** (refer to FIGS. **1** and **5**). The lever cover **80** includes a main portion **81** that is inserted into the space portion **11***c* of the lever main body **10** and mounted to the lever main body **10**, and a bending portion **82** that bends on the intermediate portion **13** side.

As illustrated in FIG. **5**, the flexible substrate **70** (film substrate **71** and rigid substrate **72**) is fixed by the lever cover **80** while pressed against a contacting portion **11***j* of the space portion **11***c* of the lever main body **10**.

The main portion **81** of the lever cover **80** includes the catch portion **81***a*, a curved portion **81***b*, and a projection portion **81***c* for pressing the flexible substrate **70** against the contacting portion **11***j*, as illustrated in the cross-sectional view of FIG. **5**. The lever cover **80** is formed of a synthetic resin, and thus can elastically bend mainly at the curved portion **81***b*. As a result, the catch portion **51***a* is fitted to and locked by the locking hole **11***g* of the lever main body **10** with the flexible substrate **70** pressed against the contacting portion **11***j* by the projection portion **81***c*.

It should be noted that the projection portion **81***c*, as illustrated in FIG. **5**, presses a substantially central portion of the substantially flexible substrate **70**, and is formed at a plurality of locations in the longitudinal axis CL direction, causing the flexible substrate **70** to press against the contacting portion **11***j* along a sliding direction of the movable contact members (first movable contact member **130**, second movable contact member **140**) as illustrated in FIG. **1**. This makes it possible to support the flexible substrate so that the flexible substrate is linearly disposed in the longitudinal axis CL direction in the movable range of the movable contact members.

Upper cover **90** and Lower Cover **91**

An upper cover **90** and a lower cover **91** sandwich and cover the lever main body **10**, the flexible substrate **70**, the lever cover **80**, and the like in an assembled state, in the direction of the arrow illustrated in FIG. **1**. The upper cover **90** and the lower cover **91** are formed of a synthetic resin and are made to cover the lever main body **10** and the like at an end of an assembly process, functioning as cover members as well as design components.

First Movable Contact Member **130** and Second Movable Contact Member **140**

The first movable contact member **130** and the second movable contact member **140**, which serve as movable contact members, include movable bodies **131**, **141**, the chive pins **132**, **142** formed protruding from the movable bodies, and the contact terminals **133**, **143** that come into contact with the contact portions (signal contacts **71***a*, ground contact **71***b*), as illustrated in FIGS. **1** and **5**. The first movable contact member **130** and the second movable contact member **140** are integrally formed with the contact terminals **133**, **143** by insert molding using a synthetic resin, respectively.

It should be noted that materials used for the contact terminals **133**, **143** include copper, phosphor bronze, beryllium copper, and the like.

The movable bodies **131**, **141**, as illustrated in FIG. **5**, are housed in the long guide holes **11***e* of the base portion **11**, and are movable while sliding in the longitudinal axis CL direction. The drive pins **132**, **142** that protrude from the movable bodies **131**, **141** are respectively inserted into the cam groove formed by fitting and integrating the cam **20** with the intermediate knob **30**, and the cam groove formed by integrating the distal end knob **50** with the cap **60**.

As described above, these cam grooves are inclined grooves that incline with respect to the longitudinal axis CL, and thus a driving force in the longitudinal axis CL direction acts on the drive pins **132**, **142** and the movable bodies **131**, **141** by the rotational operation of the rotor members (cam **20**, cap **60**) or the knob members (intermediate knob **30**, distal end knob **50**) about the longitudinal axis CL. As a result, the contact terminals **133**, **143** can move in the longitudinal axis CL direction while in contact with the surface of the film substrate **71** of the flexible substrate **70**. That is, it is possible to control the turning on and off of lights and the like in accordance with the combination of contact between the signal contacts **71***a* or the ground contact **71***b* (common contact) and the contact terminals (**133**, **143**) resulting from the rotational operation of the rotor members (cam **20**, cap **60**) or the knob members (intermediate knob **30**, distal end knob **50**) about the longitudinal axis CL.

Subassembly **100**

The subassembly **100** illustrated in FIGS. **1** and **3** is obtained by temporarily integrally assembling the intermediate knob **30**, the middle **40**, the distal end knob **50**, as well as the first springs **110**, the first balls **111**, the second springs **120**, and the second balls **121** serving as detent components in a process before incorporation into the switch device **1**.

The first springs **110** are housed in the respective bottomed holes **30***c* of the intermediate knob **30**. The intermediate knob **30** serving as the first knob is incorporated into the middle **40** serving as the fixing portion with the first balls **111** disposed in the distal end portion of the first springs **110**.

A boss portion **40***e* of the middle **40** is inserted into the intermediate knob **30** side and rotated, causing the temporary assembly surface **30***d* of the intermediate knob **30** and the temporary assembly surface **40***f* of the middle **40** to come into contact, as illustrated in FIGS. **3** and **4**B. In this state, the resilient force of the first springs **110** causes the tempo-

rary assembly surface **40***f* and the temporary assembly surface **30***d* to come into contact with a constant spring force.

Further, the first balls **111** come into contact with the detent peak portion **40***d* of the middle **40** with the spring force described above.

This causes a detent feeling (click feeling) to be felt when the intermediate knob **30** is rotationally operated. It should be noted that grease is applied to the first balls **111** and the detent peak portion **40***d*.

In this temporarily assembled state, a gap between the intermediate knob **30** and the middle **40** is d_1, as illustrated in FIG. **3**.

Next, the distal end knob **50** serving as the second knob is incorporated into the middle **40** serving as the fixing portion. The second springs **120** are housed in the respective bottomed holes **40***h* of the middle **40**. The distal end knob **50** is incorporated in the middle **40** with the second balls **121** disposed in the distal end portions of the second springs **120**. The middle stopper **40***g* of the middle **40** is passed through the notched portion **50***d* of the flange portion **50***b* of the distal end knob **50**, and the distal end knob **50** is inserted into the middle **40** and rotated, causing the sliding surface **40***j* formed on the lower portion of the middle stopper **40***g* illustrated in FIGS. **2**A and **2**B to come into contact with the sliding surface **50***e* of the distal end knob **50**. In this state, the resilient force of the second springs **120** causes the sliding surface **40***j* of the middle **40** and the sliding surface **50***e* of the distal end knob **50** to come into contact with a constant spring force. This contacting surface serves as a sliding surface upon the rotational operation of the cap **60** (distal end knob **50**) after assembly of the switch device **1**.

Further, the second balls **121** come into contact with the detent peak portion **50***c* of the distal end knob **50** with the spring force described above. This causes a detent feeling (click feeling) to be felt when the cap **60** (distal end knob **50**) is rotationally operated. It should be noted that grease is applied to the second balls **121** and the detent peak portion **50***c*.

As described above, the intermediate knob **30**, the middle **40**, the distal end knob **50**, as well as the first springs **110**, the first balls **111**, the second springs **120**, and the second balls **121** serving as detent components are temporarily integrally assembled in a process before incorporation into the switch device **1**. This makes it possible to perform assembly in one direction of the longitudinal axis CL of the lever main body **10** in the assembly process of the switch device **1**.

Further, grease is collectively applied to locations that come into contact with the first balls **111** and the second balls **121**, and then subassembly is performed. This makes it possible to collectively apply grease to the first springs **110**, the first balls **111**, the second springs **120**, and the second balls **121** serving as the detent components, simplify the grease application process, and shorten the work process.

Assembly of Switch Device **1**

The following describes the assembly of the switch device **1** on the basis of FIG. **1**.

First, the flexible substrate **70** is fixed to the base portion **11** of the lever main body **10**. The flexible substrate **70** is inserted into the space portion **11***c* of the base portion **11**, and then the main portion **81** of the lever cover **80** is pressed in, thereby causing the catch portion **81***a* to be fitted to and locked by the locking hole **11***g* and the flexible substrate and the lever cover **80** to be fixed. As a result, the flexible substrate is linearly disposed in the longitudinal axis CL direction in the movable range of the movable contact members.

Next, the cam **20** is incorporated into the base portion **11** of the lever main body **10**.

The cam **20** is inserted until being in contact with the flange portion **11***d* of the base portion **11**.

The first movable contact member **130** is passed through the incorporation hole **11***f* of the base portion **11** and inserted into the long guide hole **11***e*.

The subassembly **100** is inserted into the base portion **11** of the lever main body **10** and pressed until being fitted to the cam **20**. As a result, the fixing catch portion **40***c* of the middle **40** is fitted to and locked by the locking hole **11***h* of the lever main body **10**, thereby fixing the middle **40** to the lever main body **10**. That is, the subassembly **100** is assembled in a temporarily assembled state, and mounted to the base portion **11** of the lever main body **10**.

With the subassembly **100** incorporated into the base portion **11**, a distance from an end surface of the flange portion **11***d* to an end surface of the fixing catch portion **40***c* is a predetermined value do, as illustrated in FIGS. **2**A and **2**B. At this time, the first springs **110** are slightly compressed, causing the gap d_1 between the intermediate knob **30** and the middle **40** in a temporarily assembled state to become a setting value d_{01} in the fully assembled state (refer to FIGS. **2**A, **2**B, and **3**). The setting value d_{01} after this assembly is less than the gap d_1 in the temporary assembled state. The setting value d_{01} after assembly is set to, for example, 0.3 mm. Further, the state of contact between the temporary assembly surface **40***f* of the middle **40** and the temporary assembly surface **30***d* of the intermediate knob **30** upon temporary assembly is released, forming a gap between the temporary assembly surface **40***f* and the temporary assembly surface **30***d*. This makes the intermediate knob **30** (cam **20**) smoothly rotationally operable around the circumferential portion **11***a* of the base portion **11**.

Next, the second movable contact member **140** is passed through the incorporation hole **11***f* of the base portion **11** and inserted into the long guide hole **11***e*.

The cap **60** is inserted into the base portion **11** of the lever main body **10**, and the cap **60** is fitted and fixed to the distal end knob **50**. This makes the cap **60** (distal end knob **50**) smoothly rotationally operable around the circumferential portion **11***a* of the base portion **11** while the sliding surface **40***j* of the middle **40** is in contact with the sliding surface **50***e* of the distal end knob **50**.

Lastly, the upper cover **90** and the lower cover **91** sandwich and fix the lever main body **10** assembled as described above. With this, the assembly process of the switch device **1** is completed.

In the assembly process described above, the portion of the flexible substrate **70** that is lined with the rigid substrate **72** is assembled to the base portion **11** of the lever main body **10**, making a bending process unnecessary and allowing the flexible substrate **70** to be easily linearly disposed in the longitudinal axis CL direction in the movable range of the movable contact members (first movable contact member **130**, second movable contact member **140**). The other processes are also processes in which the members are simply sequentially disposed, thereby making automatic assembly possible. It should be noted that the upper cover **90** and the lower cover **91** are design components, and therefore may be assembled in a separate process after automatic assembly.

Effect of Embodiment(s) of Present Invention

According to the embodiment of the present invention, the intermediate knob **30**, the middle **40**, the distal end knob

50, as well as the first springs 110, the first balls 111, the second springs 120, and the second balls 121 serving as detent components are temporarily integrally assembled in a process before incorporation into the switch device 1, and incorporated into the switch device 1 as the subassembly 100. As a result, it is possible to perform subassembly with grease collectively applied to locations that come into contact with the first balls 111 and the second balls 121, which serve as detent components. That is, it is possible to collectively apply grease to the first springs 110, the first balls 111, the second springs 120, and the second balls 121 serving as the detent components, which simplifies the grease application process, and shortens the work process. Furthermore, it is possible to improve the efficiency of the manufacturing line.

Although embodiments of the present invention have been described above, these embodiments are merely examples and the invention according to claims is not to be limited thereto. Novel embodiments and modifications thereof 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 combinations of the features described in these embodiments are not necessary to solve the problem of the invention. Further, these embodiments and modifications 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.

REFERENCE SIGNS LIST

1 Switch device
10 Lever main body
11 Base portion
11*a* Circumferential portion
11*b* Flat portion
11*c* Space portion
11*d* Flange portion
11*e* Long guide hole
11*f* Incorporation hole
11*g* Locking hole
11*h* Locking hole
11*j* Contacting portion
12 Lever shaft portion
13 Intermediate portion
20 Cam (rotor member)
20*a* End surface
20*b* Cain portion
20*c* Projection portion
30 Intermediate knob (knob member)
30*a* Outer circumferential portion
30*b* Cam portion
30*c* Bottomed hole
30*d* Temporary assembly surface
30*e* Fitting recess portion
30*f* Wall
40 Middle
40*a* Outer circumferential portion
40*b* Inner circumferential portion
40*c* Fixing catch portion
40*d* Detent peak portion
40*e* Boss portion
40*f* Temporary assembly surface
40*g* Middle stopper
40*h* Bottomed hole
40*j* Sliding surface
40*k* Middle stopper surface
50 Distal end knob (knob member)
50*a* Cylindrical portion
50*b* Flange portion
50*c* Detent peak portion
50*d* Notched portion
50*e* Sliding surface
50*f* Cam portion
50*g* Locking catch portion
50*h* Groove portion
60 Cap (rotor member)
60*a* Projection portion
60*b* Fitting hole
60*c* Cam portion
60*d* Cap stopper
70 Flexible substrate
71 Film substrate
71*a* Signal contact
71*b* Ground contact
71*c* Connector end portion
72 Rigid substrate
80 Lever cover
81 Main portion
81*a* Catch portion
81*b* Curved portion
81*c* Projection portion
82 Bending portion
90 Upper cover
91 Lower cover
100 Subassembly
110 First spring
111 First ball
120 Second spring
121 Second ball
130 First movable contact member
131, **141** Movable body
132, **142** Drive pin
133, **143** Contact terminal
140 Second movable contact member
200 Water droplet
CL Longitudinal axis

What is claimed is:

1. A switch device comprising:

a first knob rotatably fitted to and supported by a fixing portion;

a first spring and a first ball for giving a detent feeling upon a rotary movement between the fixing portion and the first knob;

a second knob rotatably fitted to and supported by the fixing portion;

a second spring and a second ball for giving a detent feeling upon a rotary movement between the fixing portion and the second knob;

a lever main body comprising a base portion provided with a movable contact member and a support shaft having a circumferential portion for receiving and rotatably supporting the first and second knob members, and

first and second connecting mechanisms for axially interconnecting the first knob and the fixing portion, and the second knob and the fixing portion, respectively, without support from the support shaft, such that the first knob, the first spring and the first ball, and the second knob, the second spring and the second ball are integrally assembled and connected along an axis of rotation as a subassembly by the fixing portion prior to the subassembly being received by and rotatably supported by the support shaft,

wherein the first and second connecting mechanisms each include interlocking members that interfere with one another along the axis of rotation.

2. The device according to claim **1**, wherein the subassembly is assembled into the switch device in a temporarily assembled state.

3. The device according to claim **1**, wherein grease is collectively applied to locations that come into contact with the first ball and the second ball.

4. The device according to claim **1**, wherein the first knob and the second knob face each other across the fixing portion.

5. The device according to claim **1**, wherein the fixing portion comprises engaging portions with the first knob and the second knob, respectively.

6. A switch device comprising:

a first knob rotatably fitted to and supported by a fixing portion;

a first spring and a first ball for giving a detent feeling upon a rotary movement between the fixing portion and the first knob;

a second knob rotatably fitted to and supported by the fixing portion;

a second spring and a second ball for giving a detent feeling upon a rotary movement between the fixing portion and the second knob,

a lever main body including a base portion provided with a support shaft having a circumferential portion for receiving and rotatably supporting the first and second knob members, and the fixing portion, and

first and second connecting mechanisms for axially interconnecting the first and second knobs to the fixing portion without support from the support shaft of the lever main body such that the first knob, the first spring and the first ball, and the second knob, the second spring and the second ball and fixing portion are integrally connected along an axis of rotation as a subassembly independently of the lever main body prior to the subassembly being received by and rotatably supported by the support shaft,

wherein the first and second connecting mechanisms each include interlocking members that interfere with one another along the axis of rotation.

7. A method of assembling a switch device comprising a first knob rotatably fitted to and supported by a fixing portion; a first spring and a first ball for giving a detent feeling upon a rotary movement between the fixing portion and the first knob; a second knob rotatably fitted to and supported by the fixing portion; a second spring and a second ball for giving a detent feeling upon a rotary movement between the fixing portion and the second knob, a lever main body including a base portion provided with a support shaft having a circumferential portion for receiving and rotatably supporting the first and second knob members, and the fixing portion, and first and second connecting mechanisms for axially interconnecting the first and second knobs to the fixing portion without support from the support shaft of the lever main body, comprising the sequential steps of:

axially interconnecting the first and second knob members to the fixing portion solely with the first and second connecting mechanisms without support from the main lever body to form an integral sub-assembly, and

assembling the integral sub-assembly to the support shaft of the lever main body.

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