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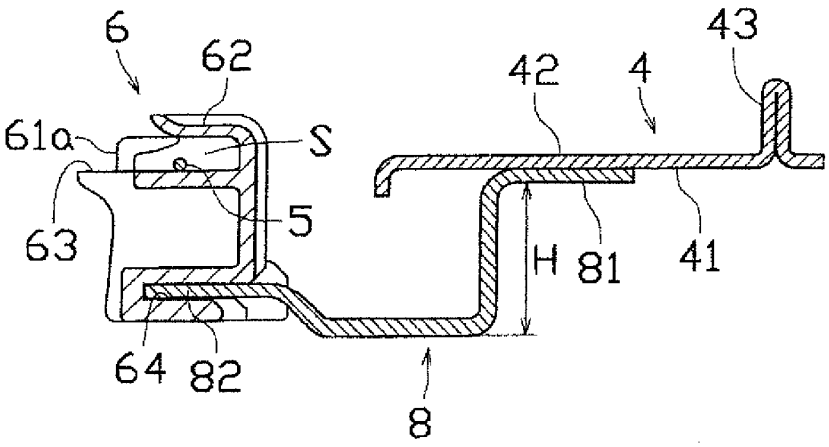
(54) OPENING-CLOSING DEVICE FOR OPENING-CLOSING BODY

(57) An opening-closing device for an opening-closing body characterized in that: an inner guide (6) has a first restricting part (61) which is elastic and a second restricting part (62) and forms a confining structure (S) such that the first restricting part (61) and the second restricting part (62) prevent an inner cable (5) from escaping out of the inner guide (6). The inner cable (5) is disposed in the confining structure (S) by being moved due to tension applied to the inner cable (5) and pressing on and bending the first restricting part (61). By using this device, an opening-closing device for an opening-closing body can be provided for which inserting an inner cable is simple and for which the inner cable after insertion does not escape even when moving in the inner guide.

FIG. 6



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Description

TECHNICAL FIELD

[0001] The present invention relates to an opening/closing device for an opening/closing body having an inner guide that restricts an inner cable such that the inner cable is arranged along a guide rail.

BACKGROUND ART

[0002] A window regulator, which descents or ascends a glass window attached to a carrier plate along a guide rail by driving an inner cable, has been known. In a window regulator for descending or ascending a glass window provided in a door of a vehicle, a guide rail is typically arced like a bow to ascend or descend the glass window along a body of the vehicle. Therefore, in such a window regulator, for example, an inner guide is attached to the guide rail in order to restrict the inner cable such that the inner cable is arranged along the guide rail (See Patent Literature 1, for example).

[0003] In Patent Literature 1, a guide member (an inner guide) is provided between both ends of the guide rail to slidably support the inner cable such that the inner cable is approximated to the guide rail. Accordingly, the inner cable is prevented from aligning obliquely in an inner-cable guide member of a pulley rotatably arranged at the upper end of the guide rail and/or an inner-cable groove of a drum of a driving unit arranged at the lower end of the guide rail, and then the generation of a noise is inhibited.

CITATION LIST

PATENT LITERATURE

[0004] Patent Literature 1: Japanese Utility Model No. 3118237 U

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] However, since a guide member disclosed in Patent Literature 1 is formed such that the inner cable is inserted and supported into a gap defined between two fixing claws (supporting arms), the insertion of the inner cable is difficult. In addition, since the gap is defined, there is some risk of removing the inner cable from the guide member through the gap even after the insertion of the inner cable.

[0006] The present invention is made in view of the above problem and the object of the present invention is to provide an opening/closing device for an opening/closing body in which it is easy to insert the inner cable and the inner cable does not escape from the inner guide even if the inner cable moves inside the inner guide after inserting the inner cable.

SOLUTION TO PROBLEM

[0007] To achieve the above object, an opening/closing device for an opening/closing body according to the present invention includes a driving unit, a movement body to which the opening/closing body is attached, a guide rail configured to guide the movement body, an inner cable configured to move the movement body by being driven by the driving unit, and an inner guide configured to restrict the inner cable such that the inner cable is arranged along the guide rail. The inner guide has a first restriction part which is elastic, and a second restriction part. The first restriction part and the second restriction part form a closing structure configured to keep the inner cable in the inner guide, and the inner cable is moved into the closing structure by an application of tension to the inner cable, with the first restriction part being pressed by the inner cable and deformed.

ADVANTAGEOUS EFFECT OF INVENTION

[0008]

(1) According to the opening/closing device for the opening/closing body of the present invention, the insertion of the inner cable is easy because the inner guide, which is configured to restrict the inner cable such that the inner cable is arranged along the guide rail, has the first restriction part which is elastic and the second restriction part. The first restriction part and the second restriction part form the closing structure configured to keep the inner cable in the inner guide. The inner cable is moved into the closing structure by an application of tension to the inner cable, with the first restriction part being pressed by the inner cable and deformed. In addition, in the inner guide, the inner cable does not escape even if the inner cable moves inside the inner guide because the first restriction part and the second restriction part form the closing structure configured to keep the inner cable in the inner guide.

(2) According to the opening/closing device for the opening/closing body of the present invention, since the inner guide has a temporal staying part on which the inner cable can be stayed temporarily, the insertion of the inner cable into the closing structure becomes easy by temporarily staying the inner cable on the temporal staying part when inserting the inner cable into the closing structure. In addition, since temporarily staying the inner cable on the temporal staying part when inserting the inner cable into the closing structure prevents the inner cable from moving under the inner guide, and etc., the inner cable can be inserted securely into the closing structure.

(3) According to the opening/closing device for the opening/closing body of the present invention, since

the first restriction part has a pair of restriction members separately arranged in an axial direction of the guide rail, and the second restriction part is arranged between the pair of the restriction members such that the second restriction part faces the restriction members, the inner cable can be inserted securely and easily into the closing structure.

BRIEF DESCRIPTION OF DRAWING

[0009]

Fig. 1 is a schematic front view showing an overall structure of one example of an embodiment of an opening/closing device for an opening/closing body according to the present invention.
Fig. 2 is a schematic front view showing one example of an inner guide.
Fig. 3 is a schematic side view showing one example of an inner guide.
Fig. 4 is a cross sectional view of Fig. 2 cut along an A-A line.
Fig. 5 is a cross sectional view of Fig. 2 cut along a B-B line.
Fig. 6 is a schematic cross sectional view showing a state where an inner guide is fixed to a guide rail.
Fig. 7 is a schematic cross sectional view showing a state where an inner guide is fixed to a guide rail.
Fig. 8 is a schematic view explaining a process of inserting an inner cable into an inner guide. (a) shows a state where an inner cable stays on a temporal staying part. (b) shows a state where restriction members are deformed by an inner cable. (c) shows a state where an inner cable is inserted into an inner guide.

DESCRIPTION OF EMBODIMENT

[0010] One example of an embodiment of the present invention will be described below, referring to figures. An opening/closing device for an opening/closing body according to the present invention is a device that is used as, for example, a window regulator provided to a door of a vehicle to open/close a glass window of the vehicle, which is not shown in the figures, and etc. As shown in Fig. 1, a window regulator 1 includes a driving unit 2, a carrier plate (a movement body) 3 to which an opening/closing body such as a glass window is attached, a guide rail 4 configured to guide the carrier plate 3, an inner cable 5 configured to move the carrier plate 3 by the driving unit 2, and an inner guide 6 configured to restrict the inner cable 5 such that the inner cable 5 is arranged along the guide rail 4. In addition, the window regulator 1 according to the present embodiment includes a pulley 7 that is a direction-changing member rotatably arranged at the upper end of the guide rail 4, and a bracket 8 arranged between both ends (the upper end and the lower end) of the guide rail 4 in order to attach the inner guide 6 to itself.

[0011] As shown in Fig. 1, the driving unit 2 is attached to the lower end of the guide rail 4 and is arranged such that the driving unit 2 is positioned lower than the lower limit position of the carrier plate 3. The driving unit 2 has a drum 21 that reels in and off the inner cable 5, a motor 22 that drives the drum 21, and a housing 23. In the present embodiment, the driving unit 2 is attached to the lower end of the guide rail 4. However, the position of the driving unit 2 is not limited to this and the driving unit 2 may be provided in other places.

[0012] The drum 21, whose detail is not shown in the figures, is formed substantially in a cylindrical shape and has an anchoring part that anchors the end part of the inner cable 5. In addition, a spiral guide groove is formed on the outer peripheral surface to reel in some end part of the inner cable 5.

[0013] The motor 22 is a device configured to drive the drum 21, and is connected to the drum 21 via a reducer such as a worm gear reducer. In the window regulator 1 of the present invention, the glass window fixed to the carrier plate 3 via the inner cable 5 can descend or ascend by driving the drum 21 by the motor 22.

[0014] The housing 23, whose detail is not shown in the figures, has a gear housing that houses the reducer such as the worm gear reducer connected to the motor 22, and a drum housing that houses the drum 21 connected to an output axis of the reducer and is attached to the gear housing using screws and etc. In addition, the drum housing is formed with a groove to insert and fix the lower end of the guide rail 4 therein. Although a material of the housing 23 is not limited, the weight of the housing can be reduced by forming the housing 23 using synthetic resin, for example.

[0015] As shown in Fig. 1, the carrier plate 3 is supported such that the carrier plate 3 can slide along the guide rail 4 extending in a vertical direction. In the carrier plate 3, a cable-end connection part is provided to attach the end part of the inner cable 5, which is not shown in detail in the figures. In addition, fixing holes 31 are formed in the carrier plate 3 to fix the glass window (which is not shown in the figures) thereto, using screws and etc. The carrier plate 3 may be formed integrally using synthetic resin and etc., or may be formed such that some pieces are fixed to each other by heat sealing. It should be noted that a material of the carrier plate 3 is not limited to synthetic resin, however metal or a combination of metal and synthetic resin may also be used as the material of the carrier plate 3.

[0016] The guide rail 4 is formed by bending a metal thin plate such as a zinc-plated steel sheet, which is substantially rectangular with a predetermined length, in a bow shape in a vertical direction such that the glass window can descend or ascend on a bent track. As shown in Fig. 1 and Fig. 6, for example, one end of the guide rail 4 in its width direction is bent substantially at a right angle towards a concave surface 41 side, and a rail part 43 is formed at another end of the guide rail 4 such that

the rail part 43 protrudes towards a convex surface 42 side opposite to the concave surface 41 side. The rail part 43 is formed along the vertical direction and fitted into the guide groove formed in the carrier plate 3, which is not shown in the figures.

[0017] The inner cable 5 is driven by the driving unit 2 to ascend or descend the carrier plate 3 and is arranged linearly such that the inner cable 5 extends in the shortest distance between the pulley 7 arranged at the upper end of the guide rail 4 and the drum 21 arranged at the lower end of the guide rail 4, when the inner cable 5 is not inserted into the inner guide 6.

[0018] The pulley 7 functions as the direction changing member that changes the direction of the inner cable 5. The direction changing member is not limited to the pulley 7 and any member known as a guide member that changes the moving direction of the inner cable 5, such as a member that has a groove formed in a semicircular shape, can also be used as the direction changing member.

[0019] Next, the inner guide 6 of the present embodiment will be described. The inner guide 6 restricts the inner cable 5 such that the inner cable 5 is arranged along the guide rail 4 and has a first restriction part 61 which is elastic and a second restriction part 62, as shown in Fig. 2 and Fig. 3.

[0020] As shown in Fig, 3, in the inner guide 6, the first restriction part 61 and the second restriction part 62 construct a closing structure S that has a space in which the inner cable 5 can slide inside the inner guide 6 when the carrier plate 3 ascends or descends. The closing structure S is constructed such that the inner cable 5 arranged in the inner guide 6 can be kept inside the inner guide 6 and, in the present embodiment, the closing structure S is formed such that the shape of the inner guide 6 seen from the longitudinal direction of the guide rail 4 is a closed shape with no gap, as shown in Fig. 3.

[0021] In addition, as shown in Fig. 1 and Fig. 6, the inner guide 6 is detachably attached to a planar bracket 8 that extends in the direction substantially perpendicular to the axial direction of the guide rail 4, while one end part 81 of the bracket 8 is fixed to the concave surface 41 of the guide rail 4. As shown in Fig. 4 and Fig. 6, in the inner guide 6, an insertion groove 64 is formed to insert another end part 82 of the bracket 8. In addition, as shown in Fig. 2 and Fig. 5, in the inner guide 6, a pair of anchoring pieces 65, which extend in the direction perpendicular to the sliding direction of the inner cable 5, are formed. The anchoring pieces 65 are elastic and the tips of the anchoring pieces 65 are anchored to holes 82a formed in another end part 82 of the bracket 8, as shown in Fig. 7. As shown in Fig. 6 and Fig. 7, for example, the bracket 8 is bent to form a step H in order to position the bracket 8 away from the track on which the carrier plate 3 ascends and descends, thus the hindrance to ascending and descending the carrier plate 3 can be avoided. As such, the inner guide 6 is attached to the bracket 8 such that the closing structure S is positioned at the same level as the convex surface 42 of the guide rail 4, by anchoring the anchoring pieces 65 to the holes 82a of the bracket 8 while another end part 82 of the bracket 8 is inserted into the insertion groove 64.

[0022] As shown in Fig. 2, the first restriction part 61 has a pair of restriction members 61a, which are separately arranged in the axial direction of the guide rail 4. The restriction members 61a are made of elastic synthetic resin, for example. As shown in Fig. 3, the tip sides of the restriction members 61 a are formed as claw members that protrude in the direction substantially perpendicular to the sliding direction of the inner cable 5. The restriction members 61 a are elastic enough to deform to allow the inner cable 5 to be inserted into the closing structure S when the inner cable 5 is inserted into the closing structure S, and, after inserting the inner cable 5 into the closing structure S, to allow the inner cable 5 to restore to its original position before the deformation to form the closing structure S again. In addition, the restriction members 61a are formed such that the deformation, due to the force generated by the inner cable 5 that is about to move from the inside of the closing structure S to the outside of the closing structure S, is inhibited.

[0023] As shown in Fig. 2 and Fig. 3, the second restriction part 62 is arranged between the pair of the restriction members 61a such that the second restriction part 62 is expanding in the direction that the restriction members 61 a extends orthogonal to the longitudinal direction of the guide rail 4. The second restriction part 62 protrudes perpendicularly to the sliding direction of the inner cable 5 and in the direction opposite to the protrusion direction of the tips of the restriction members 61a. As shown in Fig. 3, when seen from the longitudinal direction of the guide rail 4, the protruded tip of the second restriction part 62 is positioned in the direction perpendicular to the longitudinal direction of the guide rail 4 such that the tip of the second restriction part 62 and the tips of the restriction members 61a overlap each other. In addition, the bottom surface of the second restriction part 62 is formed such that the level of the bottom surface of the second restriction part 62 substantially coincides with the level of the upper surfaces of the restriction members 61a. Therefore, as shown in Fig. 3, when seen from the longitudinal direction of the guide rail 4, the closing structure S with no gap is formed in the inner guide 6. In addition, as shown in Fig. 3, the tip of the second restriction part 62 is tapered, thus it is easier to guide the inner cable 5 into the closing structure S when the inner cable 5 is inserted into the closing structure S.

[0024] The inner guide 6 has temporal staying parts 63 on which the inner cable 5 can be stayed temporarily. As shown in Fig. 2, the temporal staying parts 63 are the parts on which the inner cable 5 temporarily stays when the inner cable 5 is inserted into the closing structure S. The temporal staying pars 63 are arranged in pair between the pair of the restriction members 61a. The inner cable 5 can temporarily be stayed on the temporal staying parts 63 before applying tension to the inner cable 5 to

insert the inner cable 5 into the closing structure S. The application of the tension to the inner cable 5 moves the inner cable 5 on the temporal staying parts 63 to the restriction members 61 a. In Fig. 3, the temporal staying parts 63 are arranged such that they protrude in the direction perpendicular to the sliding direction of the inner cable 5 and the upper surfaces of the temporal staying parts 63 are substantially horizontal. As shown in Fig. 3, the size of the upper surfaces of the temporal staying parts 63 in the depth direction perpendicular to the sliding direction of the inner cable 5 is set at least larger than the diameter of the inner cable 5, thus the inner cable 5 can stay securely on the temporal staying parts 63. In addition, the level of the upper surfaces of the temporal staying parts 63 is substantially the same as the level of a sliding surface 66 on which the inner cable 5 slides when the inner cable 5 is arranged inside the closing structure S. It should be noted that the position of the upper surfaces of the temporal staying parts 63 is not limited to the above, as long as the position of the upper surfaces of the temporal staying parts 63 is at least lower than the upper surfaces of the restriction members 61 a. The position of the upper surfaces of the temporal staying parts 63 may be higher than the sliding surface 66. It should be noted that, as shown in Fig. 2, although the pair of the temporal staying parts 63 are formed between the restriction members 61a in the present embodiment, the number and position of the temporal staying parts 63 are not limited to the above, as long as the inner cable 5 can temporarily stay on the temporal staying parts 63 such that the inner cable 5 can be inserted easily by moving the inner cable 5 along the outer surfaces of the restriction members 61 a when the inner cable 5 is inserted into the closing structure S..

[0025] The sliding surface 66 is the surface on which the inner cable 5 inside the closing structure S slides and, as shown in Fig. 2, the sliding surface 66 is slightly curved in the sliding direction of the inner cable 5. Thus, since the inner cable 5 slides on the sliding surface 66 and along the curvature of the curved guide rail 4, the surface pressure can be reduced, thus the inner cable 5 can slide smoothly.

[0026] The method of inserting the inner cable 5 into the inner guide 6 will be described below, referring to Fig. 8. When the inner cable 5 is not inserted into the closing structure S of the inner guide 6, the inner cable 5 is arranged linearly, by the tension applied by the driving unit 2, such that the inner cable 5 extends in the shortest distance between the pulley 7 arranged at the upper end of the guide rail 4 and the drum 21 arranged at the lower end of the guide rail 4. When inserting the inner cable 5 into the closing structure S of the inner guide 6 from the state described above, tension is applied to the inner cable 5 manually or by an apparatus not shown in the figures, such that the inner cable 5 moves away from its linear arrangement. Here, as shown in Fig. 8 (a), the inner cable 5 is pulled in the direction towards the upper surfaces of the restriction members 61a and then the inner cable 5 temporarily stays on the upper surfaces of the temporal staying parts 63.

[0027] Then, as shown in Fig. 8 (a), the inner cable 5 is moved along the outer surfaces of the restriction members 61a and then towards the upper surfaces of the restriction members 61a. In this process, the tension is applied to the inner cable 5.

[0028] Therefore, as shown in Fig. 8 (b), the tension applied to the inner cable 5 moves the inner cable 5, pushes the restriction members 61a, which are elastic such that the tension applied to the inner cable 5 becomes smaller, to deform the restriction members 61 a downward, and inserts the inner cable 5 into the closing structure S. It should be noted that the tension applied to the inner cable 5 may be strong enough to at least deform the restriction members 61a.

[0029] As shown in Fig. 8 (c), after inserting the inner cable 5 into the closing structure S, the restriction members 61 a deformed by the tension of the inner cable 5 are restored to its original position before the deformation and then the closing structure S is again formed. As such, the restriction members 61a may be deformed by the tension applied to the inner cable 5 when the inner cable 5, which is arranged between the upper and lower ends of the guide rail 4 while the driving unit 2 applies the tension to the inner cable 5, is inserted into the inner guide 6 such that the inner cable 5 is arranged along the guide rail 4. In addition, the restriction members 61a has the elasticity that inhibits the restriction members 61 a from being deformed by the force in the direction in which the inner cable 5 inserted into the closing structure S is about to escape from the closing structure S, as a result, the inner cable 5 can be prevented from escaping from the closing structure S.

[0030] The temporal staying parts 63 formed in the inner guide 6 of the present embodiment enable the inner cable 5 to be inserted easily into the closing structure S, by staying the inner cable 5 on the temporal staying parts 63 and moving the inner cable 5 along the outer surface of the restriction members 61a when the inner cable 5 is inserted into the closing structure S. In addition, staying temporarily the inner cable 5 on the temporal staying parts 63 can prevent the inner cable 5 from moving under the inner guide 6 and etc. It should be noted that the inner cable 5 may be moved directly onto the upper surfaces of the restriction members 61 a without providing the temporal staying parts 63. Although the pair of the restriction members 61a are formed in the inner guide 6 of the present embodiment, it is also acceptable that at least one restriction member 61a is formed.

[0031] Although the window regulator 1 has been described as an example of the opening/closing device for the opening/closing body in the present embodiment, the opening/closing device for the opening/closing body is not limited to the window regulator. The opening/closing device for the opening/closing body can be applied to any type of the device such as a power sliding door or a window opening/closing device for a house, in which the

inner cable 5 moves the movement body such as the carrier plate 3 along the guide rail 4.

[0032] It should be noted that the embodiment of the present invention is not limited to the above-described embodiment and any changes can be made arbitrarily within the scope of the present invention.

INDUSTRIAL APPLICABILITY

[0033] The opening/closing device for the opening/closing body according to the present invention can be used as a window regulator that is provided to a door of a vehicle and etc. to open/close a glass window of the vehicle, a power sliding door, a window opening/closing device for a house, and etc.

REFERENCE SIGN LIST

[0034]

1	WINDOW REGULATOR (OPENING/CLOSING DEVICE FOR OPENING/CLOSING BODY)
2	DRIVING UNIT
3	CARRIER PLATE (MOVEMENT BODY)
4	GUIDE RAIL
5	INNER CABLE
6	INNER GUIDE
61	FIRST RESTRICTION PART
61a	RESTRICTION MEMBER
62	SECOND RESTRICTION PART
63	TEMPORAL STAYING PART
S	CLOSING STRUCTURE

Claims

1. An opening/closing device for opening/closing an opening/closing body comprising:

a driving unit;
a movement body to which the opening/closing body is attached;
a guide rail configured to guide the movement body;
an inner cable configured to move the movement body by being driven by the driving unit; and
an inner guide configured to restrict the inner cable such that the inner cable is arranged along the guide rail,
wherein the inner guide has a first restriction part which is elastic, and a second restriction part, the first restriction part and the second restriction part form a closing structure configured to keep the inner cable in the inner guide, and the inner cable is moved into the closing structure by an application of tension to the inner cable, with the first restriction part being pressed by the inner cable and deformed.

2. The opening/closing device according to claim 1, wherein the inner guide has a temporal staying part on which the inner cable can be stayed temporarily.

3. The opening/closing device according to claim 1 or 2, wherein the first restriction part has a pair of restriction members separately arranged in an axial direction of the guide rail, and the second restriction part is arranged between the pair of the restriction members such that the second restriction part faces the restriction members.

FIG. 1

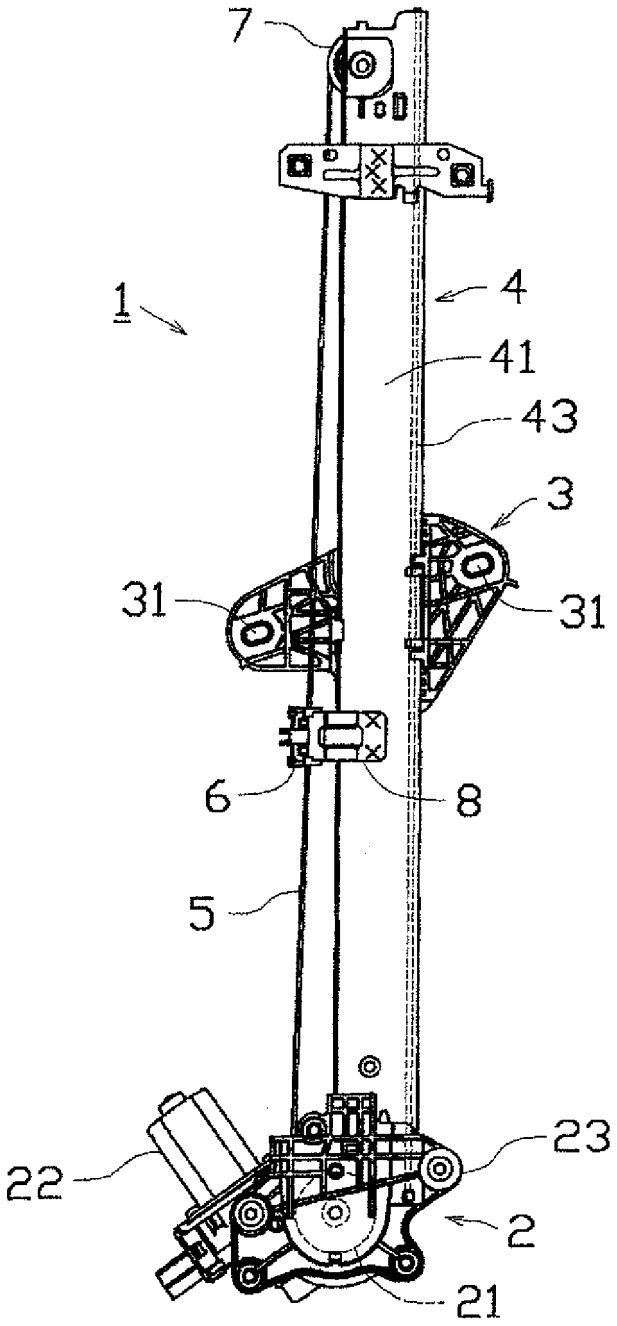


FIG. 2

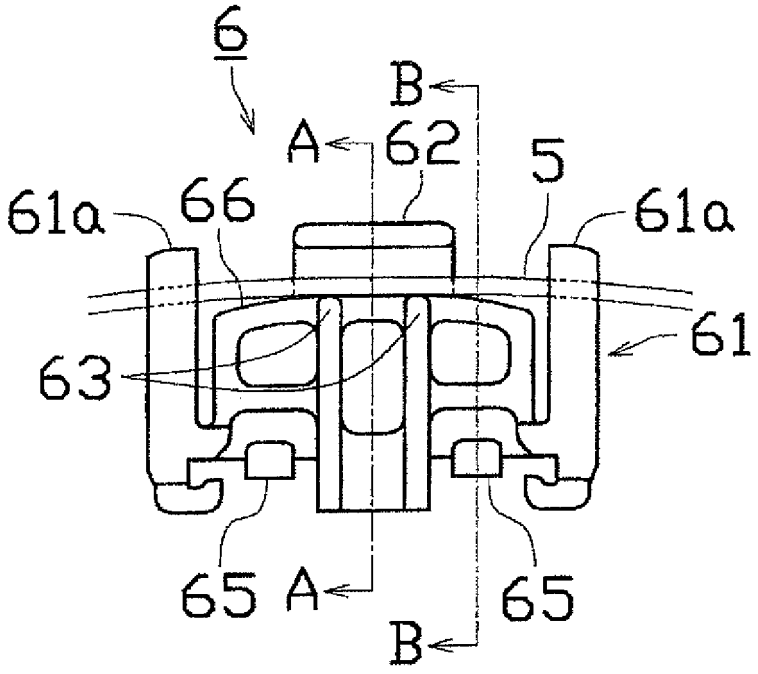


FIG. 3

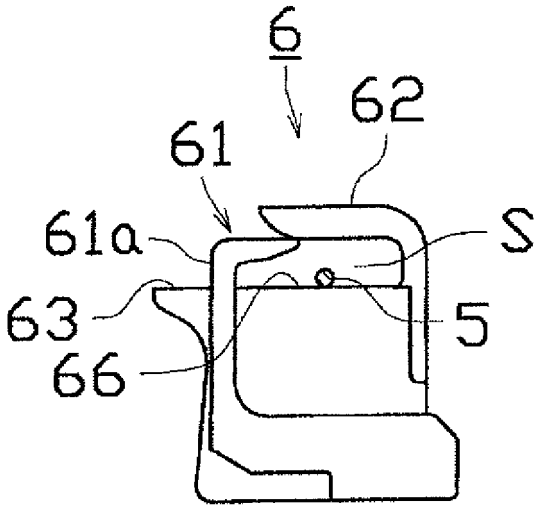


FIG. 4

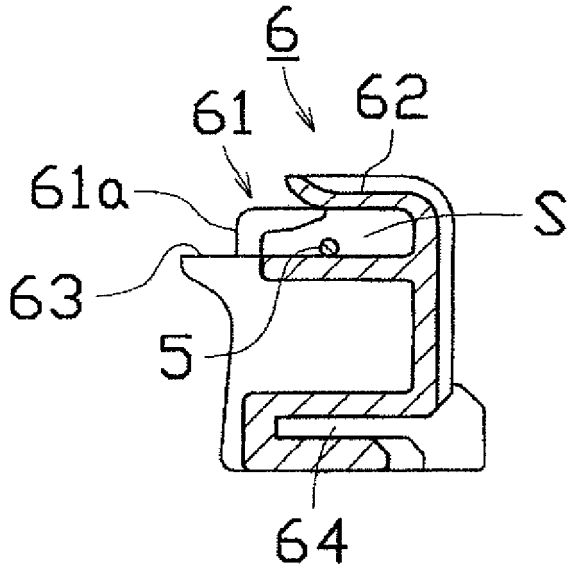


FIG. 5

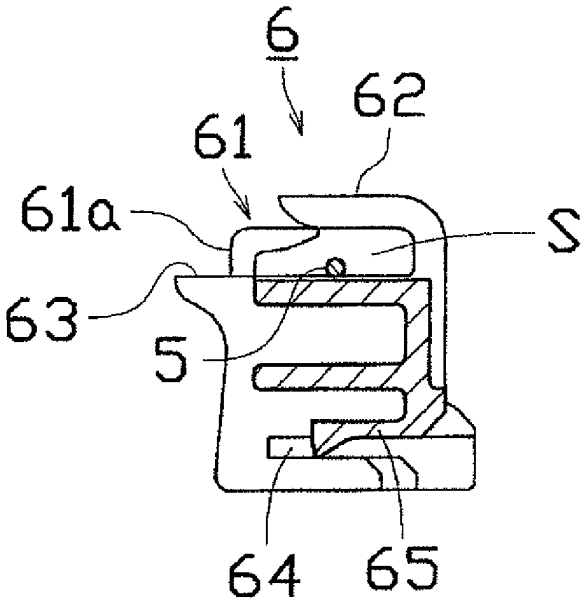


FIG. 6

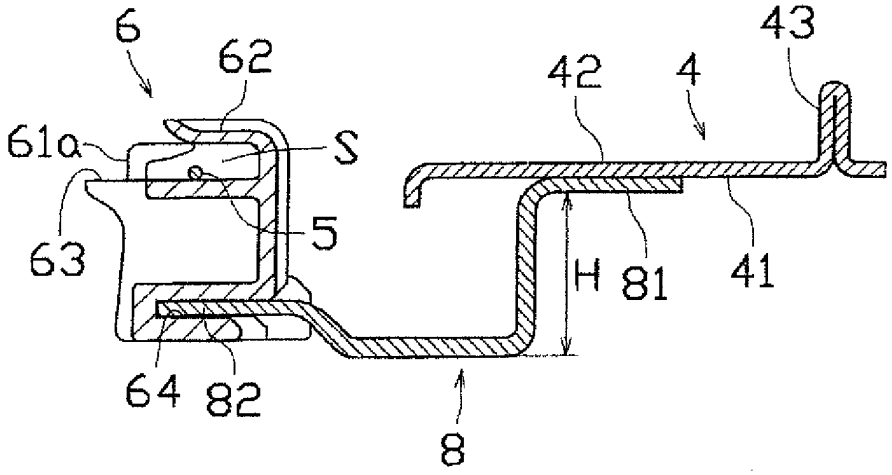


FIG. 7

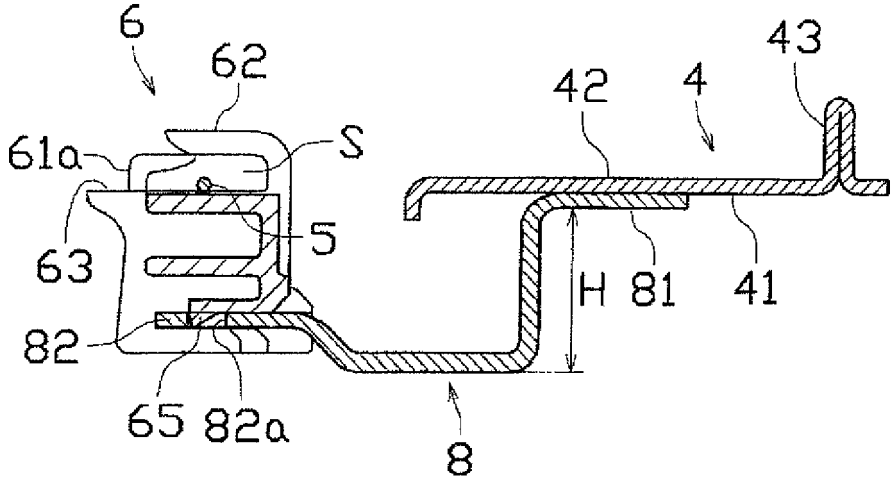
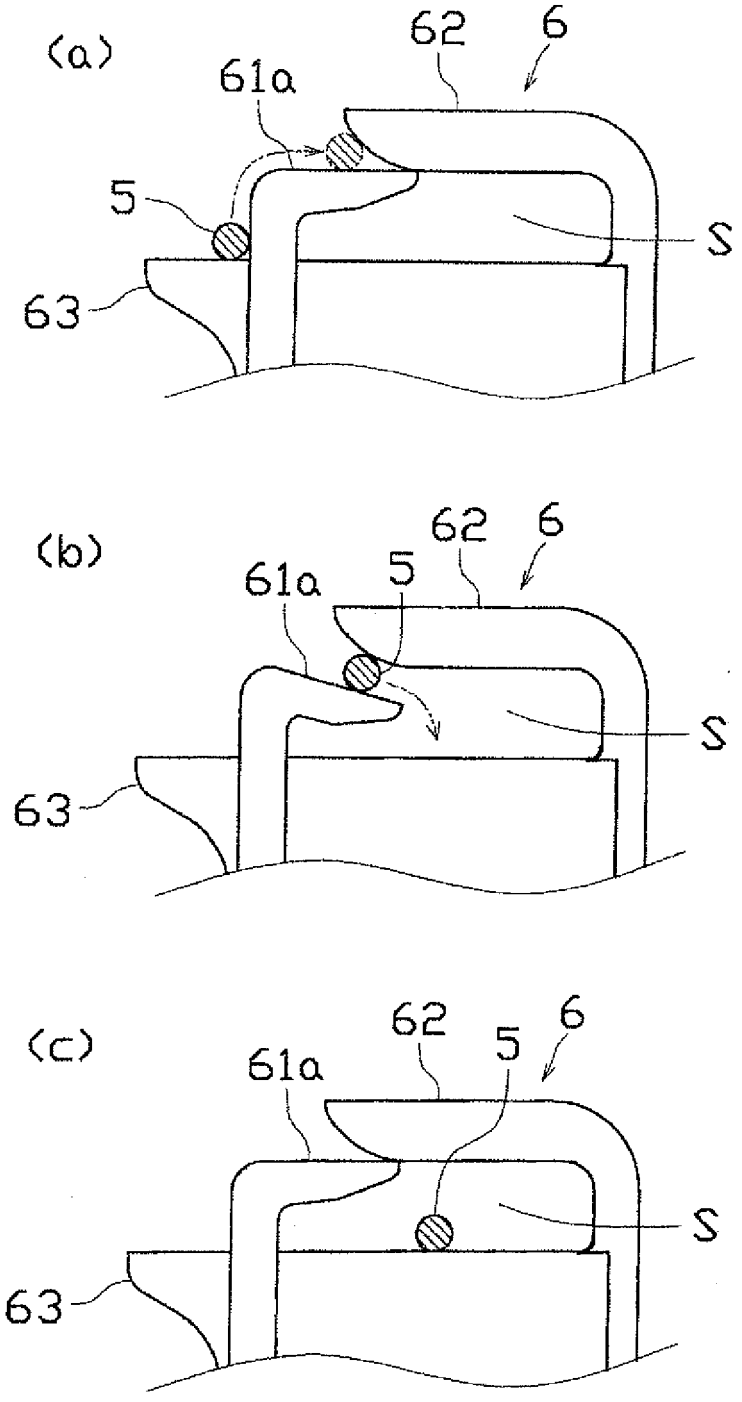


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/083832

A. CLASSIFICATION OF SUBJECT MATTER
E05F11/48(2006.01)i, *B60J1/17*(2006.01)i, *E05F15/16*(2006.01)i

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)
E05F11/38, E05F11/48, B60J1/17

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014
Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2011-69059 A (Johnan Manufacturing Co., Ltd.), 07 April 2011 (07.04.2011), entire text; fig. 1 to 13 (Family: none)	1-3
A	JP 4-32472 Y2 (Nippon Cable System, Inc.), 04 August 1992 (04.08.1992), entire text; fig. 1 to 6 (Family: none)	1-3
A	JP 2008-169684 A (Toyota Motor Corp.), 24 July 2008 (24.07.2008), entire text; fig. 1 to 16 (Family: none)	1-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 February, 2014 (12.02.14)	01 April, 2014 (01.04.14)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3118237 U **[0004]**