(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 643 862 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
29.04.2020 Bulletin 2020/18

(21) Application number: **18821406.8**

(22) Date of filing: **31.05.2018**

(51) Int Cl.:
E05D 7/04 *(2006.01)* ***E05D 3/14*** *(2006.01)*
F16C 11/04 *(2006.01)*

(86) International application number:
PCT/JP2018/020942

(87) International publication number:
WO 2018/235559 (27.12.2018 Gazette 2018/52)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **19.06.2017 JP 2017119922**

(71) Applicant: **Sugatsune Kogyo Co., Ltd.**
Tokyo 101-8633 (JP)

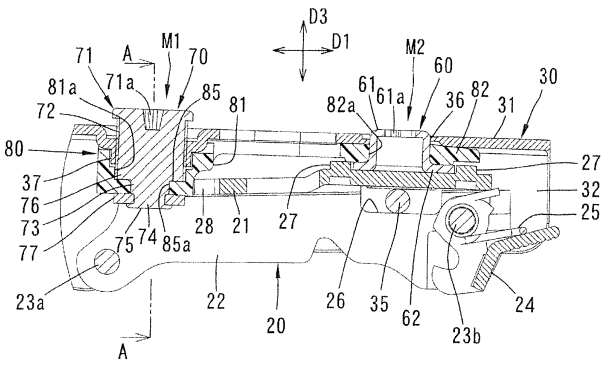
(72) Inventors:
- **TAKAMATSU Shingo**
  Tokyo 101-8633 (JP)
- **OGASAWARA Hideki**
  Tokyo 101-8633 (JP)
- **TSUKAMOTO Koichi**
  Tokyo 101-8633 (JP)

(74) Representative: **Zoli, Filippo**
BRUNACCI & PARTNERS S.r.l.
Via Scaglia Est, 19-31
41126 Modena (IT)

(54) HINGE DEVICE

(57) A hinge device 3 includes a first hinge body 4 to be attached to a furniture main body and a second hinge body 6 to be attached to a door. The first hinge body 4 includes a base member 5, a main hinge member 30, a positional adjustment mechanism M for adjusting the position of the main hinge member 30 with respect to the base member 5. The positional adjustment mechanism M includes a female-threaded part 37 formed in the main hinge member 30, a receptacle hole 28 formed in the base member 5 and an adjustment screw 70 screwed into the female-threaded part 37. The adjustment screw 70 includes a neck part 73 and nip parts 76, 77 larger in diameter than the neck part 73. The nip parts 76, 77 include a pair of engagement faces 76a, 77a, which nip engagement parts 29 formed on the opposite sides of the receptacle hole 28. The rotation control member 80 made of resin, which is prevented from rotating relative to the base member 5 and the main hinge member 30, has a frictional engagement part 85. The frictional engagement part 85 is held in the receptacle hole 28 while frictionally engaging with the pair of engagement faces 76a, 77a, thereby preventing the rotation of the adjustment screw 70. The neck part 73 of the adjustment screw 70 penetrates the frictional engagement part 85.

Fig. 5



EP 3 643 862 A1

Description

Technical Field

[0001] The present invention relates to a hinge device for rotatably attaching a second subject such as a door on a first subject such as a furniture main body, a wall of a building or others, and particularly to a hinge device that allows the adjustment of the position of the second subject with respect to the first subject.

Background Art

[0002] Hinge devices disclosed in Patent Documents 1 and 2, listed later, comprise a first hinge body to be fastened on a furniture main body, a second hinge body to be fastened on a door and a link mechanism for rotatably coupling the first and second hinge bodies with each other.

The first hinge body has a base member fixed to the furniture main body and a main hinge member attached on the base member such that the position of the main hinge member can be adjusted in a horizontal direction. The main hinge member is coupled to the second hinge body via the link mechanism.

[0003] In order to perform the above-mentioned positional adjustment, either of the main hinge member and the base member is provided with a female-threaded part, and the other member is provided with a receptacle hole extending in an anteroposterior direction of the furniture main body, the opposite side edges serving as engagement parts. Into the female-threaded part, an adjustment screw is screwed. The adjustment screw has a neck part penetrating the receptacle hole, as well as a first and a second nip part, larger in diameter than the neck part, disposed on the opposite ends of the neck part in an axial direction. The first and second nip parts nip the engaging parts.

By turning the adjustment screw, the main hinge member is displaced in the horizontal direction with respect to the base member through the engagement of the pair of nip parts with the engaging part, and thus the position of the door in the horizontal direction with respect to the furniture main body is adjusted.

Prior Art Document(s)

Patent Document(s)

[0004]

Patent Document 1: JP H10-238199 A, and
Patent Document 2: JP 3139821 U.

Summary of the Invention

Problem(s) to be solved by the Invention

[0005] In the hinge device of Patent Document 1 and 2, impacts generated by repeatedly opening and closing the door causes unintended rotation in the adjustment screw, leading to the misalignment of the door from the adjusted desired position with respect to a furniture main body.

Means for solving the problem(s)

[0006] In order to solve the above problems, the present invention provides a hinge device comprising a first hinge body to be attached to a first subject, a second hinge body to be attached to a second subject and a coupling mechanism for rotatably coupling the second hinge body to the first hinge body, wherein the first hinge body comprises a base member to be attached to the first subject, a main hinge member coupled to the second hinge body via the coupling mechanism and a positional adjustment mechanism for adjusting a position of the main hinge member with respect to the base member,

the positional adjustment mechanism comprises a first positional adjustment part for adjusting a position of the main hinge member in a predetermined direction with respect to the base member, the first positional adjustment part having a female-threaded part formed in one of the main hinge member and the base member, an engagement part formed in the other member, and an adjustment screw,

the adjustment screw comprises a male-threaded part to be screwed in the female-threaded part and a neck part intersecting the engagement part, and further comprises first and second nip parts disposed on opposite sides of the neck part and being larger in diameter than the neck part, the first and second nip parts having their surfaces facing each other to be provided as a pair of engagement faces, between the pair of engagement faces the engagement part being set, and

the positional adjustment mechanism further comprises a rotation control member made of resin, the rotation control member being prevented from rotating about an axis extending in the predetermined direction with respect to the base member and the main hinge member while having a frictional engagement part nipped by the pair of engagement faces to frictionally engage with the pair of engagement faces.

[0007] With the above configuration, the frictional engagement part of the rotation control member is frictionally engaged with a pair of engagement faces of the adjustment screw to prevent the adjustment screw from rotating unintendedly, thereby retaining the adjusted position of the main hinge member in a predetermined direction with respect to the base member and thus retaining the second subject in the predetermined direction with respect to the first subject in an adjusted desired position.

[0008] It is preferable that the frictional engagement part of the rotation control part has a thickness greater than a distance between the pair of engagement faces of the adjustment screw in its natural state, and the frictional engagement part is nipped in a state elastically compressed between the pair of locking surfaces of the adjustment screw.
With this configuration, the frictional engagement part can be reliably in frictional engagement with the pair of engagement faces.

[0009] It is preferable that the adjustment screw comprises a screw body and a washer, the screw body having the male-threaded part, the neck part and a washer mounting part, arranged in this order in the predetermined direction, the washer being mounted to the washer mounting part in such a way that the washer is fixed with a crimped part formed on a tip of the washer mounting part, and the male-threaded part having its end on the neck part side provided as the first nip part while the washer is provided as the second nip part.
With this configuration, the use of the washer facilitates bringing the frictional engagement part into an elastic compression state.

[0010] It is preferable that the other of the main hinge member and the base member is provided with a receptacle hole, a pair of side edges locating on the opposite sides of the receptacle hole being provided as the respective engagement parts, the neck part of the adjustment screw being inserted into the receptacle hole while the frictional engagement part of the rotation control member is held in the receptacle hole.
With this configuration, the positional adjustment can be conducted stably by the pair of engagement parts.

[0011] It is preferable that the frictional engagement part comprises a through hole, which the neck part of the adjustment screw penetrates.
With this configuration, the frictional engagement part can be frictionally engaged with the pair of engagement faces being in balance around the neck part.

[0012] It is preferable that the rotation control member is connected to the frictional engagement part and has the first interposing part interposed between the base member and the main hinge member, and the first interposing part is provided with exposure windows on the opposite sides of the frictional engagement part so as to allow the engagement part of the other of the main hinge member and the base member to abut the engagement face of the first nip part of the adjustment screw.
With this configuration, the first interposing part can reliably prevent contact between the base member and the main hinge member.

[0013] It is preferable that the female-threaded part is formed in the main hinge member to protrude toward the base member, on which the receptacle hole and the engagement part are formed, the first interposing part of the rotation control member having a housing space with its opposite ends in the predetermined direction open, the housing space receiving the female-threaded part and the end of the male-threaded part protruding from the female-threaded part, the frictional engagement part being formed to intersect an opening at one end of the housing space, the exposure windows being formed between the circumference of the opening at the one end and the frictional engagement part. With this configuration, the female-threaded part of the main hinge member can be prevented from abutting the base member.

[0014] It is preferable that the positional adjustment mechanism further comprises a second positional adjustment part for adjusting a position of the main hinge member in another direction orthogonal to the predetermined direction with respect to the base member, the second positional adjustment part comprising a support hole formed in the main hinge member, a pair of cam receivers formed in the base member at a distance in the other direction, and an eccentric cam, the eccentric cam having an operational part rotatably fitted in the support hole and a cam part engaged between the pair of cam receivers, the rotation control member further comprising a second interposing part integrally formed with the first interposing part at a distance from the first interposing part in the other direction, the second interposing part being interposed between the main hinge member and the base member and having a frictional receptacle hole, into which the operational part of the eccentric cam is press fitted.
With this configuration, the rotation control member can also conduct detent of the eccentric cam for the positional adjustment in the other direction.

Advantageous Effect(s) of the Invention

[0015] In accordance with the present invention, the unintended rotation of the adjustment screw can be avoided so as to retain the adjusted position of the main hinge member in the predetermined direction with respect to the base member, and thus the position of the second subject relative to the first subject can be retained in the adjusted desired position.

Brief Description of the Drawings

[0016]

[FIG. 1] is a perspective view showing a part of furniture attached with a hinge device according to a first embodiment of the present invention, with its door closed;
[FIG. 2] is an exploded perspective view of the hinge device;
[FIG. 3] is a cross-sectional view of taken in the arrows of a line A-A in FIG. 1;
[FIG. 4] illustrates correspondingly to FIG. 3 the hinge device with its door open;
[FIG. 5] is an enlarged cross-sectional view of the main section of the hinge device in FIG. 3;
[FIG. 6] is a cross-sectional view taken in the arrows

of a line A-A in FIG. 5;
[FIG. 7] is a perspective view of the main section of the hinge device;
[FIG. 8] is a perspective view of the main section shown in FIG. 7 viewed from the opposite side of FIG. 7;
[FIG. 9] is a perspective view solely showing the intermediate member of the hinge device;
[FIG. 10] is a perspective view showing the intermediate member, eccentric cam and adjustment screw of the hinge device;
[FIG. 11] is a cross-sectional view with an engagement part of the intermediate member enlarged;
[FIG. 12] is a perspective view of a rotation control member of the hinge device;
[FIG. 13] is a perspective view of the rotation control member viewed from the direction opposite to the direction in FIG. 12;
[FIG. 14] is a plan view of the rotation control member;
[FIG. 15] is a cross-sectional view taken in the arrows of a line A-A in FIG. 14;
[FIG. 16] is a cross-sectional view of taken in the arrows of a line B-B FIG. 14;
[FIG. 17] is a cross-sectional view showing in an exploded manner the main section of the hinge device before assembled;
[FIG. 18] is a perspective view of the main section of a hinge device according to a second embodiment of the present invention;
[FIG. 19] is an exploded perspective view of the main section of the hinge device of FIG. 18;
[FIG. 20] is a plan view of the main section of the hinge device of FIG. 18;
[FIG. 21] is a cross-sectional view taken in the arrows of a line A-A in FIG. 20; and
[FIG. 22] is a cross-sectional view taken in the arrows of a line B-B FIG. 20.

Mode(s) for Carrying Out the Invention

[0017] With reference to FIGS. 1 to 17, a first preferred embodiment of the present invention will be described below.
As shown in FIGS. 1 to 3, furniture is configured in such a way that a furniture main body 1 (housing: first subject) and a door 2 (second subject) are rotatably coupled to each other via a hinge device 3.
In the following description, it is defined for purposes of easier understanding of the invention that a depth direction of the furniture main body 1 is an anteroposterior direction D1 (first direction), and furthermore a horizontal direction D3 (third direction: predetermined direction) and a vertical direction D2 (second direction) are defined.
[0018] The hinge device 3 comprises a first hinge body 4 attached on the inner surface of a side plate of the furniture main body 1, and a second hinge body 6 attached to the door 2.
The second hinge body 6 has a socket part 6a and a fixed jaw part 6b projecting from the rim of the socket part 6a in the vertical direction D2. As shown in FIG. 3, when the door 2 is closed, a concave portion 2a is formed on the surface of a side edge of the door 2 facing the furniture main body 1. The socket part 6a is accommodated in the concave part 2a, and the fixed jaw part 6b is fastened to the door 2 with wood screws.
[0019] As shown in FIGS. 2 and 3, the first hinge body 4 has a washer 10, an intermediate member 20 detachably fitted to the washer 10, and a main hinge member 30 fitted adjustably in position to the intermediate member 20. The washer 10 forms a base member 5 together with the intermediate member 20.
[0020] The washer 10 has a fixed plate part 11 fastened on the inner surface of the side plate of the furniture main body 1 with a wood screw, and a raised part 12 formed in the center of the fixed plate part in the vertical direction D2 and extending in the anteroposterior direction D1. In the raised part 12, an engagement concave part 12a is formed on its front end part and an engagement convex part 12b is formed on its rear end part. In the illustrative embodiment, the position of the raised part 12 can be adjusted in the vertical direction D2 with respect to the fixed plate part 11.
[0021] The intermediate member 20 is formed in an elongated shape in the anteroposterior direction D1, and provided with a top wall part 21 and a pair of side wall parts 22 formed on the opposite sides of the top wall part, thereby forming a U-shape in cross-section. The intermediate member 20 is detachably fitted in such a way that the intermediate member covers the raised part 12. To put it simply, an engagement pin 23a extending in the vertical direction D2 is fitted into the front end parts of the pair of side wall parts 22 of the intermediate member 20, and the engagement pin 23a is thereby engaged with the engagement concave part 12a of the raised part 12 of the washer 10. On the rear end part of the intermediate member 20, a support pin 23b extending in the vertical direction D2 is fitted, on the support pin 23b an engagement member 24 being rotatably held and also a torsion spring 25 being wound for urging the engagement member 24 to rotate. The engagement member 24 has its engagement concave part 24a engaged with the engagement convex part 12b of the raised part 12 by the force of the torsion spring 25.
[0022] The main hinge member 30 is formed in an elongated shape in the anteroposterior direction D1, and provided with a top wall part 31 and a pair of side wall parts 32 formed on the opposite sides of the top wall part, thereby forming a U-shape in cross-section. The main hinge member 30 is detachably fitted to the intermediate member 20 such that it covers the intermediate member 20 and enables the positional adjustment by means of a positional adjustment mechanism M which will be described later.
[0023] The main hinge member 30 of the first and second hinge bodies 4 and 6 are coupled to each other by

a link mechanism 50 (coupling mechanism) so as to be able to rotate about a rotation axis extending in the vertical direction D2. The link mechanism 50 has two links 51 and 52. One of the links, or link 51, has its one end rotatably coupled to the front end part of the main hinge member 30 via a shaft pin 53, and has its other end rotatably coupled to the socket part 6a of the second hinge body 6 via a shaft pin 54. The other link 52 has its one end rotatably coupled to the front end part of the main hinge member 30 via a shaft pin 55, and has its other end rotatably coupled to the socket part 6a of the second hinge body 6 via a shaft pin 56. The shaft pins 53 to 56 extend in the vertical direction D2.

[0024] When the door 2 is in its closed state as shown in FIG. 3, the front end part of the main hinge member 30 of the first hinge body 4 and the link mechanism 50 are accommodated in the socket part 6a of the second hinge body 6. The door 2 is located adjacent to the front end face of the furniture main body 1.

When the door 2 is open, the door 2 rotates about the rotation axis extending in the vertical direction D2. Due to the function of the link mechanism 50, the rotation axis moves in a direction separating away from the furniture main body 1 in parallel with the opening movement of the door 2. When the door 2 is fully open as shown in FIG. 4, the front end part of the main hinge member 30 and the almost entire portion of the link mechanism 50 locate outside the socket part 6a of the second hinge body 6.

[0025] Around the shaft pin 55, wound is a torsion spring 57, of which the one end abuts the front end part of the top wall part 31 of the main hinge member 30 and the other end abuts a support pin 58 attached near the shaft pin 53 in the link 51. Thus, the torsion spring 57 urges the door 2 in its closed direction when the door 2 locates within the range from its closed position to a position at a certain open angle.

[0026] The positional adjustment mechanism M comprises a first positional adjustment part M1 for adjusting the position of the main hinge member 30 in the horizontal direction D3 with respect to the base member 20 and a second positional adjustment part M2 for adjusting the position of the main hinge member 30 in the anteroposterior direction D1. A description about the positional adjustment mechanism M will now be made by referring principally to FIGS. 2 and 5 to 10.

[0027] At the rear end part of the main hinge member 30, a slide shaft 35 extending in the vertical direction D2 is held to penetrate the pair of side wall parts 32. On the other hand, the pair of side wall parts 22 on the rear end part of the intermediate member 20 is provided with a guide slot 26 that extends in the anteroposterior direction D1, into the guide slot 26 the slide shaft 35 being inserted slidably in the anteroposterior direction D1. The dimension of the guide slot 26 in the vertical direction D3 is almost equal to the diameter of the slide shaft 35. Consequently, the rear end part of the main hinge member 30 is movable in the anteroposterior direction D1 relative to the intermediate member 20 and also rotatable about the slide shaft 35 in the horizontal direction D3.

[0028] At first, the second positional adjustment part M2 will be described. The second positional adjustment part M2 comprises a circular support hole 36 formed on the rear end part of the top wall part 31 of the main hinge member 30, a pair of cam receivers 27 formed on the rear end part of the top wall part 21 of the intermediate member 20 at a distance in the anteroposterior direction D1 and an eccentric cam 60. The eccentric cam 70 has its operational part 61 rotatably fitted in the support hole 36 and its cam part 62 engaged between the pair of cam receivers 27. The operational part 61 has its axis extending in the horizontal direction D3, and has its outer end provided with a tool insertion hole 61a. By turning the operational part 61, the position of the main hinge member 30 is adjusted in the anteroposterior direction D1 relative to the intermediate member 20.

[0029] Next, the first positional adjustment part M1 will be described. The first positional adjustment part M1 comprises a cylindrical female-threaded part 37 formed in a longitudinal intermediate part of the top wall part 31 of the main hinge member 30 and protruding toward the intermediate member 20, a receptacle hole 28 formed on the front end part of the tope wall part 21 of the intermediate member 20 and an adjustment screw 70.

[0030] The receptacle hole 28 extends in the anteroposterior direction D1 and its front end is open. The receptacle hole 28 has its opposite side edges adapted as a pair of engagement parts 29. As shown in FIG. 11, each engagement part 29 has raised ridges 29a formed in the center of the opposite surfaces thereof in the anteroposterior direction D1, so that the edges of the raised ridges 29a provide abutting parts 29b, details of which will be described later.

[0031] As shown in FIGS. 5 and 6, the adjustment screw 70 is formed by a screw body 71 and a washer 77. The screw body 71 comprises a male-threaded part 72, a neck part 73 being smaller in diameter than the male-threaded part 72, a washer mounting part 74 being much smaller in diameter than the neck part 73 and a crimped part 75, which are disposed in this order along the axis extending in the horizontal direction D3 from its outer end to its inner end. The screw body 71 is provided with a tool insertion hole 71a on its outer end face.

[0032] On the washer mounting part 74, the washer 77 is mounted. The washer 77 is nipped by an annular step formed between the neck part 73 and the washer mounting part 74 and the crimped part 75 so as to be held non-rotatably against the screw body 71.

[0033] In the illustrative embodiment, the male-threaded part 72 of the adjustment screw 70 has its inner end part 76 (end part on the neck part 73 side) provided as a first nip part, while the washer 77 is provided as a second nip part. The inner end part 76 and the washer 77 are larger in diameter than the neck part 73.

As shown in FIG. 11, the surfaces of the inner end part 76 of the male-threaded part 72 and the washer 77, which

are opposed to one another, are formed by annular planes orthogonal to the axis of the adjustment screw 70 so as to be provided as engagement faces 76a and 77a, respectively.

[0034] The male-threaded part 72 of the adjustment screw 70 is screwed into the female-threaded part 37 of the main hinge member 30, and the inner end part 76 thereby protrudes from the female-threaded part 37 toward the intermediate member 20. The neck part 73 of the adjustment screw 70 penetrates the receptacle hole 28 of the intermediate member 20. The inner end part 76 of the male-threaded part 72 and the washer 77 nip the engagement parts 29 formed on the opposite sides of the receptacle hole 28. The distance between the engagement faces 76a, 77a is almost equal to the distance between the abutting parts 29a formed on the opposite surfaces of the engagement parts 29, and thus the engagement faces 76a and 77a are subcontiguous to the abutting parts 29b.

[0035] By turning the adjustment screw 70, the adjustment screw 70 moves back and forth in the horizontal direction D3 with respect to the main hinge member 30. Since the engagement faces 76a and 77a of the adjustment screw 70 are engaged with the engagement parts 29 of the intermediate member 20, the main hinge member 30 rotates about the slide shaft 35 in the horizontal direction D3 as the adjustment screw 70 moves back and forth. Thus, the position of the front end part of the main hinge member 30 is adjusted in the horizontal direction D3, and the position of the door 2 is consequently adjusted in the horizontal direction. The rotational range of the main hinge member 30 according to the positional adjustment in the horizontal direction is about 4 angular degrees at the maximum.

[0036] The positional adjustment mechanism M further comprises a rotation control member 80 made of resin. As shown in FIGS. 12 to 16, the rotation control member 80 is in the form of plate elongated in the anteroposterior direction D1, and integrally comprises a first interposing part 81 formed on the front end part, a second interposing part 82 formed on the rear end part, a cross-linking part 83 for linking the first and second interposing parts 81 and 82, and a frictional engagement part 85 linked to the intermediate member 20 of the first interposing part 81.

[0037] The cross-linking part 83 for the first and second interposing parts 81 and 82 is interposed between the top wall part 21 of the intermediate member 20 and the tope wall part 31 of the main hinge member 30, and the cross-linking part 83 abuts the pair of side wall parts 32 of the main hinge member 30 to prevent the rotation of the rotation control member 80 relative to the intermediate member 20 and the main hinge member 30.

[0038] The first interposing part 81 comprises a housing space 81a, which has a circular cross-section and its opposite ends in the horizontal direction D3 open. As shown in FIGS. 5 and 6, the housing space 81a accommodates the female-threaded part 37 of the main hinge member 30 and the inner end part 76 of the male-threaded part 72 of the adjustment screw 70 protruding from the female-threaded part 37.

[0039] The frictional engagement part 85 has an oblong shape extending in the anteroposterior direction D1, and its side surfaces are flat and orthogonal to the axis of the housing space 81a extending in the horizontal direction D3. The frictional engagement part 85 has its width approximately equivalent to that of the receptacle hole 28 of the intermediate member 20 and is inserted into the receptacle hole 28 displaceably in the anteroposterior direction D1. It enables the positional adjustment of the main hinge member 30 in the anteroposterior direction D1 relative to the intermediate member 20. The frictional engagement part 85 intersects the opening of the intermediate member 20 in the housing space 81a. As the width of the frictional engagement part 85 is smaller than the diameter of the opening of the housing space 81a, exposure windows 86 are formed on both sides of the frictional engagement part 85 in the vertical direction D2. Through these exposure windows 86, the surfaces on the main hinge member 30 side of the engagement parts 29 of the intermediate member 20 expose, so that an abutting part 39b of the surface abuts the engagement face 76a of the adjustment screw 70.

[0040] The frictional engagement part 85 is provided with a through hole 85a coaxial with the housing space 81a. The through hole 85a has its diameter smaller than the housing space 81a but almost equal to that of the neck part 73 of the adjustment screw 70. On the surface of the intermediate member 20 of the frictional engagement part 85, a pair of arc-shaped convex parts 85b is formed at a distant in the anteroposterior direction D1 across the through hole 85a.

[0041] The second interposing part 82 of the rotation control member 80 is provided with a frictional receptacle hole 82a. The frictional receptacle hole 82a is slightly smaller in diameter than the operational part 61 of the eccentric cam 60. The second interposing part 82 has its surface on the intermediate member 20 side provided with an annular expansion part 82b surrounding the frictional receptacle hole 82a.

[0042] Now, the steps of assembling the intermediate member 20, the main hinge member 30, the eccentric cam 60, the adjustment screw 70 and the rotation control member 80, which provide the above-described configuration, will be described with reference particularly to FIG. 17. Before assembly, the washer mounting part 74 of the adjustment screw 70 has its tip provided with a part-to-be-crimped 75' which is equal in diameter to the washer mounting part 74.

[0043] In the housing space 81a of the first interposing part 81 of the rotation control member 80, the female-threaded part 37 of the main hinge member 30 and the male-threaded part 72 of the adjustment screw 70 screwed into the female-threaded part 37 are accommodated, and the neck part 73 of the adjustment screw 70 is inserted through the through hole 85a of the frictional engagement part 85 whereas the operational part 61 of

the eccentric cam 60 is pressed into the frictional receptacle hole 82a of the second interposing part 82.

[0044] The intermediate member 20 is arranged along the rotation control member 80, and the cam part 62 of the eccentric cam 60 is arranged between the pair of cam receiver 27, and then the frictional engagement part 85 of the rotation control member 80 is inserted into the receptacle hole 28.

[0045] In the above-described configuration, the washer 77 is mounted on the washer mounting part 74 of the adjustment screw 70, and the part-to-be-crimped 75' is then crimped. In this crimping step, the washer 77 is locked by an annular step 73x on the boundary between the neck part 73 and the washer mounting part 74. The distance D between the step 73x and the engagement face 76a of the inner end part of the male-threaded part 72 is equivalent to the distance between the engagement face 77a of the washer 77 and the engagement face 76a of the inner end part 76 of the male-threaded part 72 and also substantially corresponds to the distance between the abutting parts 29b of the engagement part 29.

[0046] The frictional engagement part 85 of the rotation control member 80 has a thickness T (dimension from the flat surface on the housing space 81a and the top surface of the convex part 85b in a natural state) that is larger than the distance D. Thus, in the above crimping step, the frictional engagement part 85 is elastically compressively deformed between the engagement faces 76a and 77a. As a consequence, both sides of the frictional engagement part 85 come into contact with the engagement faces 76a, 77a with suppress strength. Thus, the rotation of the adjustment screw 70 is controlled with frictional resistance of the frictional engagement part 85 so as to be inhibited from casual rotation after the positional adjustment. Accordingly, the main hinge member 30 and in turn the door 2 can stably keep their adjusted positions in the horizontal direction D3.

In the illustrative embodiment, the thickness between both surfaces except the convex part 85b of the frictional engagement part 85 is slightly greater than the distance L.

[0047] Since the eccentric cam 60 is pressed into the frictional receptacle hole 82a of the rotation control member 80, friction acts between the eccentric cam and the inner periphery of the frictional receptacle hole 82a. Further in the illustrative embodiment, the thickness of the second interposing part 82 of the rotation control member 80 (thickness of the second interposing part 82 including the expansion part 82b in the natural state) is greater than a distance between the cam part 62 and the top wall part 31 of the main hinge member 30 determined by inserting the slide shaft 35 into the guide slot 26. Thus, the second interposing part 82 is elastically compressed so that the friction acts between the second interposing part 82 and the cam part 62. Consequently, the eccentric cam 60 is controlled in its rotation with the frictional resistance of the second interposing part 82 so as to be inhibited from casual rotation after the positional adjustment, and thus the main hinge member 30 and in turn the door 2 can stably keep their adjusted positions in the anteroposterior direction D1.

[0048] By means of the first and second interposing parts 81 and 82, the intermediate member 20 can certainly avoid abutting the main hinge member 30 during the positional adjustment in the horizontal direction D3. Specifically in the illustrative embodiment, the female-threaded part 37 is accommodated in the housing space 81a of the first interposing part 81 to reliably prevent its tip from abutting the intermediate member 20, thereby avoiding the eccentric cam 60 from obstructing the positional adjustment in the anteroposterior direction D1.

[0049] Next, a second embodiment will be described with reference to FIGS. 18 to 22. In the following embodiment, the components like those previously described are allotted with the same reference numerals as in the figures, and repetitive description thereon will be avoided.

In the second embodiment, the intermediate member 20 is provided with a female-threaded part 127 that protrudes on the washer side, not shown. The main hinge member 30 has its concave part 135, which is formed on the top wall part 31, provided with a receptacle hole 138 extending in the anteroposterior direction D1, on the opposite sides of the hole 138 an engagement part 139 being disposed.

[0050] The rotation control member 80 is in the form of plate extending in the anteroposterior direction D1, in which the first and second interposing parts 81 and 82 are coupled together with a step height.

The main hinge member 30 of the first interposing part 81 has its surface provided with the frictional engagement part 85 protruding toward the main hinge member 30. The frictional engagement part 85 has an elliptical shape elongated in the anteroposterior direction D1 and accommodated in the receptacle hole 138 of the main hinge member 30. The through hole 85a of the frictional engagement part 85 also has the elliptical shape. At two positions opposing each other in the vertical direction D2 in the frictional engagement part 85, convex parts 85b are formed.

In the first interposing part 81, the frictional engagement part 85 has its sides in the vertical direction D2 provided with the exposure windows 86 adjacent to the frictional engagement part 85.

[0051] The screw body 71 of the adjustment screw 70 comprises the male-threaded part 72, the neck part 73, the washer mounting part 74 and the crimped part 75, which are disposed in this order from the intermediate member 20 toward the main hinge member 30. The male-threaded part 72 is screwed into the female-threaded part 127 of the intermediate member 20, and the neck part 73 passes through the through hole 85a of the frictional engagement part 85 of the rotation control member 80. The washer 77 is held inside the concave part 135 of the main hinge member 30 so as to be in contact with the outer surface of the engagement part 139. The outer end

part 76, or first nip part, of the male-threaded part 72 abuts the inner surface of the engagement part 139, or surface on the intermediate member 20 side, via the exposure window 86.

[0052] Since the neck part 73 of the adjustment screw 70 is inserted in the through hole 85a with the elliptical shape of the frictional engagement part 85, the adjustment screw 70 can be relatively displaced in the anteroposterior direction D1 with respect to the rotation control member 80 and the main hinge member 30, thereby enabling the positional adjustment in the anteroposterior direction D1 of the main hinge member 30 relative to the intermediate member 20.

[0053] The steps of assembling the rotation control member 80, the main hinge member 30 and the intermediate member 20 as well as the action of the rotation control member 80 are similar to those of the first embodiment, and thus repetitive description thereon is omitted.

[0054] The present invention is not limited to the above embodiments, but can be modified in various ways without departing from the spirit of the invention. As coupling mechanism for coupling the first hinge body and the second hinge body, any types of link mechanism as well as the link mechanisms according to the above-mentioned embodiments may be employed, or the coupling mechanism may be configured by means of one coupling shaft. In the above embodiments, the base member 5 is composed of the washer 10 and the intermediate member 20 detachably attached to the washer 10, but can be configured by using an integral base member to be fastened to the first subject.

The adjustment screw may have integrally formed nip portions with two large diameters without using washers. The engagement part may have a plate shape instead of the specific shape shown in FIG. 11. In such a case, there will be slight looseness in the engagement between the engagement part and the engagement faces of the pair of nip parts of the adjustment screw.

Industrial Applicability

[0055] The present invention can be applied to a hinge device and equivalent that couples a door to a furniture main body or a wall of a building.

Claims

1. A hinge device comprising a first hinge body (4) to be attached to a first subject (1), a second hinge body (6) to be attached to a second subject (2) and a coupling mechanism (50) for rotatably coupling the second hinge body to the first hinge body, wherein
the first hinge body (4) comprises a base member (5) to be attached to the first subject (1), a main hinge member (30) coupled to the second hinge body (6) via the coupling mechanism (50) and a positional adjustment mechanism (M) for adjusting a position of the main hinge member with respect to the base member,
the positional adjustment mechanism (M) comprises a first positional adjustment part (M1) for adjusting a position of the main hinge member (3) in a predetermined direction with respect to the base member (5), the first positional adjustment part having a female-threaded part (37; 127) formed to one of the main hinge member and the base member, an engagement part (29; 139) formed to another of the members, and an adjustment screw (70),
the adjustment screw (70) comprises a male-threaded part (72) to be screwed in the female-threaded part (37; 127) and a neck part (73) intersecting the engagement part (29; 139), and further comprises first and second nip parts (76, 77) disposed on opposite sides of the neck part and being larger in diameter than the neck part, the first and second nip parts having surfaces facing each other to be provided as a pair of engagement faces (76a, 77a), between the pair of engagement faces the engagement part being set, and
the positional adjustment mechanism (M) further comprises a rotation control member (80) made of resin, the rotation control member being prevented from rotating about an axis extending in the predetermined direction with respect to the base member (5) and the main hinge member (30) while having a frictional engagement part (85) nipped by the pair of engagement faces (76a, 77a) to frictionally engage with the pair of engagement faces.

2. The hinge device in accordance with claim 1, wherein the frictional engagement part (85) of the rotation control part (80) has a thickness greater than a distance between the pair of engagement faces (76a, 77a) of the adjustment screw (70) in a natural state, and the frictional engagement part is nipped in a state elastically compressed between the pair of locking surfaces of the adjustment screw.

3. The hinge device in accordance with claim 2, wherein the adjustment screw (70) comprises a screw body (71) and a washer (77), the screw body having the male-threaded part (72), the neck part (73) and a washer mounting part (74), arranged in order in the predetermined direction,
the washer being mounted to the washer mounting part in such a way that the washer is fixed with a crimped part (75) formed on a tip of the washer mounting part,
the male-threaded part having an end (76) on the neck part side provided as the first nip part while the washer (77) is provided as the second nip part.

4. The hinge device in accordance with any of claims 1 to 3, wherein the other of the main hinge member

(30) and the base member (5) is provided with a receptacle hole (28; 138), a pair of side edges locating on opposite sides of the receptacle hole being provided as the engagement parts (29; 139), the neck part (73) of the adjustment screw (70) being inserted into the receptacle hole while the frictional engagement part (85) of the rotation control member (80) is held in the receptacle hole.

5. The hinge device in accordance with claim 4, wherein the frictional engagement part (85) comprises a through hole (85a), which the neck part (73) of the adjustment screw (70) penetrates.

6. The hinge device in accordance with claim 5, wherein the rotation control member (80) is connected to the frictional engagement part (85) and has the first interposing part (81) interposed between the base member (5) and the main hinge member (30), and the first interposing part is provided with exposure windows (86) on opposite sides of the frictional engagement part so as to allow the engagement part (29; 139) of the other of the main hinge member (30) and the base member (5) to abut the engagement face (76a) of the first nip part (76) of the adjustment screw (70).

7. The hinge device in accordance with claim 6, wherein the female-threaded part (37) is formed in the main hinge member (30) to protrude toward the base member (5), on which the receptacle hole (28) and the engagement part (29) are formed,
the first interposing part (81) of the rotation control member (80) having a housing space (81a) with opposite ends in the predetermined direction open, the housing space receiving the female-threaded part and the end of the male-threaded part (72) protruding from the female-threaded part,
the frictional engagement part (85) being formed to intersect an opening at one end of the housing space, the exposure windows (86) being formed between a circumference of the opening at the one end and the frictional engagement part.

8. The hinge device in accordance with claim 6, wherein the positional adjustment mechanism (M) further comprises a second positional adjustment part (M2) for adjusting a position of the main hinge member (30) in another direction orthogonal to the predetermined direction with respect to the base member (5), the second positional adjustment part comprising a support hole (36) formed in the main hinge member, a pair of cam receivers (27) formed in the base member at a distance in the other direction, and an eccentric cam (60), the eccentric cam having an operational part (61) rotatably fitted in the support hole and a cam part (62) engaged between the pair of cam receivers,
the rotation control member (80) further comprising a second interposing part (82) integrally formed with the first interposing part (81) at a distance from the first interposing part in the other direction, the second interposing part being interposed between the main hinge member and the base member and having a frictional receptacle hole (82a), into which hole the operational part of the eccentric cam is press fitted.

Fig. 1

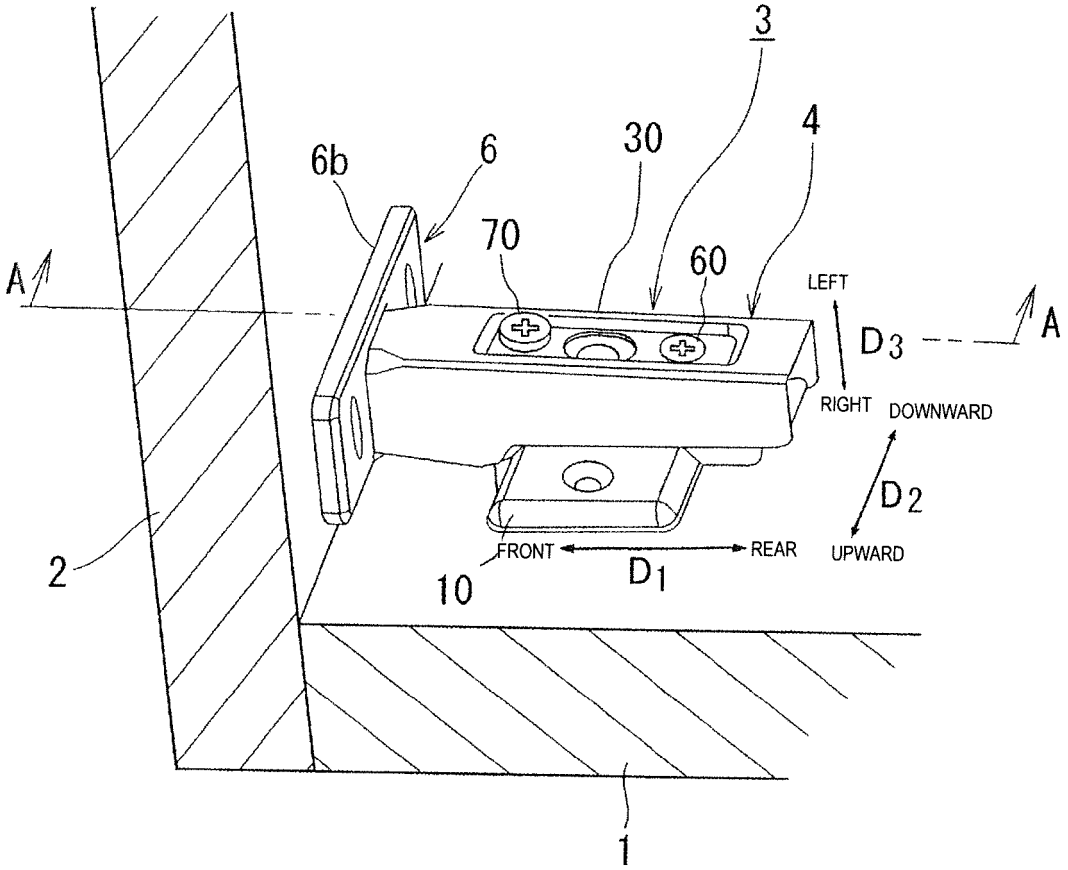

3
4
30
6
6b
70
60
A
A
LEFT
RIGHT
D3
DOWNWARD
D2
UPWARD
FRONT
REAR
D1
2
10
1

Fig. 2

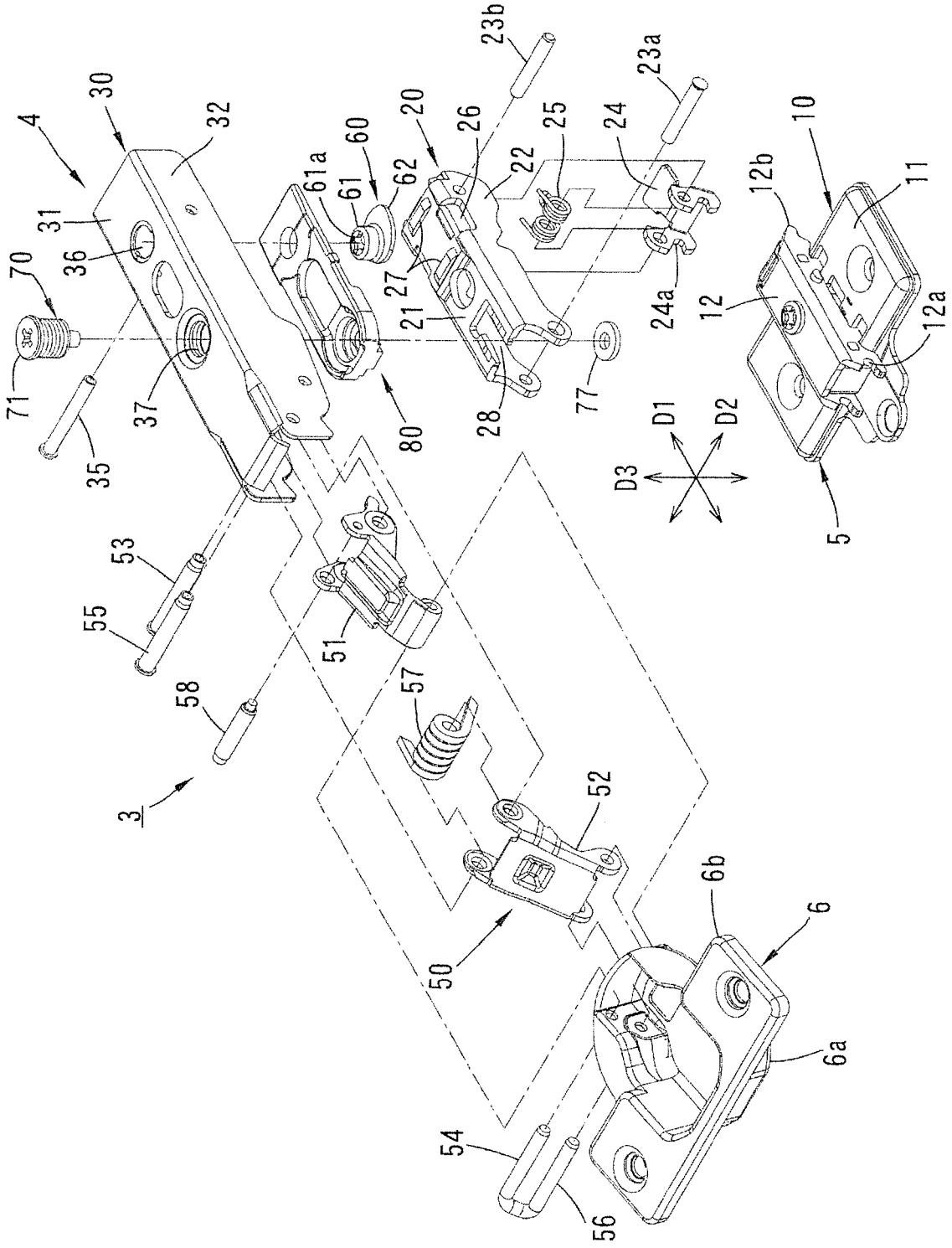

4
30
32
31
36
70
71
35
37
61a
61
60
62
20
26
25
24
23b
23a
22
27
21
28
80
77
24a
10
12b
11
12
12a
5
D1
D2
D3
53
55
58
3
51
57
52
50
6b
6
6a
54
56

Fig. 3

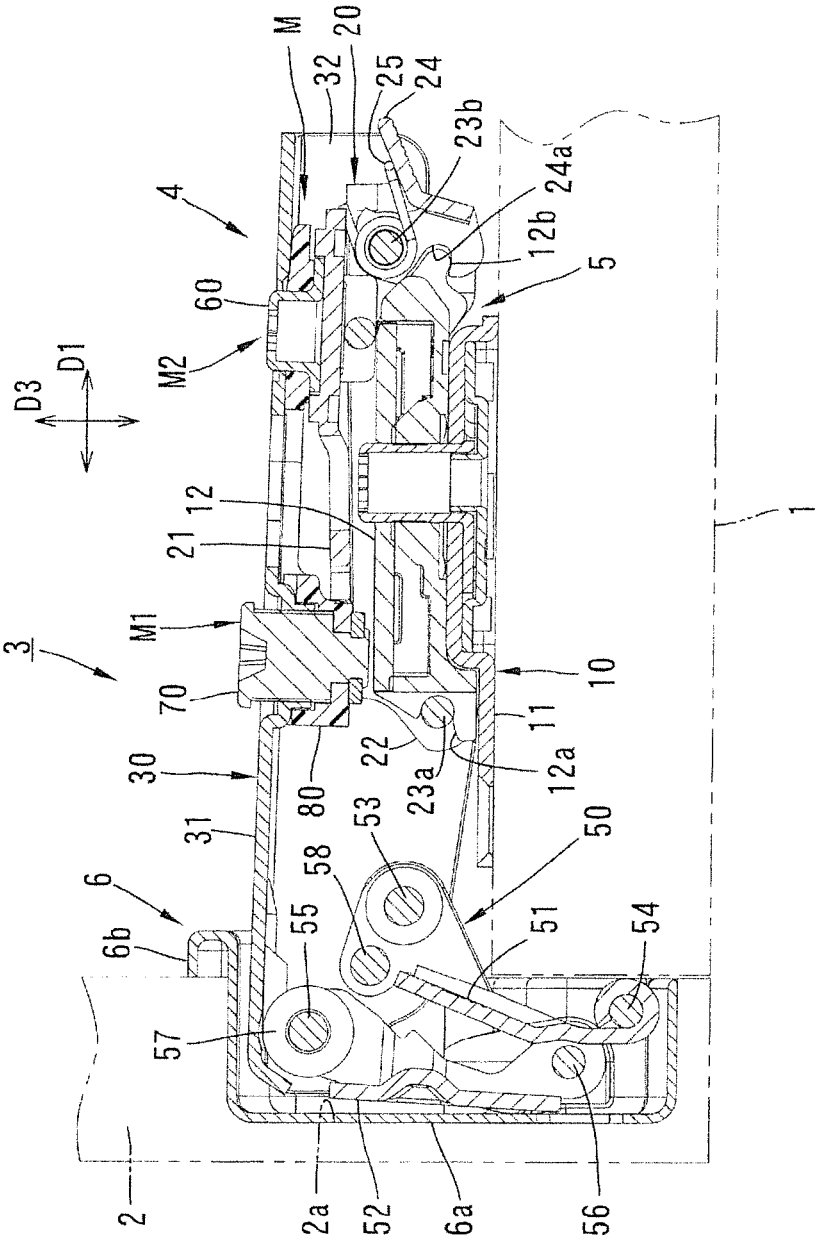

M
20
32
25
24
23b
24a
12b
5
4
60
M2
D1
D3
12
21
1
3
M1
70
10
11
22
23a
12a
30
80
53
50
31
58
6
55
51
54
6b
57
2
2a
52
6a
56

Fig. 4

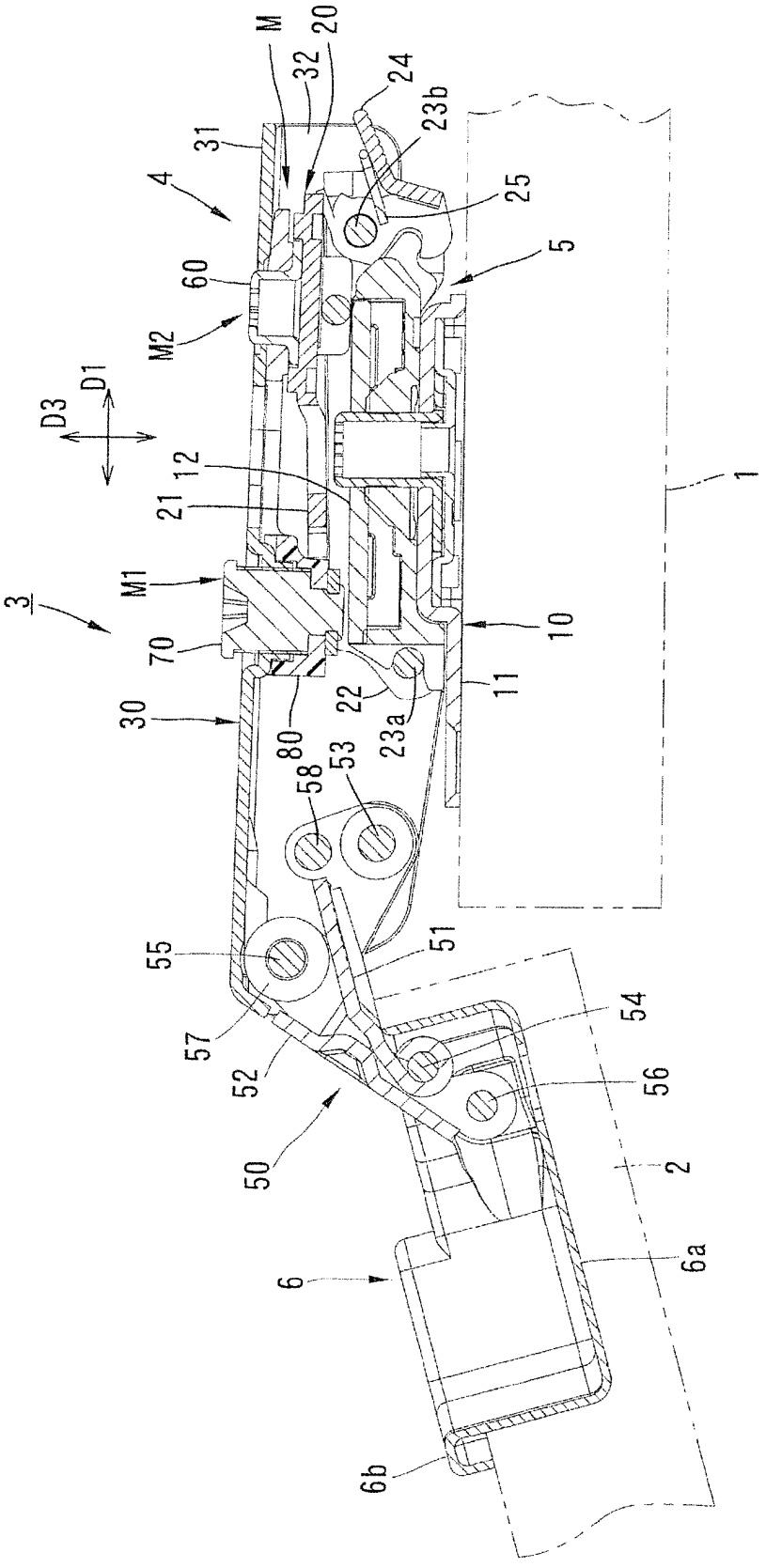

M
20
32
24
23b
31
4
25
5
60
M2
D3
D1
12
21
1
M1
3
10
70
22
11
30
80
23a
53
58
55
51
54
57
52
56
50
2
6
6a
6b

Fig. 5

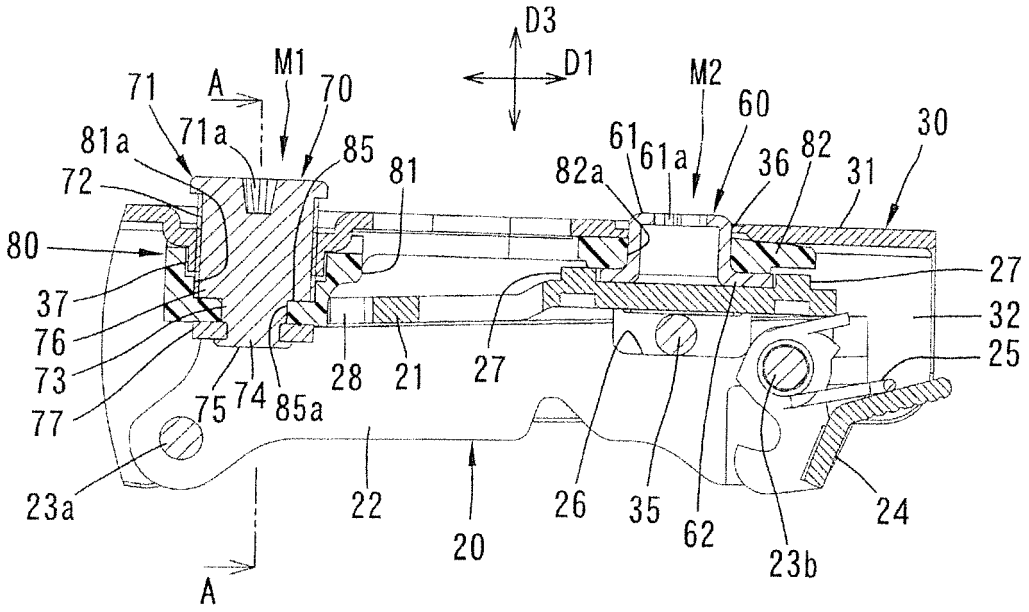

D3
D1
M1
M2
A
71
70
81a
71a
85
81
72
61
61a
60
36
82
30
82a
31
80
27
37
32
76
25
73
28
21
27
77
75
74
85a
23a
22
20
26
35
62
24
23b
A

Fig. 6

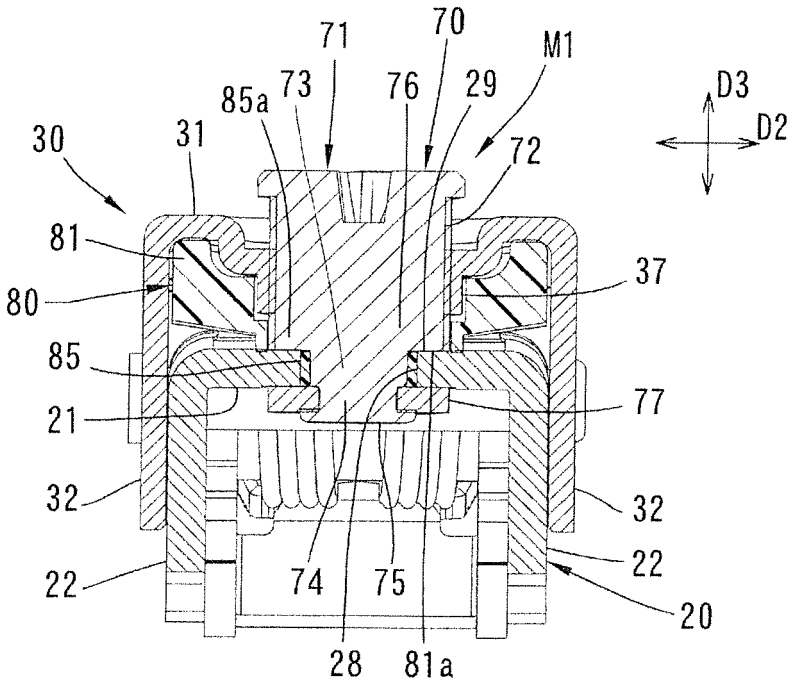

71
70
M1
85a
73
76
29
D3
D2
30
31
72
81
37
80
85
77
21
32
32
22
22
74
75
20
28
81a

Fig. 7

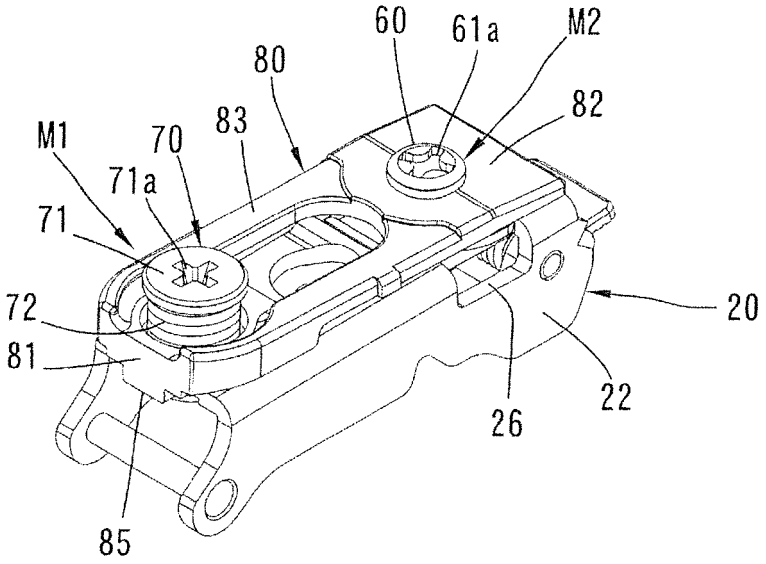

60
61a
M2
80
82
M1
70
83
71a
71
72
20
81
22
26
85

Fig. 8

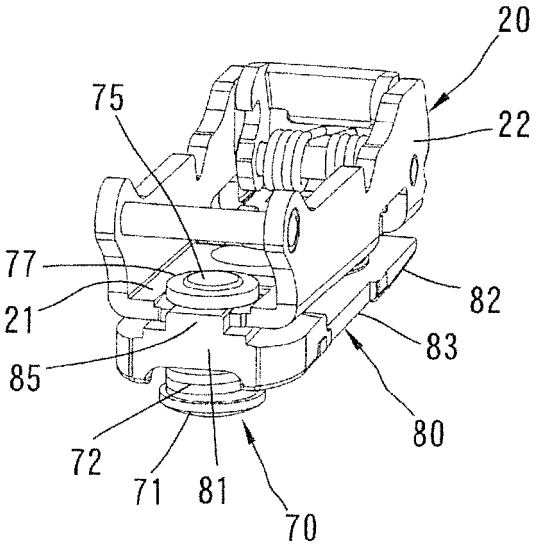

20
75
22
77
82
21
83
85
80
72
71
81
70

Fig. 9

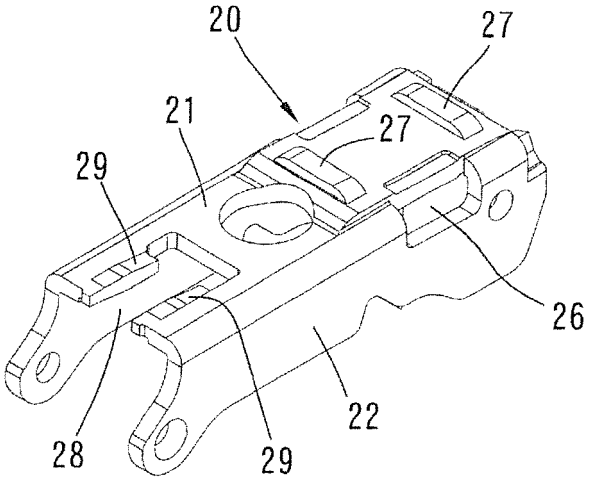

20
27
21
27
29
26
22
28
29

Fig. 10

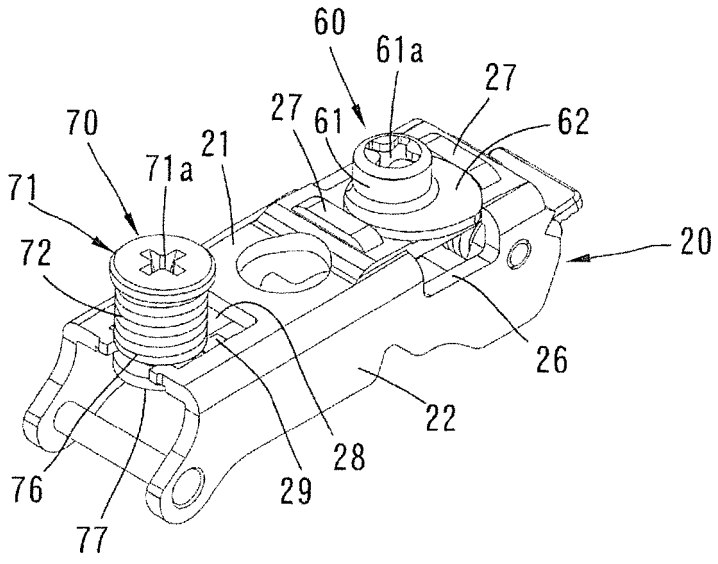

60
61a
27
27
61
62
70
21
71a
71
72
20
26
22
28
76
29
77

Fig. 11

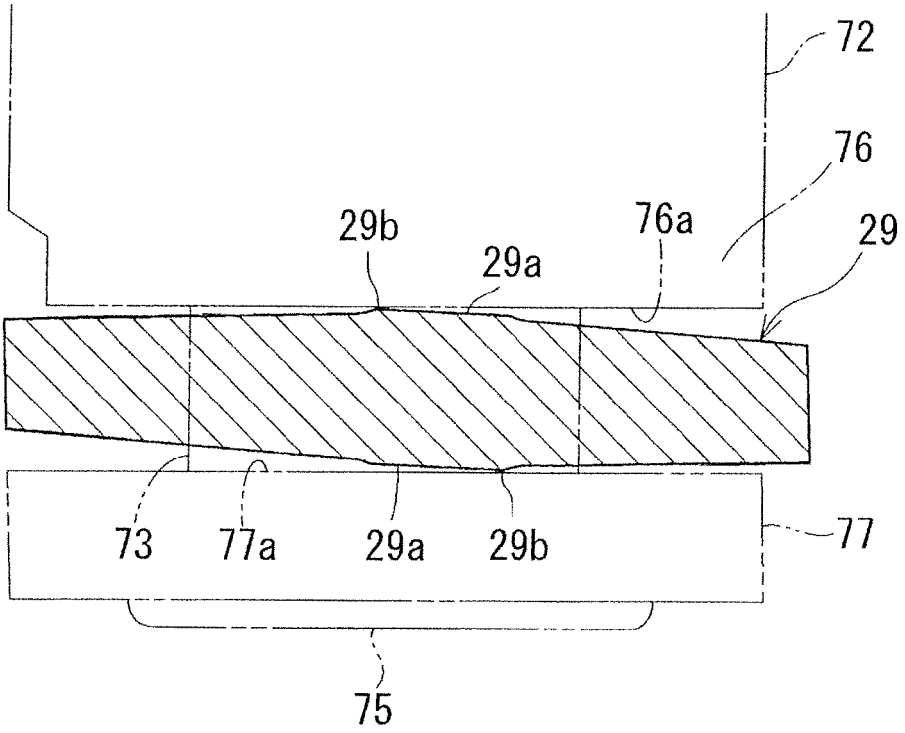

72
76
76a
29b
29a
29
73
77a
29a
29b
77
75

Fig. 12

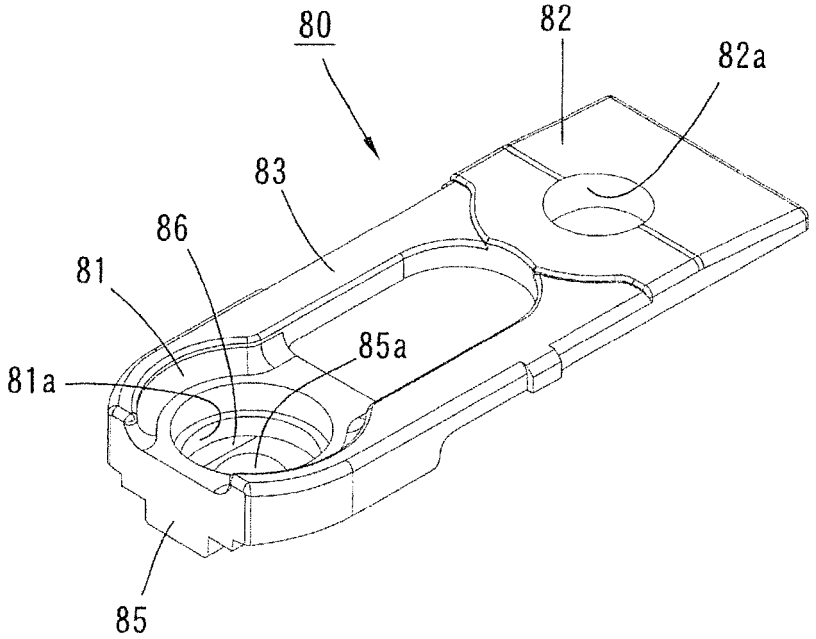

80
82
82a
83
86
81
85a
81a
85

Fig. 13

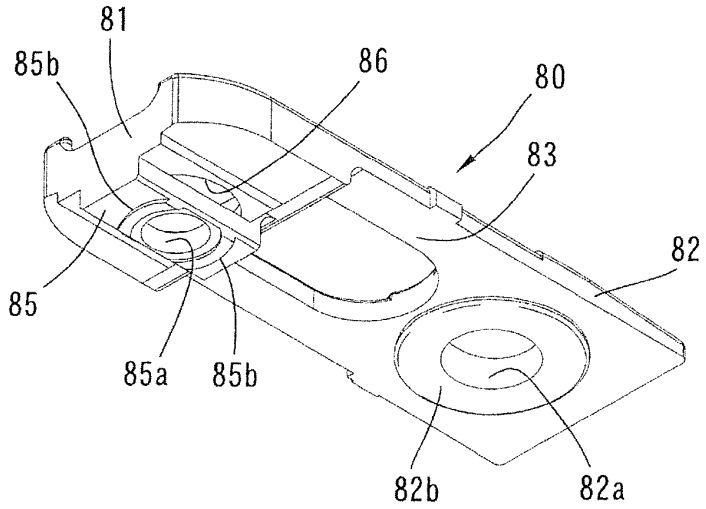


Fig. 14

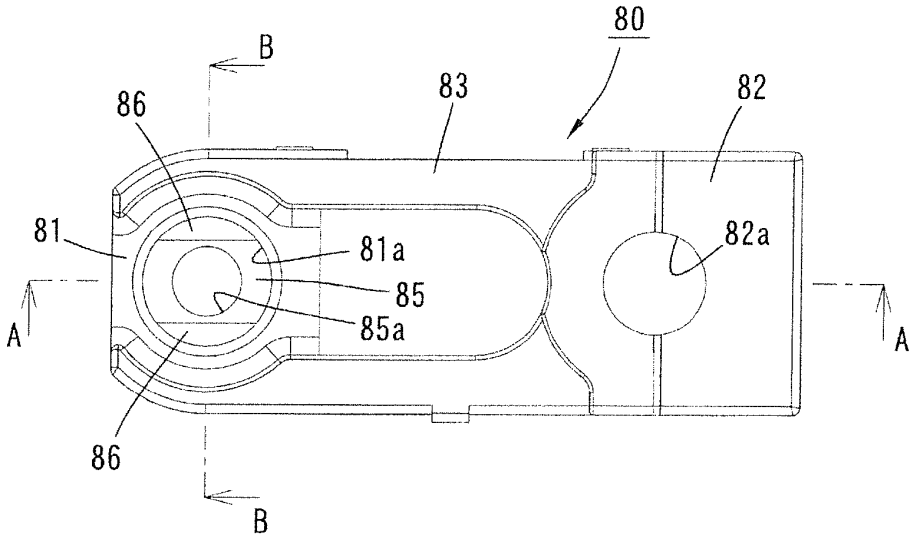


Fig. 15

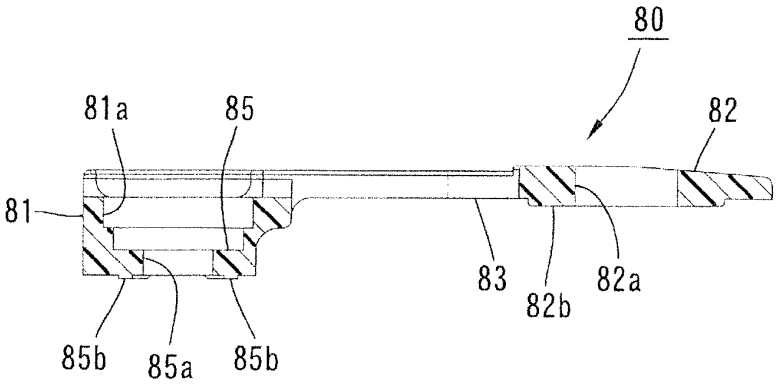


Fig. 16

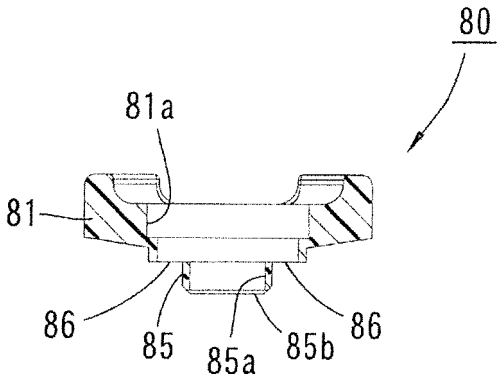


Fig. 17

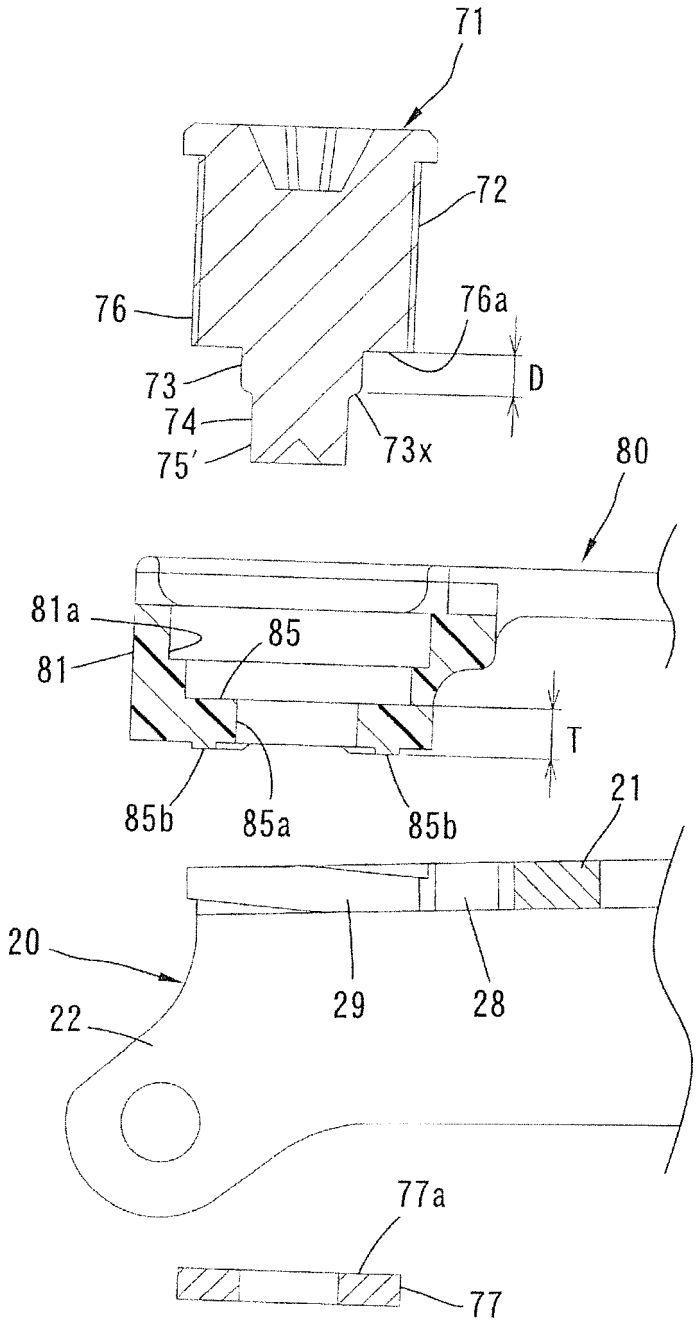

71
72
76
76a
D
73
74
75'
73x
80
81a
85
81
T
85b
85a
85b
21
20
29
28
22
77a
77

Fig. 18

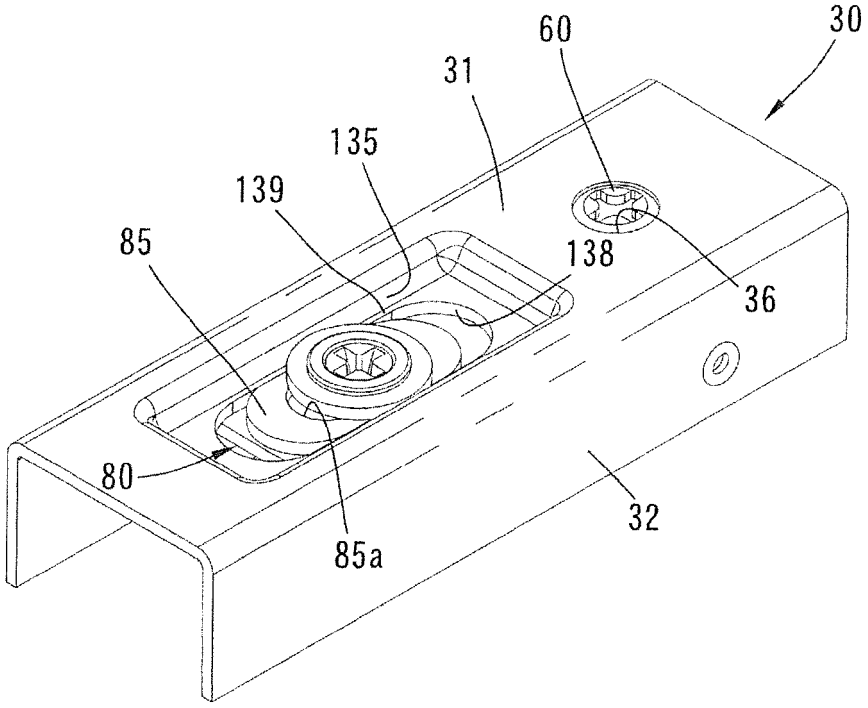


Fig. 19

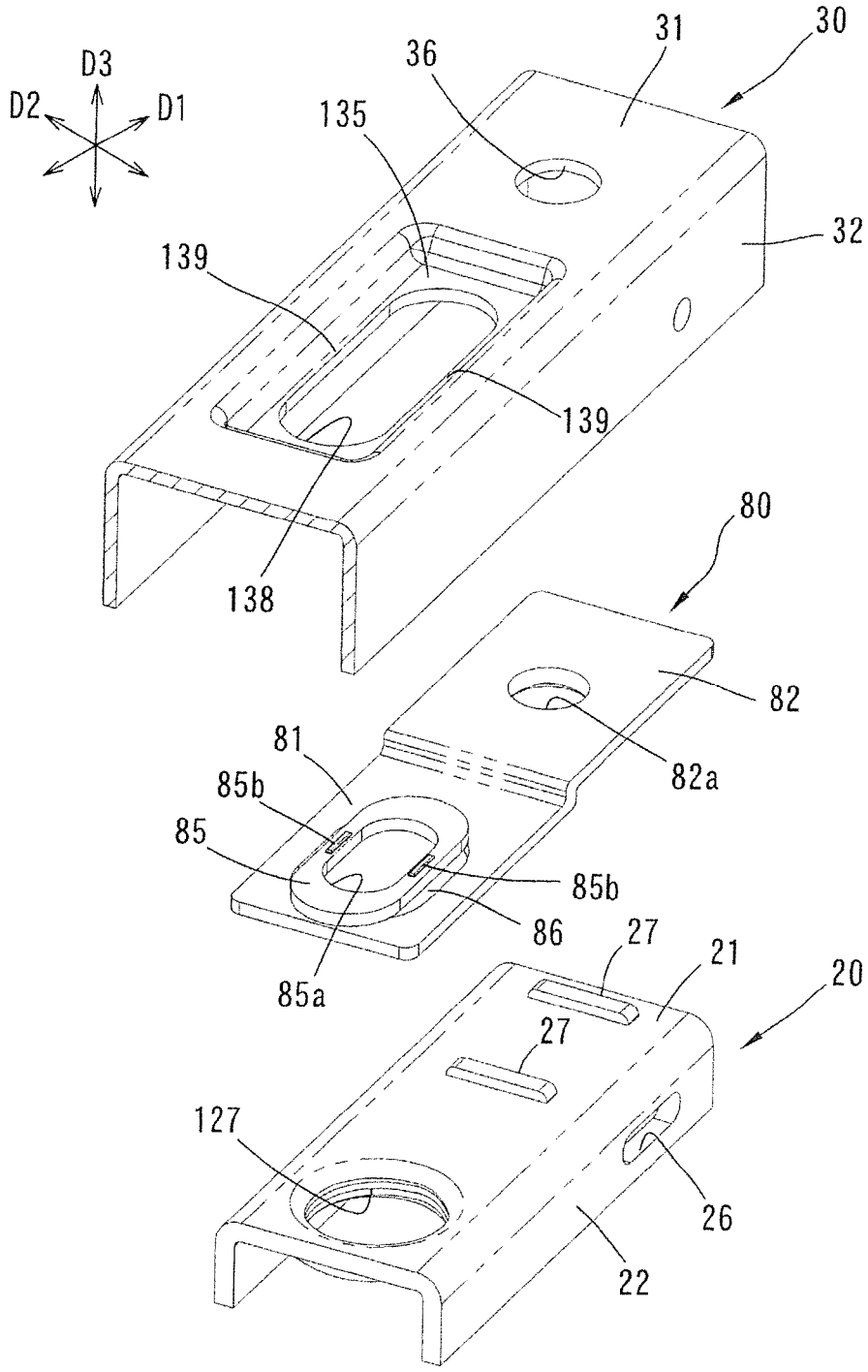

D3
D2
D1
36
31
30
135
32
139
139
138
80
82
81
82a
85b
85
85b
86
27
21
20
85a
27
127
26
22

Fig. 20

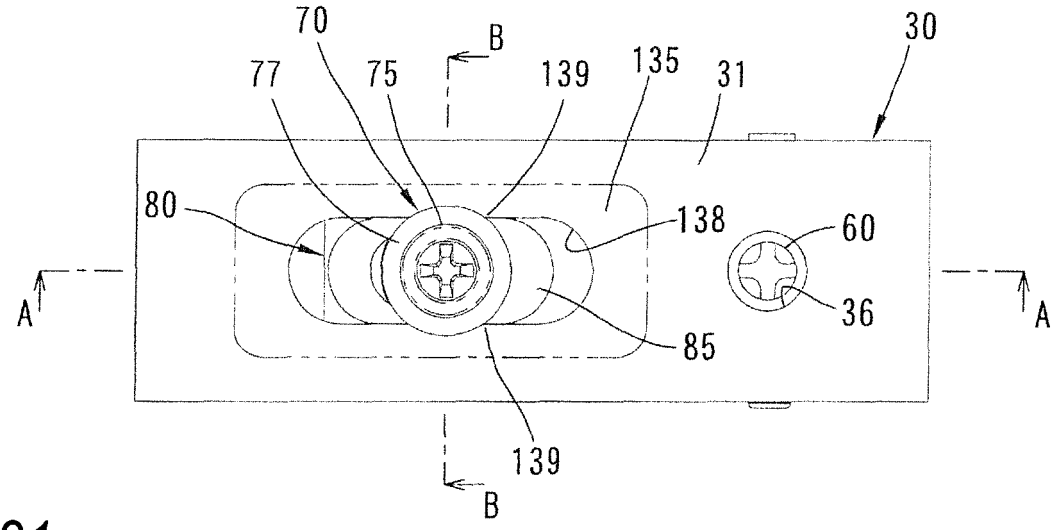


Fig. 21

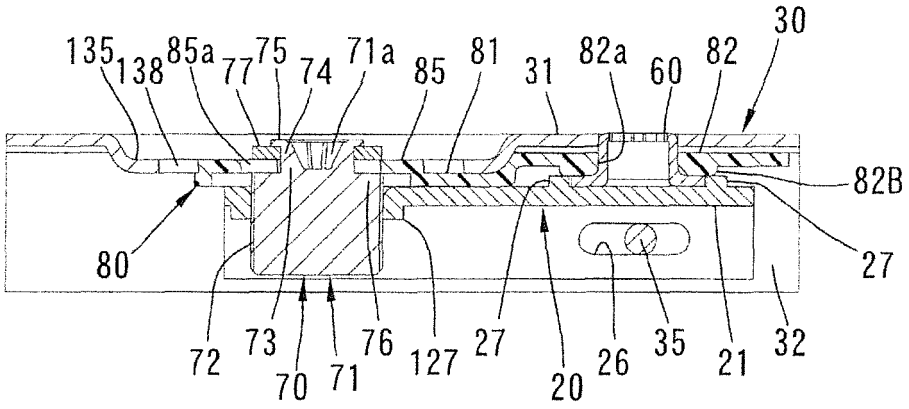
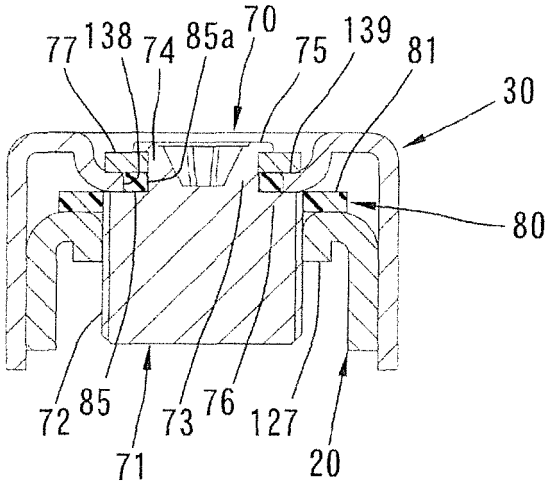


Fig. 22



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/020942

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. E05D7/04(2006.01)i, E05D3/14(2006.01)i, F16C11/04(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)
Int.Cl. E05D7/04, E05D3/14, F16C11/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2018
Registered utility model specifications of Japan 1996-2018
Published registered utility model applications of Japan 1994-2018

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.
P, A	WO 2018/012291 A1 (SUGATSUNE KOGYO) 18 January 2018, entire text, fig. 1-10 & TW 201802340 A	1-8
A	WO 2012/057249 A1 (SUGATSUNE KOGYO) 03 May 2012, paragraph [0019], fig. 1-34 & US 8881346 B2, column 8, lines 33-44 & EP 2634334 A1 & CN 103069091 A	1-8
A	US 2004/0034965 A1 (MUELLER, W.) 26 February 2004, entire text, fig. 1-3 & EP 1342874 A2 & DE 10210017 C1 & AT 445072 T	1-8

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
06.08.2018	21.08.2018
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP H10238199 A **[0004]**
- JP 3139821 U **[0004]**