



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**30.11.2011 Bulletin 2011/48**

(51) Int Cl.:  
**A47C 1/025 (2006.01)**

(21) Application number: **11154638.8**

(22) Date of filing: **16.02.2011**

(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**

(71) Applicant: **Koyo Giken Kabushiki Kaisha Sakai-shi Osaka (JP)**

(72) Inventor: **Yamashita, Tadanobu Osaka (JP)**

(30) Priority: **26.05.2010 JP 2010120096**

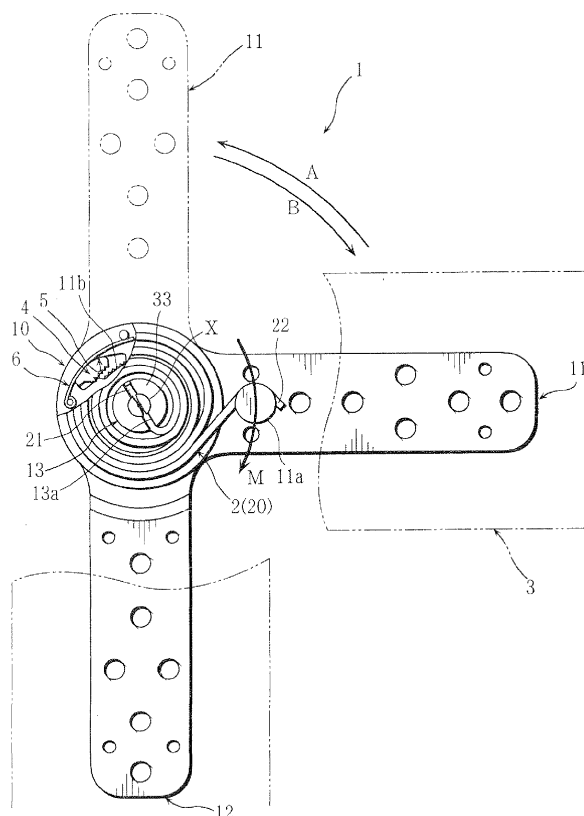
(74) Representative: **HOFFMANN EITLE Patent- und Rechtsanwälte Arabellastraße 4 81925 München (DE)**

(54) **Angle-adjustable hinge**

(57) In an angle-adjustable hinge, used for a sofa (S) provided with a reclinable rest portion (3), making oscillation of the rest portion (3) in a standing direction (A) possible, and stopping oscillation in an inclining direction

(B) with multi stage to keep a desired inclination angle, an elastic member (2), giving rotation resistance moment (M) to restrict the oscillation of the rest portion (3) in the standing direction (A), is provided.

Fig. 2



## Description

**[0001]** This invention relates to an angle-adjustable hinge used for sofas.

**[0002]** Conventionally, angle-adjustable hinges to make headrests, armrests, and footrests mounted on sofas reclinable are widely used.

**[0003]** The inventor of the present invention proposed an angle-adjustable hinge, making oscillation in a standing direction of a reclining part possible, stops oscillation in inclining direction to hold the reclining part with predetermined multi-stage inclination angles as disclosed in Japanese patent No. 4296223.

**[0004]** However, the conventional angle-adjustable hinge has a construction in which the oscillation in the inclining direction of the headrest, etc. is restricted with multi stage to hold the posture of the reclining part. So the headrest, etc. oscillates very lightly with click sound in the opposite standing direction. Therefore, when the cover of the seat, receiving the load of a person sitting on the sofa, is sagged and the cover of the backrest is pulled downward, the headrest, etc. is pulled in the standing direction by the tension of the cover as to unintentionally stand, and desired final inclination state can't be maintained.

**[0005]** And, in production and upholstering of the sofa, the reclining part is oscillated in the standing direction when the cover is pulled, and the work can't be conducted with the final inclination state maintained. So it is quite difficult to upholster with sufficiently large tension as not to generate creases on the cover.

**[0006]** Therefore, it is an object of the present invention to provide an angle-adjustable hinge with which rest portions such as the headrest, the armrest, and the footrest can be prevented from oscillating in the standing direction as to certainly maintain the final inclination state.

**[0007]** This object is solved according to the present invention by angle-adjustable hinge including features of claim 1. Furthermore detailed embodiments are described in the dependent claims 2, 3, 4, and 5.

**[0008]** The present invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a simplified perspective view of examples of positions to which an angle-adjustable hinge of the present invention is applied;

Figure 2 is a front view with partial cross section showing an embodiment of the angle-adjustable hinge relating to the present invention;

Figure 3 is a side view with partial cross section showing the angle-adjustable hinge;

Figure 4 is a bottom view showing the angle-adjustable hinge;

Figure 5 is an explanatory perspective view of a sofa to which the angle-adjustable hinge of the present invention is applied;

Figure 6 is a cross-sectional front view exemplifying the angle-adjustable hinge;

Figure 7 is a cross-sectional front view exemplifying the angle-adjustable hinge;

Figure 8A is an enlarged front view of a principal portion to explain function of the angle-adjustable hinge;

Figure 8B is an enlarged front view of the principal portion to explain function of the angle-adjustable hinge;

Figure 8C is an enlarged front view of the principal portion to explain function of the angle-adjustable hinge;

Figure 8D is an enlarged front view of the principal portion to explain function of the angle-adjustable hinge;

Figure 8E is an enlarged front view of the principal portion to explain function of the angle-adjustable hinge;

Figure 8F is an enlarged front view of the principal portion to explain function of the angle-adjustable hinge;

Figure 9 is a perspective view showing another embodiment of the angle-adjustable hinge of the present invention;

Figure 10 is a front view showing the other embodiment of the angle-adjustable hinge of the present invention; and

Figure 11 is a top view showing the other embodiment of the angle-adjustable hinge of the present invention.

**[0009]** Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

**[0010]** As shown in Figure 1 and Figure 5, an angle-adjustable hinge of the present invention is used for a sofa S provided with reclinable rest portions 3. Plural angle-adjustable hinges 1 are attached to the sofa S to attach the plural rest portions 3 to a fixation side of the sofa 3 as to be freely oscillated. The sofa S shown in Figure 1 and Figure 5 is supported by leg portions 42 and having a seat portion 41 and a backrest portion 40 fixed to the leg portions 42. And, as the rest portions 3, headrest portions 30 are attached to an upper end of the backrest portion 40, footrest portions 31 are attached to a front end of the seat portion 41, and armrest portions 32 are attached to the both sides of the seat portion 41 with the angle-adjustable hinges 1. The sofa S is upholstered with continuous cover E from fixation side to the rest portions 3. The cover E is upholstered as to be tensed with predetermined tension with small number of creases generated when the rest portions 3 stand in the final inclination state in which the rest portions 3 are oscillated in an inclining direction B to the limit of movement range.

**[0011]** The angle-adjustable hinge 1 is constructed as to make the rest portion 3 oscillatable in a standing direction A and stop oscillation in the inclining direction B with multi stage to hold a desired inclination angle.

**[0012]** And, as shown in Figure 2, the angle-adjustable

hinge 1 is provided with an elastic member 2 giving rotation resistance moment M to restrict the oscillation of the rest portion 3 in the standing direction A. The elastic member 2, as described later, restricts the oscillation in the standing direction A with resistant force as to hold the rest portion 3 in the final inclination state resisting against the tension generated by some load received by the cover E of the sofa S and working on the rest portion 3 in the final inclination state.

**[0013]** In the present invention, "stop oscillation with multi stage" means that 10 or more stages of posture holding angles are set with uniform pitch within a range from the final inclination state to a final standing state toward which the rest portion 3 is oscillated in the standing direction A, and the rest portion 3 oscillated in the standing direction A is restricted gradationally as not to return toward the inclining direction B.

**[0014]** To explain this concretely with an example of the headrest 30, in the angle-adjustable hinge, used for the sofa S provided with the headrest portion 30 attached to the upper end of the backrest portion 40 as to be freely oscillated back and forth in the standing direction A and the inclining direction B and having the cover E upholstered continuously from the backrest portion 40 to the headrest portion 30 as to be tensed with predetermined tension in the final inclination state of the headrest portion 30, the headrest portion 30 is oscillatable in the standing direction A, and the oscillation in the inclining direction B is stopped with multi stage to hold the desired inclination angle, the elastic member 2 is provided to give rotation resistance moment M as resistant force to a part of the headrest portion 30 to restrict the oscillation of the headrest portion 30 in the standing direction A and keep the headrest portion 30 in the final inclination state when the cover E of the backrest portion 40 in tension is pulled downward by the load of a person sitting on the sofa S. Within a range from the final inclination state in which the headrest portion 30 is made horizontal to a vertical posture, posture holding angles of, for example, 16 stages with uniform pitch are set to restrict the headrest portion 30 oscillated forward (in the standing direction A) as not to return backward (in the inclining direction B) gradationally.

**[0015]** And, to explain this concretely with an example of the footrest 31, in the angle-adjustable hinge, used for the sofa S provided with the footrest portion 31 attached to the upper end of the seat portion 41 as to be freely oscillated back and forth in the standing direction A and the inclining direction B and having the cover E upholstered continuously from the seat portion 41 to the footrest portion 31 as to be tensed with predetermined tension in the final inclination state of the footrest portion 31, the footrest portion 31 is oscillatable in the standing direction A, and the oscillation in the inclining direction B is stopped with multi stage to hold the desired inclination angle, the elastic member 2 is provided to give rotation resistance moment M as resistant force to a part of the footrest portion 31 to restrict the oscillation of the footrest

portion 31 in the standing direction A and keep the footrest portion 31 in the final inclination state when the cover E of the seat portion 41 in tension is sagged by the load of a person sitting on the sofa S. Within a range from the final inclination state in which the footrest portion 31 is made vertical to a horizontal posture, posture holding angles of, for example, 16 stages with uniform pitch are set to restrict the footrest portion 31 oscillated upward (in the standing direction A) as not to return downward (in the inclining direction B) gradationally.

**[0016]** To explain further in detail, as shown in Figures 2 through 4, an oscillation piece portion 11 attached to the rest portion 3, an attachment piece portion 12 fixed to a fixation side of the sofa S, and a connecting pin member 13 assembled with the attachment piece portion 12 unrotationally to connect the oscillation piece portion 11 and the attachment piece portion 12, are provided. The connecting pin member 13, fitting to the attachment piece portion 12, connects the oscillation piece portion 11 as to freely oscillate around an oscillation axis X. An end of the connecting pin member 13 is made into a head 33 of large diameter, and a hitching groove 13a at right angles with the oscillation axis X is formed on the head 33. Another end of the connecting pin member 13 is having small diameter, and stopped by caulking in assembled state.

**[0017]** The elastic member 2 is a spiral spring 20 composed of a spiral metal spring of which outer end portion 22 bent in L-shape is hitched to a hitching portion 11a protruding from a position near a base end portion of the oscillation piece portion 11, and of which inner end portion 21 bent approximately into right angle is hitched to the hitching groove 13a of the connecting pin member 13. The spiral spring 20 is elastically giving resistant force as the rotation resistance moment M to the oscillation piece portion 11 as to restrict the oscillation in the standing direction A of the oscillation piece portion 11 as the rest portion 3 does not stand even if the cover E in tension receives load further in the rest portion 3 in the final inclination state.

**[0018]** As shown in Figure 2, Figure 6, and Figure 7, the angle-adjustable hinge 1 is provided with a pair of parallel wall portions 12a formed circular around the oscillation axis X as the center, 4 wedge-shaped window portions 5 disposed on each of the wall portions 12a in rotation symmetry of which axis of symmetry is the oscillation axis X, a pair of floating wedge members 4, movable within the wedge-shaped window portion 5, disposed on positions rotation-symmetric for 180° of which axis of symmetry is the oscillation axis X, and each of which has a toothed face 4a on one side, a pair of arc-shaped gear portions 11b disposed between the wall portions 12a and formed around the oscillation axis X as the center as to have outer teeth to engage with the toothed face 4a, and spring wires 6 always elastically pushing the floating wedge members 4 to the pair of arc-shaped gear portions 11b.

**[0019]** The wall portions 12a are extended from the

attachment piece portion 12, formed as facing plates between which the gear portions 11b can be inserted, and penetrated by a center hole concentric with the oscillation axis X.

**[0020]** In the wedge-shaped window portion 5, an inner side near the oscillation axis X is an arc face 5b, and an arc-shaped wedge face 5a is formed on an outer side. Each wedge face 5a is formed around a guiding axis Y as the center eccentric with the oscillation axis X and disposed rotation symmetric for 90° of which axis of symmetry is the oscillation axis X. That is to say, as approaching in clockwise direction in Figure 6, the gap between the wedge face 5a and the gear portion 11b gradually becomes small (diminishes). And, a floating staged portion 8 is formed protruding from the arc face 5b on the inner side to guide the floating wedge member 4. And, a retreat space 9 for storing the floating wedge member 4 not engaging with the gear portion 11b (in engagement released state) is provided.

**[0021]** Each of the floating wedge members 4 is respectively inserted to each of the wedge-shaped window portion 5 disposed on the positions in rotation symmetry for 180°. The floating wedge member 4 is formed slightly larger than the gap dimension between the wall portions 12a, and protruding both end side portions from outer faces of the wall portions 12a when inserted to the wedge-shaped window portion 5. One face side of the floating wedge member 4 is the toothed face 4a, and an arc-shaped contact face 4b is formed on another face side to contact the wedge face 5a. The floating wedge member 4 has a guiding sloped face 14 to contact the floating staged portion 8 and guide itself toward a direction parting from the gear portion 11b. The guiding sloped face 14 is formed on a rear edge portion of the toothed face 4a.

**[0022]** The pair of gear portions 11b is attached as to oscillate around the oscillation axis X between the wall portions 12a. The gear portions 11b are formed as outer teeth on escape window portions 18, formed through the oscillation piece portion 11 to insert the floating wedge member 4, on positions in rotation symmetry for 180° of which axis of symmetry is the oscillation axis X. The configuration of the gear portion 11b hardly generates stress concentration on the base end portion of the oscillation piece portion 11. And, in the gear portion 11b, a push-in protrusion 15 to push the floating wedge member 4 to the retreat space 9 is formed on an end portion side (end portion side of engagement), and a push-out protrusion 16 to push the floating wedge member 4 out of the retreat space 9 on another end portion side (initial portion side of engagement).

**[0023]** The spring wire 6 is cut into a predetermined length and formed straight. An end of the spring wire 6 is straight and another end is bent into a hook or a circle to fit to a supporting portion 17. The spring wire 6 is touching the contact face 4b and elastically deformed into arc shape, and always elastically giving resilient force to the floating wedge member 4.

**[0024]** The contact face 4b is formed as to be guided

to the wedge face 5a to dispose the floating wedge member 4 between the gear portion 11b and the wedge face 5a when the gear portion 11b oscillates and the floating wedge member 4 is moved by engagement of the toothed face 4a with the gear portion 11b. That is to say, the floating wedge member 4 restricts the toothed face 4a to engage with the gear portion 11b, the contact face 4b to contact the wedge face 5a, and the gear portion 11b (the oscillation piece portion 11) to oscillate in one direction (the inclining direction B).

**[0025]** The wall portions 12a are embraced by the thin circular (disc-shaped) cover members 7 from the oscillation axis X direction. The connecting pin member 13 concentrically connects the wall portions 12a, the gear portions 11b, and the cover members 7. That is to say, the connecting portion 10 is composed that the wall portions 12a, the wedge-shaped window portions 5, the floating wedge members 4, the gear portions 11b, and the spring wires 6 are assembled and stored between the cover members 7.

**[0026]** A thickness dimension d of the elastic member 2 is set to be 15% to 100% of a thickness dimension  $W_0$  of the connecting portion 10 (refer to Figure 3). When the thickness dimension d of the elastic member 2 is smaller than 15% of the thickness dimension  $W_0$  of the connecting portion 10, sufficient strength and rigidity of the elastic member 2 can't be secured and the final inclination state of the rest portions 3 can't be stably kept. And, when the thickness dimension d of the elastic member 2 is larger than 100% of the thickness dimension  $W_0$  of the connecting portion 10, width dimension of the angle-adjustable hinge 1 becomes excessively large, and attachment of the hinge to the sofa S may be restricted.

**[0027]** The angle-adjustable hinge 1 may be a hinge (although not shown in Figures) having a ratchet mechanism by engagement of a claw and gear teeth, and may be modified within the scope of the present invention.

**[0028]** The method of use (working) of the above-described angle-adjustable hinge of the present invention is now described.

**[0029]** First, the cover E is set from the fixed side of the sofa S to the rest portion 3 in production process of the sofa S shown in Figure 1 and Figure 5 or upholstering of the cover E. In this case, the angle-adjustable hinge 1 to attach the rest portion 3 to the fixed side of the sofa S restricts the oscillation of the rest portion 3 in the standing direction A with the rotation resistance moment M by the elastic member 2. When the rest portion 3 is stood up in use, creases are hardly generated even if the cover E slacks because the cover E is set with appropriate tension while the rest portion 3 keeps the final inclination state.

**[0030]** Next, in the sofa S in which the rest portion 3 is oscillated in the inclining direction B to the limit of movable range, namely, to the final inclination state, when a person gives load to the seat portion 41 and the backrest portion 40 by sitting, the cover E of the seat portion 41 receiving the load of the person sags or the cover E of

the backrest portion 40 is pulled downward, and the tension working on the rest portion 3 is increased. In this case, the elastic member 2 restricts the oscillation of the rest portion 3 in the standing direction A with the rotation resistance moment M as the resistant force, and certainly keeps the final inclination state.

**[0031]** Then, the rest portion 3 in the final inclination state shown in Figure 6 and Figure 8A is stood up in the standing direction A against the rotation resistance moment M. In Figure 8A, the toothed face 4a engages with the gear portion 11b, and the contact face 4b contacts the wedge face 5a. When the gear portion 11b is oscillated in the standing direction A as shown in Figure 8B, the contact face 4b of the floating wedge member 4 becomes apart from the wedge face 5a and makes a slight gap g. When the rest portion 3 is oscillated further in the standing direction A as shown in Figure 8C, the guiding sloped face 14 of the floating wedge member 4 contacts the floating staged portion 8 of the wedge-shaped window portion 5, the engagement of the toothed face 4a and the gear portion 11b is released, and the toothed face 4a goes over the gear portion 11b with click sound as bounced by the gear portion 11b. When the oscillation of the rest portion 3 is stopped at a desired position, the floating wedge member 4 is pushed to the gear portion 11b by the spring wire 6, and the toothed face 4a engages with the gear portion 11b. The oscillation of the rest portion 3 in the inclining direction B is restricted by wedge work, and the rest portion 3 is kept with a desired inclination angle.

**[0032]** As shown in Figure 7, when the rest portion 3 is oscillated for a predetermined amount to make the final standing state, the push-in protrusion 15 contacts and pushes the floating wedge member 4 as shown in Figure 8D. When the rest portion 3 is oscillated further in the standing direction A as shown in Figure 8E, the floating wedge member 4, sliding on the floating staged portion 8 of the wedge-shaped window portion 5, is guided (conducted) by the guiding sloped face 14 to the retreat space 9. When the floating wedge member 4 is stored in the retreat space 9, the engagement of the toothed face 4a and the gear portion 11b is released, and the oscillation in the inclining direction B is made free. And, as shown in Figure 8F, when the rest portion 3 is oscillated in the inclining direction B as to return to the final inclination state, the push-out protrusion 16 contacts and pushes the floating wedge member 4 out of the retreat space 9. As described above, the state shown in Figure 8A is made again, the toothed face 4a engages with the gear portion 11b to restrict the oscillation of the rest portion 3 in the inclining direction B.

**[0033]** Next, another embodiment of the angle-adjustable hinge is described.

**[0034]** As shown in Figure 9 through Figure 11, the elastic member 2 may be a torsion coil spring 23 concentrically wound around the oscillation axis X. In this case, the torsion coil spring 23 is wound around the head 33 of the connecting pin member 13. An end portion 24

of the torsion coil spring 23 bent L-shaped is hitched to the hitching portion 11a of the oscillation piece portion 11, and another end portion 25 of the torsion coil spring 23 bent approximately J-shaped is hitched to a protruding portion 19 going through the cover member 7 and fixed to the attachment piece portion 12. The torsion coil spring 23 is elastically giving resistant force as the rotation resistance moment M to the oscillation piece portion 11 as to restrict the oscillation in the standing direction A of the oscillation piece portion 11 as the rest portion 3 does not stand even if the cover E in tension receives load further in the rest portion 3 in the final inclination state. In the case that the torsion coil spring 23 is used, the connecting pin member 13, not necessarily unrotational against the attachment piece portion 12, may simply connects the oscillation piece portion 11 and the attachment piece portion 12.

**[0035]** As described above, with the present invention, the rotation resistance moment M prevents the rest portion 3 from being pulled by the cover E of the sofa S and oscillated in the standing direction A, and the rest portion 3 does not unintentionally stand and the posture is stably kept when the sofa S is used with the rest portion 3 in the final inclination state because in an angle-adjustable hinge, used for the sofa S provided with the reclinable rest portion 3, making oscillation of the rest portion 3 in the standing direction A possible, and stopping oscillation in the inclining direction B with multi stage to keep a desired inclination angle, the elastic member 2, giving the rotation resistance moment M to restrict the oscillation of the rest portion 3 in the standing direction A, is provided. And, the cover E can be set with appropriate tension keeping the posture in which the rest portion 3 is inclined to the final inclination state, the cover E does not unnecessarily slack when the rest portion 3 is upright, and the sofa can be made fine in appearance.

**[0036]** And, the spiral spring 20 can be attached with simple construction without increase of parts, and the rotation resistance moment M is certainly given to the oscillation piece portion 11 because the oscillation piece portion 11 attached to the rest portion 3, the attachment piece portion 12 fixed to the fixation side of the sofa S, and the connecting pin member 13 unrotationally assembled with the attachment piece portion 12 and connecting the oscillation piece portion 11 and the attachment piece portion 12, are provided, and the elastic member 2 is the spiral spring 20, the outer end portion 22 of the spiral spring 20 is hitched to a part of the oscillation piece portion 11, and the inner end portion 21 of the spiral spring 20 is hitched to the connecting pin member 13. Further, the hinge is made compact and easy to attach within the sofa S.

**[0037]** And, the torsion coil spring 23 can be attached with simple construction without increase of parts, and the rotation resistance moment M is certainly given to the oscillation piece portion 11 because the oscillation piece portion 11 attached to the rest portion 3, the attachment piece portion 12 fixed to the fixation side of the

sofa S, and the connecting pin member 13 connecting the oscillation piece portion 11 and the attachment piece portion 12, are provided, and the elastic member 2 is the torsion coil spring 23, the torsion coil spring 23 is wound around the connecting pin member 13, the end portion 24 of the torsion coil spring 23 is hitched to a part of the oscillation piece portion 11, and the other end portion 25 of the torsion coil spring 23 is hitched to a part of the attachment piece portion 12. Further, the hinge is made compact and easy to attach within the sofa S.

**[0038]** And, the force (load) working on the gear portions 11b and the floating wedge members 4 can be uniformly dispersed, and the whole hinge can be made small and thin because the pair of parallel wall portions 12a formed circular of which center is the oscillation axis X of the oscillation piece portion 11, the wedge-shaped window portions 5 of even number disposed on positions in rotation symmetry of which axis of symmetry is the oscillation axis X on each of the wall portions 12a, the pair of floating wedge members 4 movable within the wedge-shaped window portions 5, disposed on positions in rotation symmetry for 180° of which axis of symmetry is the oscillation axis X, and having the toothed face 4a on one side, the pair of arc-shaped gear portions 11b disposed between the wall portions 12a, and formed around the oscillation axis X as the center into outer teeth to engage with the toothed face 4a, and the spring wires 6 always elastically pushing the floating wedge members 4 to the gear portions 11b, are provided. The posture can be certainly maintained because the floating wedge members 4 contact the gear portions 11b as to hold, oscillation can be restricted with good balance, and the load uniformly works.

**[0039]** And, sufficient strength and rigidity of the elastic member 2 can be secured because the connecting portion 10 is composed as that the wall portions 12a, the wedge-shaped window portions 5, the floating wedge members 4, the gear portions 11b, and the spring wires 6 are stored in the pair of disc-shaped cover members 7 attached from the oscillation axis X direction and assembled, and the thickness dimension d of the elastic member 2 is set to be 15% to 100% of the thickness dimension  $W_0$  of the connecting portion 10. And, giving appropriate resistant force, the whole hinge can be constructed relatively thin, and easy to attach within the sofa S.

## Claims

1. An angle-adjustable hinge, used for a sofa (S) provided with a reclinable rest portion (3), making oscillation of the rest portion (3) in a standing direction (A) possible, and stopping oscillation in an inclining direction (B) with multi stage to keep a desired inclination angle, comprising a construction in which an elastic member (2), giving rotation resistance moment (M) to restrict the oscillation of the rest portion (3) in the standing direction (A), is provided.

2. The angle-adjustable hinge as set forth in claim 1, wherein:

an oscillation piece portion (11) attached to the rest portion (3), an attachment piece portion (12) fixed to a fixation side of the sofa (S), and a connecting pin member (13) unrotationally assembled with the attachment piece portion (12) and connecting the oscillation piece portion (11) and the attachment piece portion (12), are provided; and  
the elastic member (2) is a spiral spring (20), an outer end portion (22) of the spiral spring (20) is hitched to a part of the oscillation piece portion (11), and an inner end portion (21) of the spiral spring (20) is hitched to the connecting pin member (13).

3. The angle-adjustable hinge as set forth in claim 1, wherein:

an oscillation piece portion (11) attached to the rest portion (3), an attachment piece portion (12) fixed to a fixation side of the sofa (S), and a connecting pin member (13) connecting the oscillation piece portion (11) and the attachment piece portion (12), are provided; and  
the elastic member (2) is a torsion coil spring (23), the torsion coil spring (23) is wound around the connecting pin member (13), an end portion (24) of the torsion coil spring (23) is hitched to a part of the oscillation piece portion (11), and another end portion (25) of the torsion coil spring (23) is hitched to a part of the attachment piece portion (12).

4. The angle-adjustable hinge as set forth in claim 2 or claim 3, wherein:

a pair of parallel wall portions (12a) formed circular of which center is an oscillation axis (X) of the oscillation piece portion (11);  
wedge-shaped window portions (5) of even number disposed on positions in rotation symmetry of which axis of symmetry is the oscillation axis (X) on each of the wall portions (12a);  
a pair of floating wedge members (4) movable within the wedge-shaped window portions (5), disposed on positions in rotation symmetry for 180° of which axis of symmetry is the oscillation axis (X), and having a toothed face (4a) on one side;  
a pair of arc-shaped gear portions (11b) disposed between the wall portions (12a), and formed around the oscillation axis (X) as the center into outer teeth to engage with the toothed face (4a); and  
spring wires (6) always elastically pushing the

floating wedge members (4) to the gear portions (11b);  
are provided.

5. The angle-adjustable hinge as set forth in claim 4, 5  
wherein:

a connecting portion (10) is composed as that  
the wall portions (12a), the wedge-shaped win- 10  
dow portions (5), the floating wedge members  
(4), the gear portions (11b), and the spring wires  
(6) are stored in a pair of disc-shaped cover  
members (7) attached from the oscillation axis  
(X) direction and assembled; and  
a thickness dimension (d) of the elastic member 15  
(2) is set to be 15% to 100% of a thickness di-  
mension ( $W_0$ ) of the connecting portion (10).

20

25

30

35

40

45

50

55

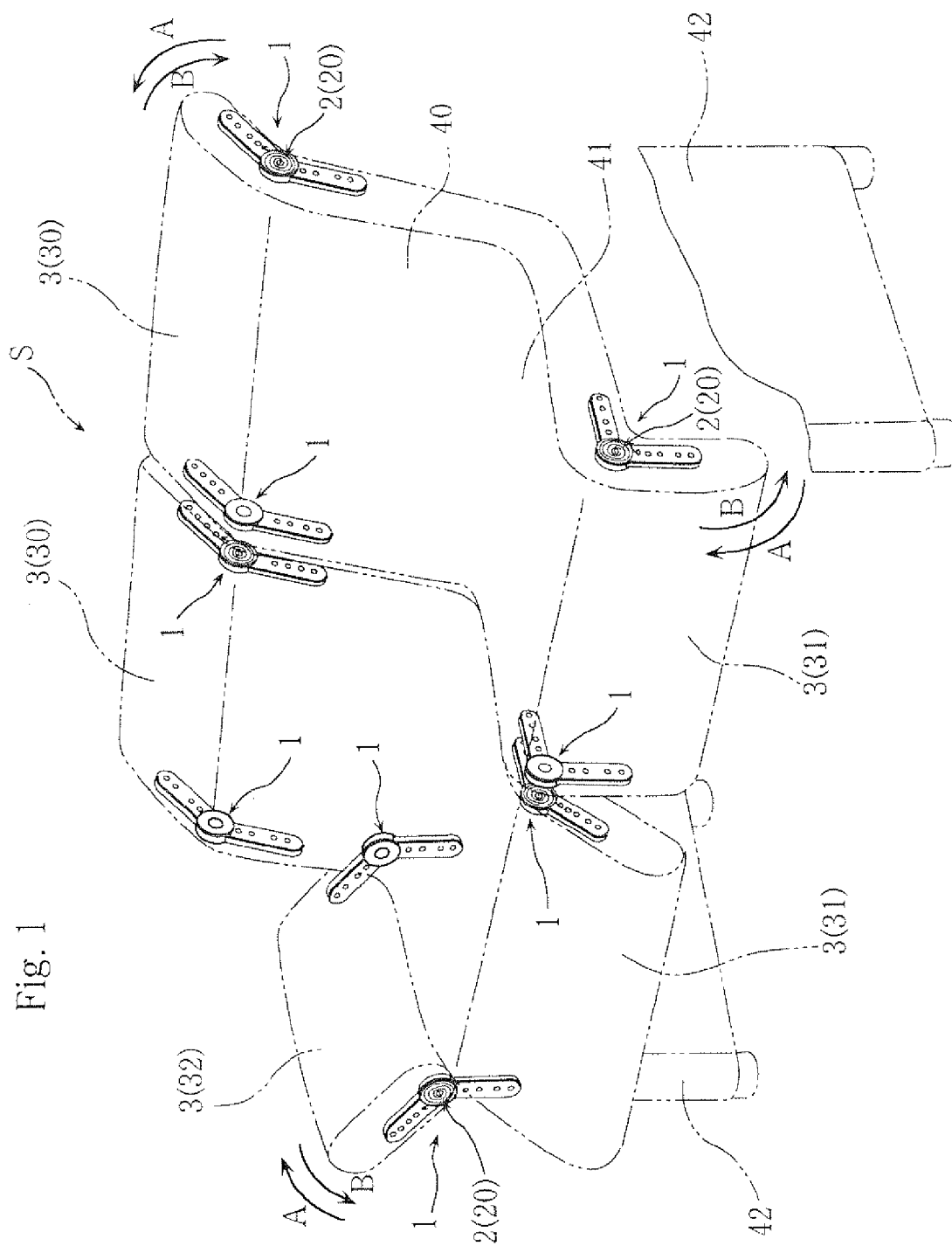




Fig. 2

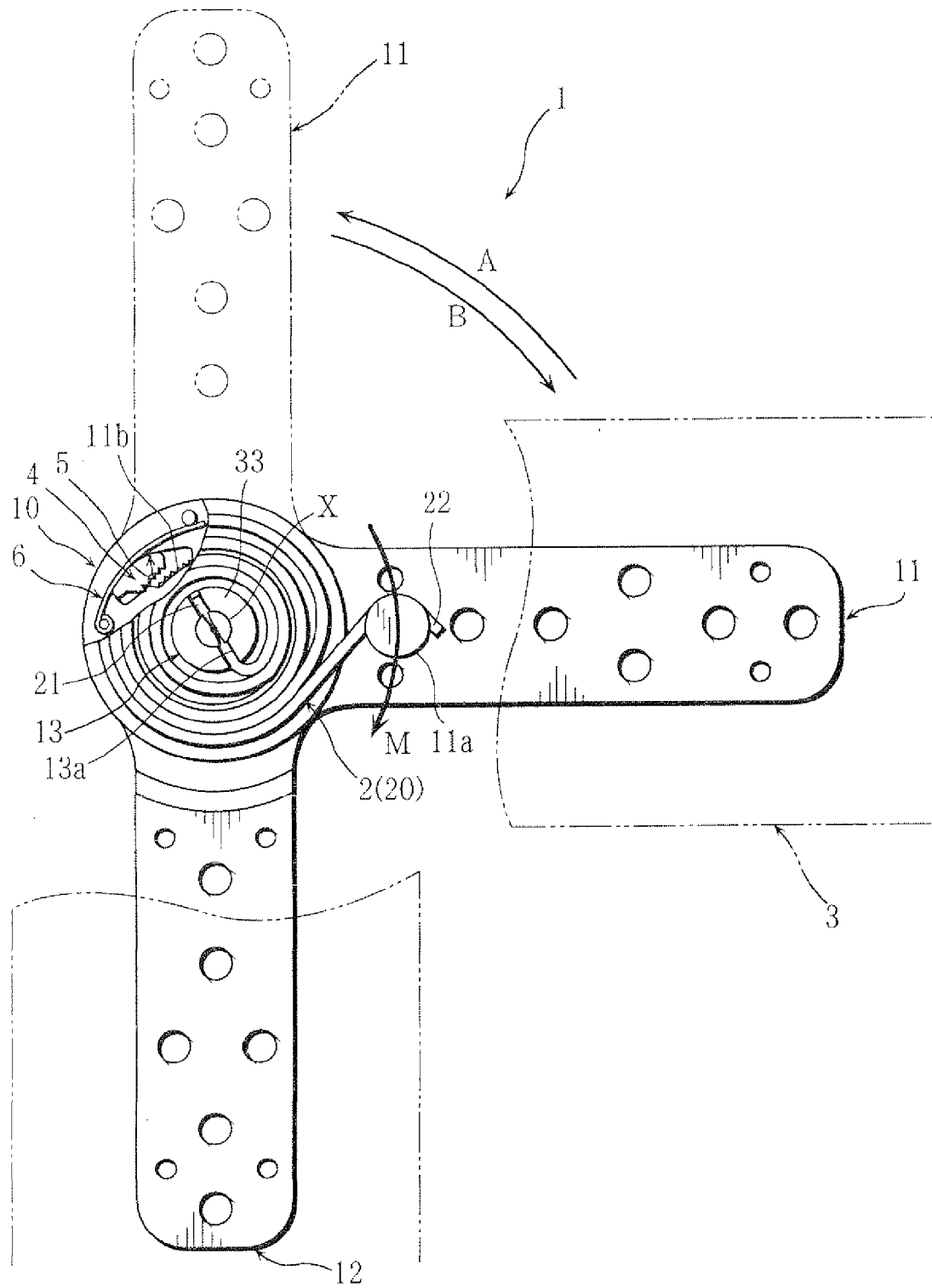
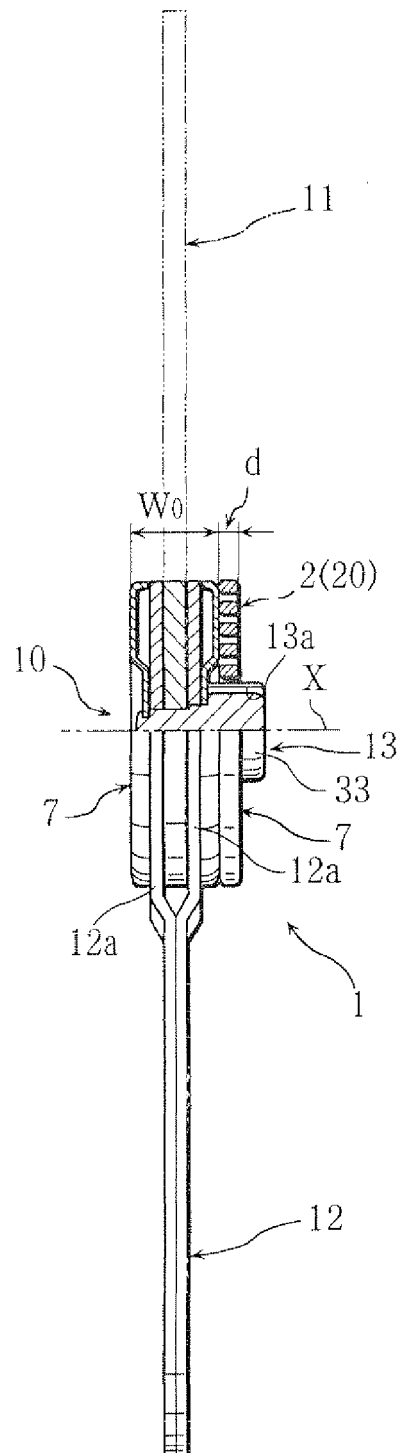
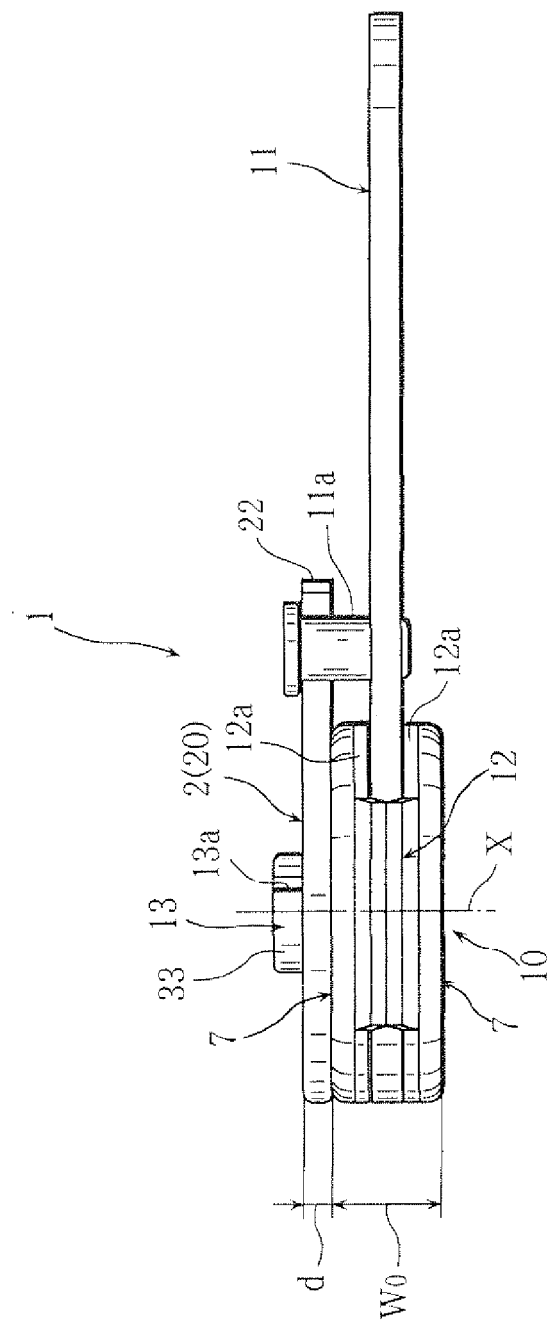


Fig. 3



400



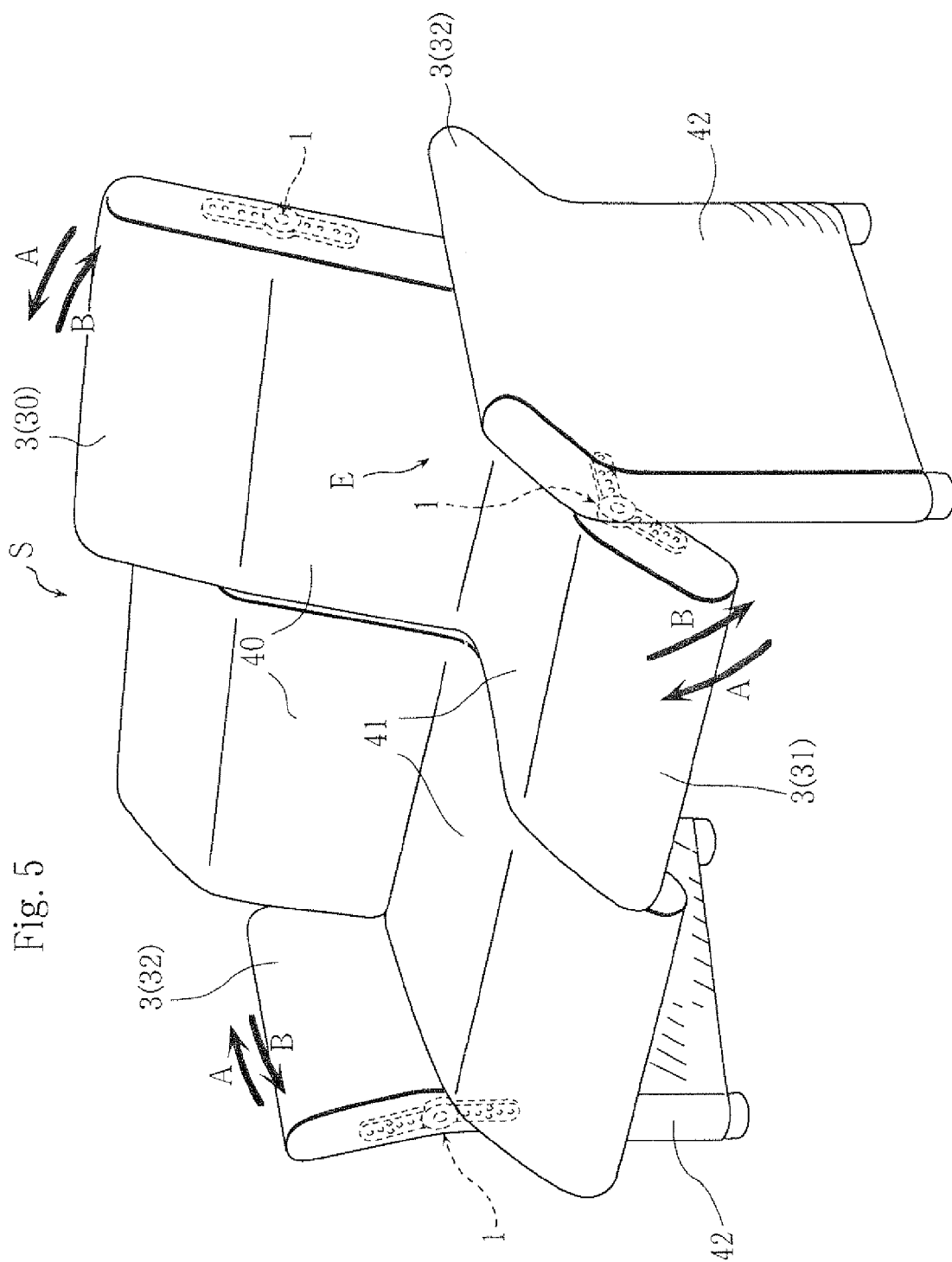


Fig. 5

Fig. 6

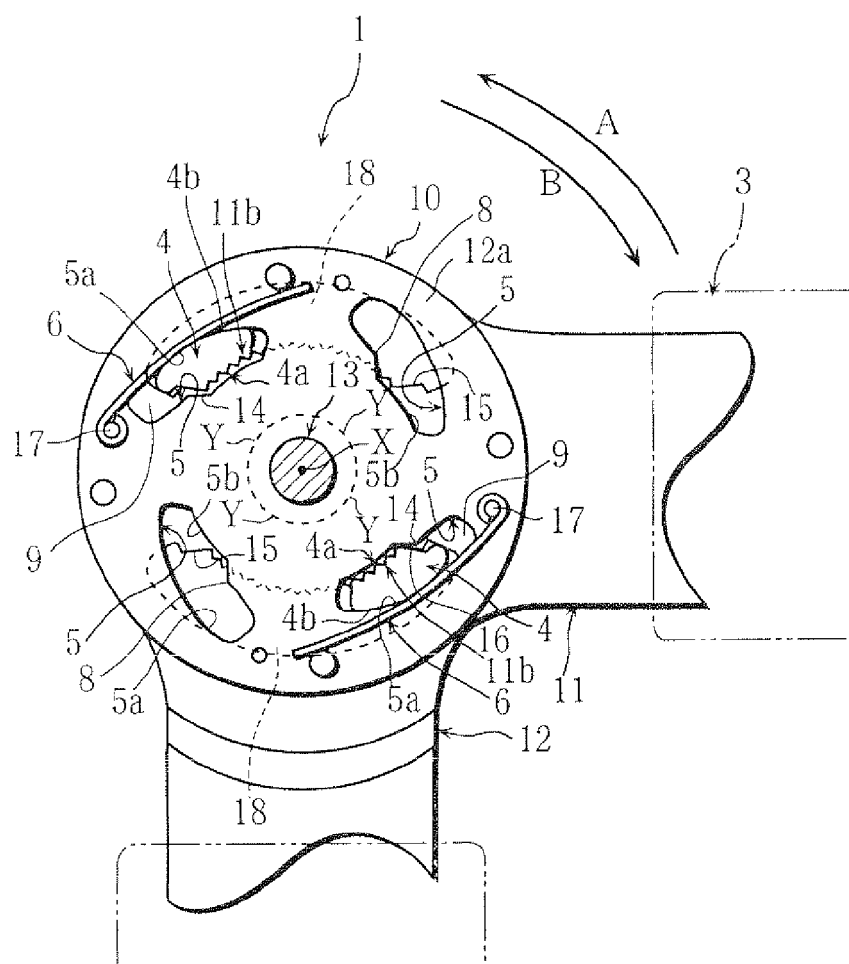


Fig. 7

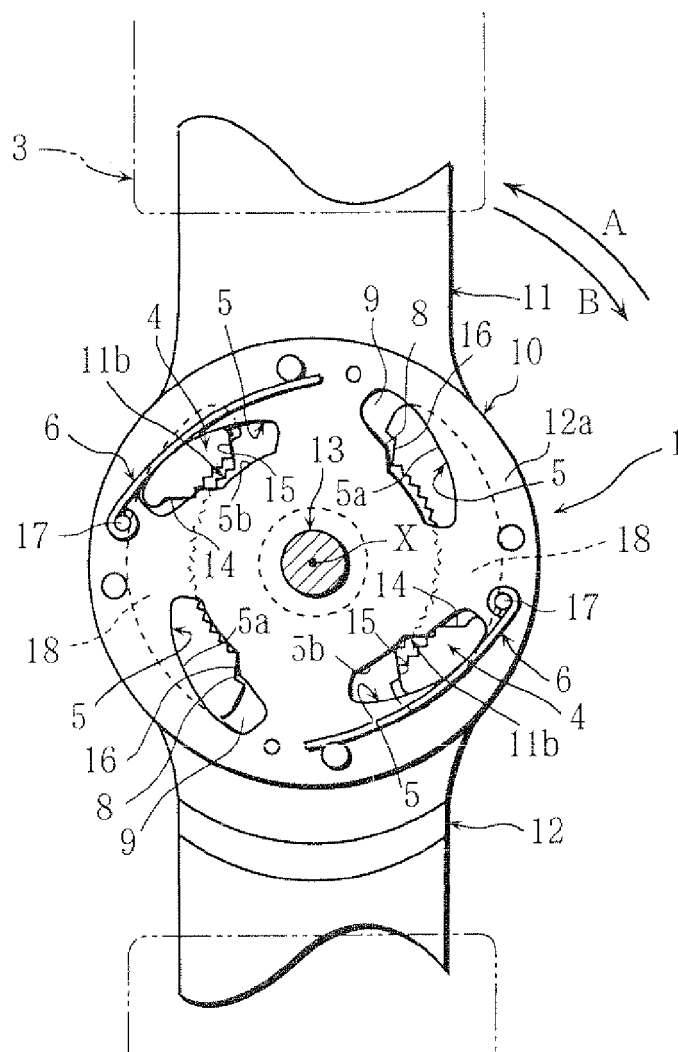


Fig. 8A

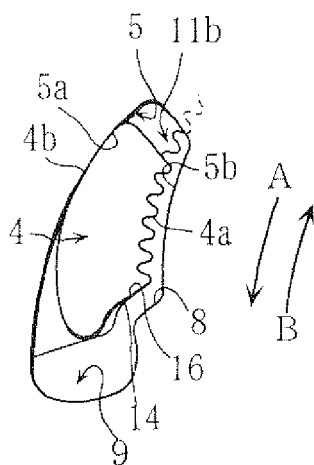


Fig. 8B

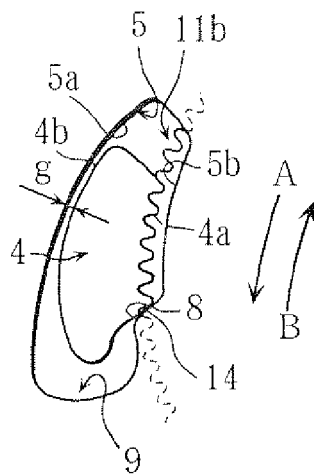


Fig. 8C

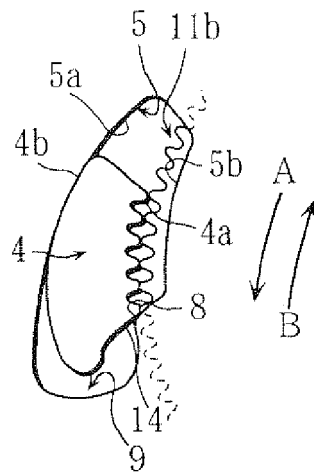


Fig. 8D

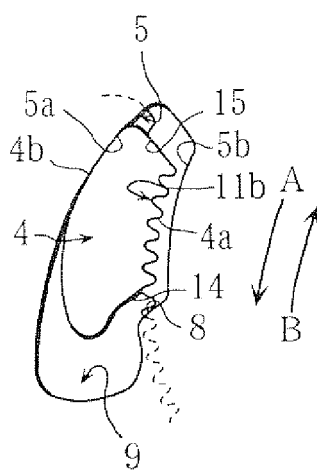


Fig. 8E

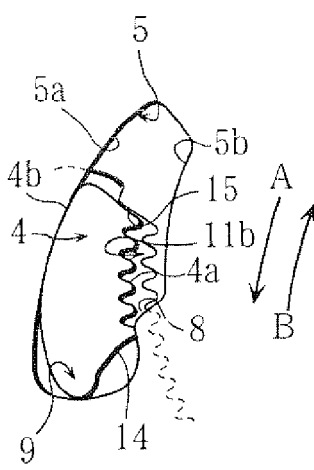


Fig. 8F

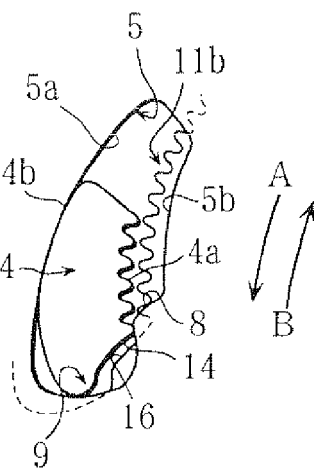


Fig. 9

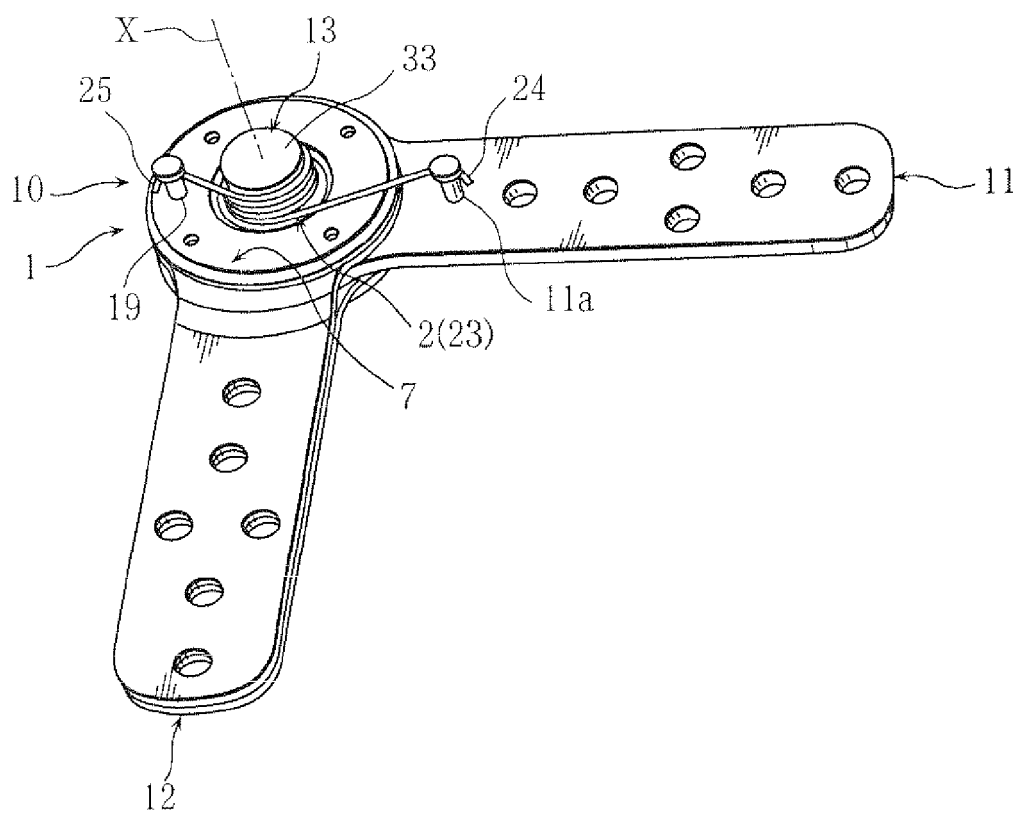




Fig. 10

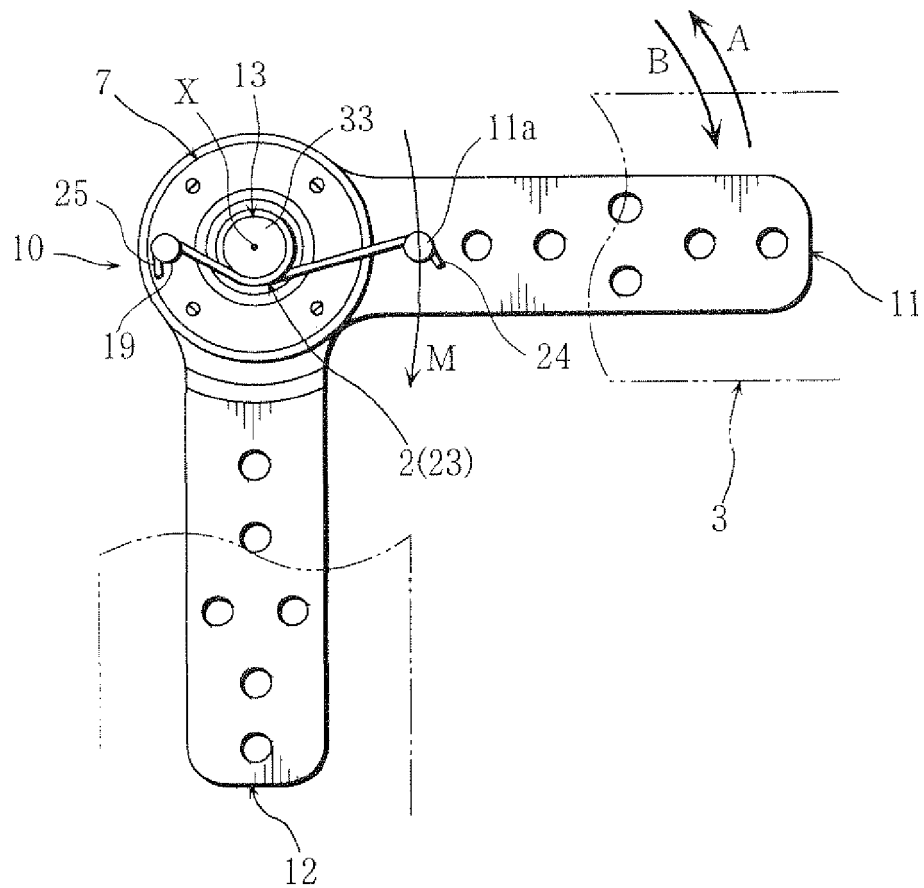
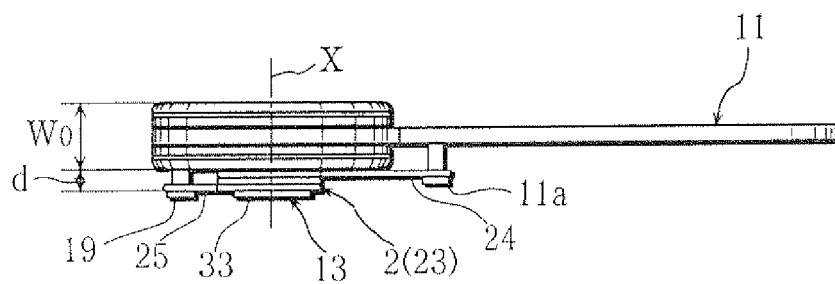


Fig. 11





## EUROPEAN SEARCH REPORT

Application Number  
EP 11 15 4638

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                    |                                  |                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages                                                      | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (IPC) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | JP 2008 259613 A (KOYO GIKEN KK)<br>30 October 2008 (2008-10-30)<br>* abstract; figures *                                          | 1-3                              | INV.<br>A47C1/025                       |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EP 1 152 158 A1 (KOYO GIKEN CO LTD [JP])<br>7 November 2001 (2001-11-07)<br>* paragraph [0049] - paragraph [0072] *<br>* figures * | 1-3                              |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GB 1 042 181 A (CARL ROBERT HAMMERSTEIN)<br>14 September 1966 (1966-09-14)<br>* page 2 - page 3 *<br>* figures *                   | 1-3                              |                                         |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 2003/202840 A1 (WATKINS MERVYN M [US])<br>30 October 2003 (2003-10-30)<br>* page 2 *<br>* figures *                             | 1-3                              |                                         |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | DE 201 12 976 U1 (FRANKE GMBH & CO KG [DE])<br>18 October 2001 (2001-10-18)<br>* abstract; figures *                               | 4,5                              |                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                    |                                  | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                    |                                  | A47C                                    |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                    | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                    | 10 May 2011                      | MacCormick, Duncan                      |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                    |                                  |                                         |

1  
EPO FORM 1503 03/02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 15 4638

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-05-2011

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| JP 2008259613                             | A                   | 30-10-2008                 | NONE                |
| EP 1152158                                | A1                  | 07-11-2001                 | NONE                |
|                                           |                     | CN 1339091 A               | 06-03-2002          |
|                                           |                     | WO 0046519 A1              | 10-08-2000          |
|                                           |                     | JP 3436501 B2              | 11-08-2003          |
|                                           |                     | JP 2000217657 A            | 08-08-2000          |
|                                           |                     | US 6565156 B1              | 20-05-2003          |
| GB 1042181                                | A                   | 14-09-1966                 | NONE                |
| US 2003202840                             | A1                  | 30-10-2003                 | NONE                |
| DE 20112976                               | U1                  | 18-10-2001                 | NONE                |
|                                           |                     | EP 1284447 A1              | 19-02-2003          |
|                                           |                     | ES 2296850 T3              | 01-05-2008          |

**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 4296223 B [0003]