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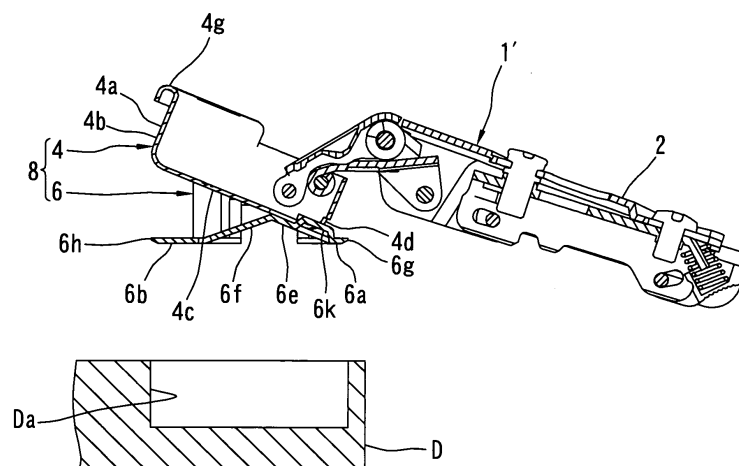
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43-45 Bloomsbury Square****London WC1A 2RA (GB)**(54) **Hinge with connection member**

(57) A door side connection member 5 is provided with a first and a second movable plate 6e, 6f. The respective one ends of the first and second movable plates 6e, 6f are convexly connected to each other. The angle formed between the first movable plate 6e and the second movable plate 6f is about 160 degrees. The respec-

tive other ends of the first and second movable plates 6e, 6f are provided with first biting parts 6g, 6h. When the connecting part between the first movable plate 6e and the second movable plate 6f is pushed down, the first biting parts 6g, 6h are moved away from each other and bitten into the inner peripheral surface of an attachment hole Da of a door D.

FIG. 19

Description

BACKGROUND OF THE INVENTION

[0001] This invention relates to a hinge apparatus used when a door is turnably attached to a skeleton, and more particularly to a hinge apparatus which can be attached to a door in a single operation.

[0002] In general, a hinge apparatus of this type includes a hinge main body attached to a skeleton, a skeleton side connection member turnably connected to the end of the hinge main body on the door side, and a door side connection member inserted in an attachment hole formed in the door. When the skeleton side connection member is inserted in the attachment hole with the door side connection member inserted in the attachment hole, the door side connection member is fixed to the attachment hole and the skeleton side connection member is connected to the door side connection member. By doing so, the door is turnably connected to the skeleton through the hinge apparatus.

[0003] As described in Japanese Utility Model Publication No. H06-45021, the door side connection member is provided with a pair of lock elements which are opposed to each other in the radial direction of the attachment hole. One end of the lock element located on the opening side of the attachment hole is connected to the door side connection member. The other end of the lock element is provided as a free end movable in the radial direction of the attachment hole. The other end of each attachment member is more internally arranged in the radial direction of the attachment hole than the one end. Thus, the interval between the pair of lock elements is reduced toward the bottom side from the opening side of the attachment hole, and smaller than that between the both sides of the skeleton side connection member. Accordingly, when the skeleton side connection member is inserted in the attachment hole, the both sides of the skeleton side connection members are abutted with the respective lock elements and move those lock elements outwardly. A serrated biting part is formed on an outwardly-directed surface of the lock element. When the other end of each lock element is moved outwardly, the biting part is bitten into an inner peripheral surface of the attachment hole. By this, the door side connection member is fixed to the attachment hole.

[0004] The resistance against the biting part when the biting part is bitten into the inner peripheral surface of the attachment hole is increased as the biting amount is increased, and the resistance is significantly increased in the final stage of biting operation. As a result, a lot of frictional resistance is generated between the contact surfaces of the lock element and the skeleton side connection member. Moreover, in the final stage of biting operation, the pushing amount of the skeleton side connection member required for the biting part to bite for a constant amount is extensively increased in comparison with the biting amount of the biting part. Accordingly,

when the skeleton side connection member is connected to the door side connection member, it is necessary to push the skeleton side connection member toward the bottom of the attachment hole with a large force in order to overcome not only the biting resistance but also the frictional resistance against the biting part. Moreover, it is necessary to push the skeleton side connection member for a comparatively long distance. Thus, the conventional hinge apparatus has such a problem that much elaboration is required when the skeleton side connection member is connected to the door side connection member.

SUMMARY OF THE INVENTION

[0005] The features of the present invention resides in a hinge apparatus comprising a hinge main body attached to a skeleton and a connection member turnably connected to one end of the hinge main body and inserted and fixed to an attachment hole formed in a door, the connection member being provided with a biting part which is bitten into an inner peripheral surface of the attachment hole when the biting part is moved radially outwardly of the attachment hole, and a moving mechanism for moving the biting part radially outwardly of the attachment hole, the biting part, when the connection member is inserted in the attachment hole, being moved radially outwardly of the attachment hole by the moving mechanism and bitten into the inner peripheral surface of the attachment hole, thereby the connection member being fixed to the attachment hole, CHARACTERIZED in that the moving mechanism includes a first and a second movable part disposed at the connection member, the respective one ends, which are adjacent to each other, of the first and second movable parts being turnably connected to each other about an axis extending in a direction orthogonal to an axis of the attachment hole and arranged in such a manner as to be away from the respective other ends in the axial direction of the attachment hole, at least one of the respective other ends of the first and second movable parts being provided with the biting part, the respective one ends of the first and second movable parts being pushed and moved in the axial direction of the attachment hole by the connection member until the respective one ends of the first and second movable parts are brought to almost the same positions as the respective other ends, thereby the biting part being moved radially outwardly of the attachment hole and bitten into the inner peripheral surface of the attachment hole.

[0006] It is preferable that the connection member includes a skeleton side connection member turnably connected to the hinge main body and a door side connection member displaceably connected to the skeleton side connection member in the axial direction of the attachment hole and inserted in the attachment hole, the door side connection member being provided with the first and second movable parts, the turnably connected one ends

of the first and second movable parts being pushed and moved in the axial direction of the attachment hole by the skeleton side connection member inserted in the attachment hole. The door side connection member may be removably connected to the skeleton side connection member or it may be non-separably connected to the skeleton side connection member.

[0007] It is preferable that the connection member are provided with second biting parts which are moved radially outwardly of the attachment hole by insertion of the connection member into the attachment hole and bitten into the inner peripheral surface of the attachment hole, the second biting parts being arranged away from the first-mentioned biting parts in a peripheral direction of the attachment hole, the moving direction of the second biting parts being set in such a manner as to intersect with the moving direction of the biting parts.

[0008] It is preferable that the door side connection member is provided with second biting parts which are moved radially outwardly of the attachment hole by insertion of the skeleton side connection member into the attachment hole and bitten into the inner peripheral surface of the attachment hole, the second biting parts being arranged away from the first-mentioned biting parts in a peripheral direction of the attachment hole, the moving direction of the second biting parts being set in such a manner as to intersect with the moving direction of the biting parts.

[0009] It is preferable that the second biting parts are arranged away from the first-mentioned biting parts for about 90 degrees in the peripheral direction of the attachment hole and the moving direction of the second biting parts is set to be generally orthogonal to the moving direction of the first-mentioned biting parts.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

FIG. 1 is a perspective view showing one embodiment of the present invention.

FIG. 2 is a sectional view of the above embodiment.

FIG. 3 is an enlarged sectional view taken on line X-X of FIG. 2.

FIG. 4 is an enlarged sectional view taken on line Y-Y of FIG. 2.

FIG. 5 is a perspective view showing a skeleton side connection member and a door side connection member according to the above embodiment in their connected states.

FIG. 6 is a plan view of the above.

FIG. 7 is a view when viewed in a direction as indicated by an arrow X of FIG. 6.

FIG. 8 is a view when viewed in a direction as indicated by an arrow Y of FIG. 6.

FIG. 9 is a perspective view showing a state of the door side connection member of the above embodiment before the skeleton side connection member

is connected thereto.

FIG. 10 is a perspective view showing a state of the door side connection member of the above embodiment after the skeleton side connection member is connected thereto.

FIG. 11 is an exploded perspective view showing a state of the door side connection member of the above embodiment before the skeleton side connection member is connected thereto.

FIG. 12 is a perspective view showing a state of a fixing member of the door side connection member of the above embodiment after the skeleton side connection member is connected thereto.

FIG. 13 is a perspective view when the fixing member of the above embodiment is viewed in a different direction.

FIG. 14 is a plan view showing a state of the fixing member of the above embodiment before the skeleton side connection member is connected thereto.

FIG. 15 is a sectional view taken on line X-X of FIG. 14.

FIG. 16 is a sectional view taken on line Y-Y of FIG. 14.

FIG. 17 is a sectional view for explaining how to connect the skeleton side connection member to the door side connection member according to the above embodiment.

FIG. 18 is a sectional view like FIG. 17.

FIG. 19 is a sectional view showing a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0011] The best mode for carrying out the present invention will be described hereinafter with reference to accompanying drawings.

[0012] FIGS. 1 through 18 show a first embodiment of the present invention. A hinge apparatus 1 of this embodiment, as shown in FIGS. 1 and 2, includes a hinge main body 2. The hinge main body 2 is attached to an inner surface of a side wall of a skeleton (not shown) such as furniture through a base plate (not shown). Respective one ends of a plurality (two in this embodiment) of arms 3A, 3B are turnably connected to one end of the hinge main body 2 on a door D side. A skeleton side connection member 4 is turnably connected to the respective other ends of the arms 3A, 3B. An attachment hole Da having a circular cross section is formed in a surface of the door D opposing the skeleton and a couple of positioning holes Db are formed in the vicinity of the attachment hole Da. A door side connection member 5 properly positioned by the positioning hole Db is attached to the attachment hole Da. By connecting the skeleton side connection member 4 to the door side connection member 5, the door D is turnably connected to the skeleton through the hinge apparatus 1.

[0013] As shown in FIGS. 1 through 8, as well as FIGS. 17 and 18, the skeleton side connection member 4 in-

cludes a cup part 4a. The other ends of the arms 3A, 3B are turnably connected to one end (the right end in FIG. 2 which is hereinafter referred to as the basal end and the end on the other side of the basal end is hereinafter referred to as the distal end) of a peripheral wall part 4b of the cup part 4a. Owing to this arrangement, the skeleton side connection member 4 is turnably connected to the hinge main body 2 through the arms 3A, 3B. A through-hole 4d is formed in the area where the peripheral wall part 4b and a bottom part 4c of the cup part 4a on the basal end side are intersected with each other. This through-hole 4d is, as shown in FIG. 6, constituted by a basal end side enlarged width part 4e and a distal end side reduced width part 4f. A flange part 4g extending in a direction orthogonal (this orthogonal direction shall be hereinafter referred to as the left and right direction, and the right side toward the distal end from the basal end shall be referred to as the right side part and the left side, as the left side part) to a line connecting the basal end and the distal end with each other is formed on the distal end of the peripheral wall part 4b of the cup part 4a. This flange part 4g is arranged at an end (this end shall be hereinafter referred to as the upper end, and the other end on the bottom part 4c side, as the lower end) of the cup part 4a on the opening side.

[0014] The cup part 4a is inserted in the attachment hole Da in an almost non-movable manner in the radial direction of the attachment hole Da. Moreover, the cup part 4a is inserted in the attachment hole Da until the flange part 4g is abutted with the door D. The position, where the cup part 4a is located until the flange part 4g is abutted with the door D, shall be hereinafter referred to as the attachment position. With the flange part 4g abutted with the door D, a gap having a predetermined width is formed between a bottom surface of the attachment hole Da and the bottom part 4c. The width of the gap is almost same as the thickness of a fixing member 6 as later described.

[0015] As shown in FIGS. 9 through 11, the door side connection member 5 includes a fixing member 6 and a couple of auxiliary fixing members 7.

[0016] The fixing member 6 is formed of a metal flat plate and insertable into the attachment hole Da. The fixing member 6 includes first and second substrate parts 6a, 6b which are each in the shape of a flat plate. The first and second substrate parts 6a, 6b are arranged on a same plane and placed on the bottom surface of the attachment hole Da. The first substrate part 6a is arranged at a basal end of the door side connection member 5. In other words, the first substrate part 6a is arranged at the end that is identical with that of the skeleton side connection member 4 (the basal end, the distal end, the vertical sides (up and down) and the left and right of the door side connection member 5 shall be hereinafter referred to in the same manner as those of the skeleton side connection member 4), and the second substrate part 6b is arranged at the distal end. Left and right sides of the first and second substrate parts 6a, 6b are connected

to each other through generally U-shaped connection parts 6c, 6d. The first and second substrate parts 6a, 6b are movable in a direction (this direction shall be hereinafter referred to as the back and forth direction) connecting the basal end and the distal end by elastic deformation of the connection parts 6c, 6d.

[0017] First and second movable plate parts (first and second movable parts) 6e, 6f are disposed between the first substrate part 6a and the second substrate part 6b. The respective one ends of the first and second movable plate parts 6e, 6f are connected to each other. In this case, the respective one ends of the first and second movable plate parts 6e, 6f are convexly bent at the connection part between the first and second movable plate parts 6e, 6f as shown in FIGS. 9, 11 and 14 through 18, before the skeleton side connection member 4 is connected to the door side connection member 5. An angle formed between the first movable plate part 6e and the second movable plate part 6f is set to be slightly smaller, for example, about 160 degrees, than 180 degrees. The other end of the first movable plate part 6e is connected to the distal end of the first substrate part 6a, and the other end of the second movable plate part 6f is connected to the basal end of the second substrate part 6b. The connection part between the other end of the first movable plate part 6e and the distal end of the first substrate part 6a and the connection part between the other end of the second movable plate part 6f and the basal end of the second substrate part 6b are concavely bent before the skeleton side connection member 4 is connected to the door side connection member 5.

[0018] Since the first and second movable plate parts 6e, 6f are constituted in the manner as mentioned above, the respective one ends of the first and second movable plate parts 6e, 6f are located higher (the opening side of the attachment hole Da) than the respective other ends. Because the respective other ends of the first and second movable plate parts 6e, 6f are abutted with the bottom surface of the attachment hole Da, when the respective one ends of the first and second movable plate parts 6e, 6f are pushed down, the respective connection parts are deformed such that the angle formed between the first movable plate parts 6e and the second movable plate part 6f and the angles formed between the first and second movable plate parts 6e, 6f and the first and second substrate parts 6a, 6b are increased and the first and second movable plate parts 6e, 6f are moved downward while they are turning in the mutually reverse directions about the respective ones thereof. As a result, the first and second substrate parts 6a, 6b are moved in the back and forth directions in such a manner as to be away from each other. Moreover, since the angle formed between the first movable plate part 6e and the second movable plate part 6f is set to be slightly smaller than 180 degrees, when the first and second movable plate parts 6e, 6f are pushed downward, the pushing force is transmitted to the first and second substrate parts 6a, 6b as a force acting in the back and forth directions and in an exten-

sively increased manner. The force transmitted to the first and second substrate parts 6a, 6b is more increased as the angle formed between the first movable plate part 6e and the second movable plate part 6f becomes closer to 180 degrees.

[0019] First biting parts (biting parts) 6g, 6h having a plurality of generally triangular biting teeth are formed on the basal end of the first substrate part 6a and the distal end of the second substrate part 6b, respectively. The first biting parts 6g, 6h are arranged on a same circumference. An outside diameter D1 (see FIG. 14) of the first biting parts 6g, 6h is generally equal to an inside diameter of the attachment hole Da before the skeleton side connection member 4 is connected to the door side connection member. Accordingly, when the first and second substrate parts 6a, 6b are moved away from each other by the first and second movable plate parts 6e, 6f, the first biting parts 6g, 6h are bitten into the inner peripheral surface of the attachment hole Da. By this, the fixing member 6 is fixed to the attachment hole Da. As apparent from the foregoing, a moving mechanism is constituted by the first and second movable plate parts 6e, 6f.

[0020] Second biting parts 6i, 6j having a plurality of generally triangular biting teeth are formed on the respective upper ends of the connection parts 6c, 6d. The second biting parts 6i, 6j are located higher than the first biting parts 6g, 6h, and located on a same circumference as the first biting parts 6g, 6h. Moreover, the second biting parts 6i, 6j are arranged away from the first biting parts 6g, 6h for about 90 degrees in the peripheral direction so that the second biting parts 6i, 6j are directed generally orthogonal to the first biting parts 6g, 6h. Since the second biting parts 6i, 6j are arranged on the same circumference as the first biting parts 6g, 6h, the biting parts 6i, 6j, when moved in a direction away from each other by elastic deformation of the connection parts 6c, 6d, are bitten into the inner peripheral surface of the attachment hole Da. The second biting parts 6i, 6j are bitten into the inner peripheral surface of the attachment hole Da at position about 90 degrees away from the first biting parts 6g, 6h in the peripheral direction. By this, the fixing member 6 is more firmly fixed by the attachment hole Da.

[0021] The auxiliary fixing member 7 is formed of resin and includes an abutment part 7A and a positioning part 7B which are integrally formed. The respective abutment parts 7A, 7A of the two auxiliary fixing parts 7, 7 are attached to the connection parts 6c, 6d respectively and inserted in the attachment hole Da together with the fixing member 6. The respective abutment parts 7A, 7A are attached to the connection parts 6c, 6d respectively in such a manner as to be non-movable in the vertical directions. The abutment part 7A is attached to the connection parts 6c in such a manner as to be non-movable in the left direction and the other abutment part 7A is attached to the connection part 6d in such a manner as to be non-movable in the right direction. Accordingly, when the abutment parts 7A, 7A are moved in the directions away from each other, the connection parts 6c, 6d

are elastically deformed in the same directions in correspondence thereto and the second biting parts 6i, 6j are moved away from each other. Moreover, the abutment parts 7A, 7A are arranged such that they are pushed and moved in the directions away from each other by the left and right sides of the cup part 4a. Accordingly, when the cup part 4a is inserted in the attachment hole Da, the upper ends of the connection parts 6c, 6d are moved away from each other and the second biting parts 6i, 6j are bitten into the inner peripheral surface of the attachment hole Da.

[0022] A plurality of ridges 7a arcuately extending along the inner peripheral surface of the attachment hole Da are formed on the outer surface of the abutment part 7A opposing to the inner peripheral surface of the attachment hole Da. Those ridges 7a, when the abutment parts 7A, 7A are moved away from each other, are pushed and contacted with the inner peripheral surface of the attachment hole Da. By this, the attachment strength of the fixing member 6 with respect to the attachment hole Da is more enhanced. It is also accepted that the first biting parts 6g, 6h and the second biting parts 6i, 6j include ridges extending in the peripheral direction of the attachment hole Da.

[0023] The positioning part 7B is located radially outwardly of the attachment hole Da at an area coming out of the attachment hole Da. The lower surface of the positioning part 7B, when the fixing member 6 is inserted in the attachment hole Da until the fixing member 6 is contacted with the bottom surface of the attachment hole Da, is generally contacted with the door D. A positioning projection 7b is formed on the lower surface of the positioning part 7B. The positioning projections 7b, 7b of the positioning parts 7B, 7B are fitted into the positioning holes Db, Db, respectively, thereby the door side connection member 5 is correctly positioned. Since the positioning projection 7b is fitted into the positioning hole Db, the positioning part 7B is non-movable in the back and forth direction and in the right and left direction. However, since the part between the abutment part 7A and the positioning part 7B is elastically deformed when the abutment part 7A is moved in the left and right direction, the movement of the abutment part 7A in the left and right direction is not disturbed by the positioning part 7B.

[0024] The cup part 4a is connected and fixed to the fixing member 6 in the following manner. As shown in FIGS. 9 through 18, an engagement plate part 6k is formed on the first movable plate part 6e by upwardly working the central part of the movable plate part 6e. This engagement plate part 6k is parallel to the first movable plate part 6e and located higher than the first movable plate part 6e by a portion generally equal to the thickness of the bottom part 4c of the cup part 4a. The both ends of the engagement plate part 6k in the back and forth direction are small in width and bent downwardly so as to be connected to the first movable plate part 6e.

[0025] As shown in FIGS. 17 and 18, the engagement plate part 6k is insertable in the through-hole 4d of the

cup part 4a through the enlarged width part 4e. When the engagement plate part 6k is inserted to the reduced width part 4f through the enlarged width part 4e, the left and side parts of the engagement plate parts 6k are co-acted with the first movable plate part 6e so as to sandwich the bottom part 4c of the cup part 4a. Owing to this feature, the central part in the sense of left and right direction of the basal end of the cup part 4a is connected to the fixing part 6 in such a manner as to be non-movable in the vertical direction.

[0026] As shown in FIGS. 9 through 18, upstanding plate parts 61 standing upwardly are formed one each on those places near the distal ends of the left and right sides of the fixing members 6. Engagement claws 6m, 6m projecting toward each other are formed one each on the upper ends of the upstanding plate parts 61, 61. The engagement claws 6m, 6m, when the cup part 4a is inserted in the attachment hole Da, are abutted with the both sides of the cup part 4a and moved away from each other. Of course, the upstanding plate parts 61 are elastically deformed at that time. When the cup part 4a is inserted in the attachment hole Da until the cup part 4a reaches the attachment position, the engagement claw 6m passes through a through-hole 4h formed in a flange part 4g from below. Then, the upstanding plate part 61 is elastically returned and deformed and the engagement claw 6m is engaged with the upper end of the cup part 4a. By this, the left and right sides of the distal end of the cup part 4a are connected to the fixing member 6 in such a manner as to be non-movable upwardly.

[0027] The cup part 4a, when its peripheral wall part 4b is abutted with the attachment hole Da, becomes unable to move in the back and forth direction and in the left and right direction, and when its bottom part 4c is abutted with the bottom surface of the attachment hole Da through the fixing member 6, becomes unable to move downwardly. Accordingly, when the cup part 4a is locked such as to be unable to move upwardly by the engagement plate part 6k and the engagement claw 6m, it becomes unable to move in any direction. By this, the skeleton side connection member 4 is connected to the door side connection member 5 and thus, to the door D. With the skeleton side connection member 4 connected to the door side connection member 5, the auxiliary fixing member 7 cannot be visually recognized because the auxiliary fixing member 7 is covered with the flange part 4g.

[0028] In the hinge apparatus 1 thus constructed, in order to fix the door side connection member 5 to the attachment hole Da and connect the skeleton side connection member 4 to the door side connection member 5, as shown in FIG. 17, the fixing member 6 is inserted in the attachment hole Da and placed on the bottom surface of the attachment hole Da. At that time, as shown in FIGS. 3 and 7, the positioning projection 7b is fitted into the positioning recess Db, thereby the direction of the door side connection member 5 is primarily determined. Then, the cup part 4a is slanted so as to be parallel

to the first movable plate part 6e and inserted in the attachment hole Da in that state. Then, as shown in FIG. 18, when the bottom part 4c of the cup part 4a is abutted with the first movable plate part 6e, the cup part 4a is moved toward the basal end along the first movable plate part 6e so that the engagement plate part 6k is inserted to the reduced width part 4f from the enlarged width part 4e of the through-hole 4d.

[0029] Thereafter, the cup part 4a is turned such that the distal end of the cup part 4a is moved downwardly and the entire cup part 4a is moved downwardly. Then, the bottom part 4c of the cup part 4a pushes the connection part between the first movable part 6e and the second movable part 6f downwardly. As a result, the first and second movable parts 6e, 6f are brought into horizontal states from their slanted states, thereby the first and second substrate parts 6a, 6b are moved away from each other. In accompany with this movement, the first biting parts 6g, 6h are moved radially outwardly of the attachment hole Da and bitten into the inner peripheral surface of the hole Da. When the cup part 4a is moved to the attachment position, the first and second movable plate parts 6e, 6f are brought into generally horizontal states and the first biting parts 6g, 6f are bitten into the inner peripheral surface of the attachment hole Da to the maximum. By this, the door side connection member 5 is fixed to the attachment hole Da.

[0030] When the bottom part 4c of the cup part 4a pushes the connection part between the first movable plate part 6e and the second movable plate part 6f downwardly, the first and second movable plate parts 6e, 6f are merely displaced in reverse directions serving the connection part as a fixing point and the connection part is scarcely moved in the back and forth direction with respect to the bottom part 4c. Accordingly, when the cup part 4a is pushed and moved downwardly, frictional resistance is hardly generated. Therefore, the cup part 4a can easily be moved to the attachment position and thus, the skeleton side connection member 4 can easily be connected to the door side connection member 5. Even if the connection part between the first movable plate part 6e and the second movable plate part 6f moves in the back and forth direction during movement of the connection part pushed and moved by the bottom part 4c, the force for pushing the cup part 4a can be small because the first and second movable plate parts 6e, 6f are brought to be in generally horizontal states when the biting resistance of the first biting parts 6g, 6h becomes largest. Moreover, the connection part between the first movable plate part 6e and the second movable plate part 6f scarcely moves in the back and forth direction. Accordingly, the cup part 4a can easily be moved to the attachment position.

[0031] When the cup part 4a is moved to the attachment position, the second biting parts 6i 6j are bitten into the inner peripheral surface of the attachment hole Da. By this, the door side connection member 5 is firmly fixed to the attachment hole Da. Moreover, since the first biting

parts 6g, 6h and the second biting parts 6i, 6j are arranged away from each other in the peripheral direction of the attachment hole Da, and especially in this embodiment, since they are arranged about 90 degrees away from each other in the peripheral direction of the attachment hole Da and in addition, since the biting direction of the first biting parts 6g, 6h and the biting direction of the second biting parts 6i, 6j are generally orthogonal to each other, the fixing strength can be improved extensively compared with the case where the door side connection member 5 is fixed to the attachment hole Da only by one of the first biting parts 6g, 6h and the second biting parts 6i, 6j.

[0032] When the cup part 4a reaches the attachment position, the engagement claw 6m passes the insertion hole 4h from below and engages the upper end of the cup part 4a. By this engagement together with the engagement of the engagement plate part 6k with the bottom part 4c, the cup part 4a is connected and fixed to the fixing member 6 and thus, the skeleton side connection member 4 is connected and fixed to the door side connection member 5. The connection structure between the skeleton side connection member 4 and the door side connection member 5 may employ any other suitable structure. After the engagement claws 6m, 6m are moved away from each other, the skeleton side connection member 4 can be removed from the door side connection member 5 by employing reverse procedure.

[0033] FIG. 19 shows a second embodiment of the present invention. In a hinge apparatus 1' of this embodiment, the engagement plate part 6k of the fixing member 6 and the bottom part 4c of the cup part 4a are non-separably fixed to each other with the engagement plate part 6k inserted in the reduced width part 4f of the through-hole 4d through the enlarged width part 4e. As a result, the skeleton side connection member 4 and the door side connection member 5 are non-separably integrated with each other, and a connection member 8 are constituted by those integrated members 4, 5. Since all other constructions are same as those in the above-mentioned embodiment, identical parts are denoted by identical reference numerals and description thereof is omitted.

[0034] In case the connection member 8 of the hinge apparatus 1' is inserted and fixed to the attachment hole Da, the connection member 8 is inserted in the attachment hole Da until the first and second substrate parts 6a, 6b are abutted with the bottom surface of the attachment hole Da. Thereafter, the connection member 8 (fixing member 6) can be fixed to the attachment hole Da by means of the same procedure as in the above-mentioned embodiment. In the hinge apparatus 1' of this embodiment, since the skeleton side connection member 4 and the door side connection member 5 are non-separably integrated with each other as the connection member 8, the connection member 8 can easily be attached to the attachment hole Da. Also in the hinge apparatus 1 shown in FIGS. 1 through 18, by inserting the engage-

ment plate part 6k in the reduced width part 4f before the skeleton side engagement member 4 and the door side engagement member 5 are inserted in the attachment hole Da, it is possible that the skeleton side connection member 4 and the door side connection member 5 are preliminarily integrated and then, inserted in the attachment hole Da in that state.

[0035] It should be noted that the present invention is, by no means, limited to the above-mentioned embodiments but that many changes and modifications can be made without departing from the gist of the invention.

[0036] For example, in the above embodiments, two first biting parts (biting parts) 6g, 6h are formed in correspondence to the first and second movable plate parts 6e, 6f. However, only one of the biting parts 6g, 6h may be formed.

[0037] Similarly, in the above embodiment, the first and second movable plate parts 6e, 6f are integrally formed with each other. However, it is also accepted that the respective one ends of the first and second movable plate parts 6e, 6f are separated and such separated one ends are turnably connected to each other through a shaft member. This can also be applied to the first movable plate part 6e and the first substrate part 6a, and to the second movable plate part 6f and the second substrate part 6b.

Claims

1. A hinge apparatus comprising a hinge main body (2) attached to a skeleton and a connection member (4, 5; 8) turnably connected to one end of said hinge main body (2) and inserted and fixed to an attachment hole (Da) formed in a door (D), said connection member (4, 5; 8) being provided with a biting part (6g, 6h) which is bitten into an inner peripheral surface of said attachment hole (Da) when said biting part (6g, 6h) is moved radially outwardly of said attachment hole (Da), and a moving mechanism (6e, 6f) for moving said biting part (6g, 6h) radially outwardly of said attachment hole (Da), said biting part (6g, 6h), when said connection member (4, 5; 8) is inserted in said attachment hole (Da), being moved radially outwardly of said attachment hole (Da) by said moving mechanism (6e, 6f) and bitten into the inner peripheral surface of said attachment hole (Da), thereby said connection member (4, 5; 8) being fixed to said attachment hole (Da),

CHARACTERIZED in that said moving mechanism (6e, 6f) includes a first and a second movable part (6e, 6f) disposed at said connection member (4, 5; 8), the respective one ends, which are adjacent to each other, of said first and second movable parts (6e, 6f) being turnably connected to each other about an axis extending in a direction orthogonal to an axis of said attachment hole (Da) and arranged in such a manner as to be away from the respective other

ends in the axial direction of said attachment hole (Da), at least one of the respective other ends of said first and second movable parts (6e, 6f) being provided with said biting part (6g, 6h), the respective one ends of said first and second movable parts (6e, 6f) being pushed and moved in the axial direction of said attachment hole (Da) by said connection member (4, 5; 8) until the respective one ends of said first and second movable parts (6e, 6f) are brought to almost the same positions as the respective other ends, thereby said biting part (6e, 6f) being moved radially outwardly of said attachment hole (Da) and bitten into the inner peripheral surface of said attachment hole (Da).

2. A hinge apparatus according to claim 1, wherein said connection member (4, 5; 8) includes a skeleton side connection member (4) turnably connected to said hinge main body (2) and a door side connection member (5) displaceably connected to said skeleton side connection member (4) in the axial direction of said attachment hole (Da) and inserted in said attachment hole (Da), said door side connection member (5) being provided with said first and second movable parts (6e, 6f), the turnably connected one ends of said first and second movable parts (6e, 6f) being pushed and moved in the axial direction of said attachment hole (Da) by said skeleton side connection member (4) inserted in said attachment hole (Da).
3. A hinge apparatus according to claim 2, wherein said door side connection member (5) is removably connected to said skeleton side connection member (4).
4. A hinge apparatus according to claim 2, wherein said door side connection member (5) is non-separably connected to said skeleton side connection member (4).
5. A hinge apparatus according to claim 1, wherein said connection member (4, 5; 8) is provided with a second biting part (6i, 6j) which is moved radially outwardly of said attachment hole (Da) by insertion of said connection member (4, 5; 8) into said attachment hole (Da) and bitten into the inner peripheral surface of said attachment hole (Da), said second biting part (6i, 6j) being arranged away from said biting part (6g, 6h) in a peripheral direction of said attachment hole (Da), the moving direction of said second biting part (6i, 6j) being set in such a manner as to intersect with the moving direction of said biting part (6g, 6h).
6. A hinge apparatus according to one of claims 2 through 4, wherein said door side connection member (5) is provided with a second biting part (6i, 6j) which is moved radially outwardly of said attachment hole (Da) by insertion of said skeleton side connection member (4) into said attachment hole (Da) and bitten into the peripheral surface of said attachment hole (Da), said second biting part (6i, 6j) being arranged away from said biting part (6g, 6h) in a peripheral direction of said attachment hole (Da), the moving direction of said second biting part (6i, 6j) being set in such a manner as to intersect with the moving direction of said biting part (6g, 6h).

tion member (4) into said attachment hole (Da) and bitten into the peripheral surface of said attachment hole (Da), said second biting part (6i, 6j) being arranged away from said biting part (6g, 6h) in a peripheral direction of said attachment hole (Da), the moving direction of said second biting part (6i, 6j) being set in such a manner as to intersect with the moving direction of said biting part (6g, 6h).

7. A hinge apparatus according to claim 5 or 6, wherein said second biting parts (6i, 6j) are arranged away from said biting part (6g, 6h) for about 90 degrees in the peripheral direction of said attachment hole (Da) and the moving direction of said second biting parts (6i, 6j) is set to be generally orthogonal to the moving direction of said biting parts (6g, 6h).

FIG. 1

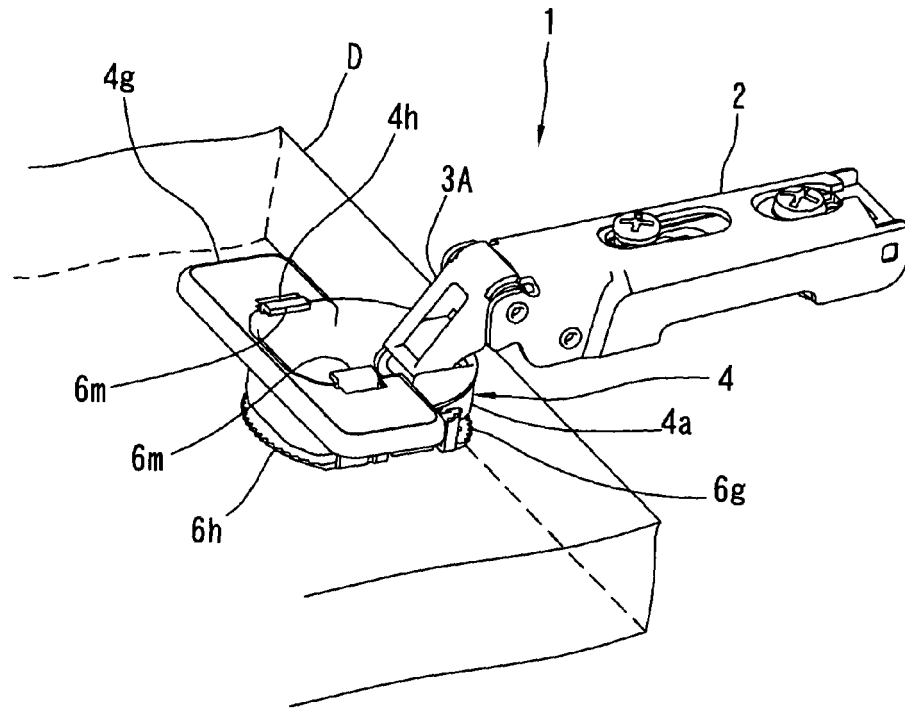


FIG. 2

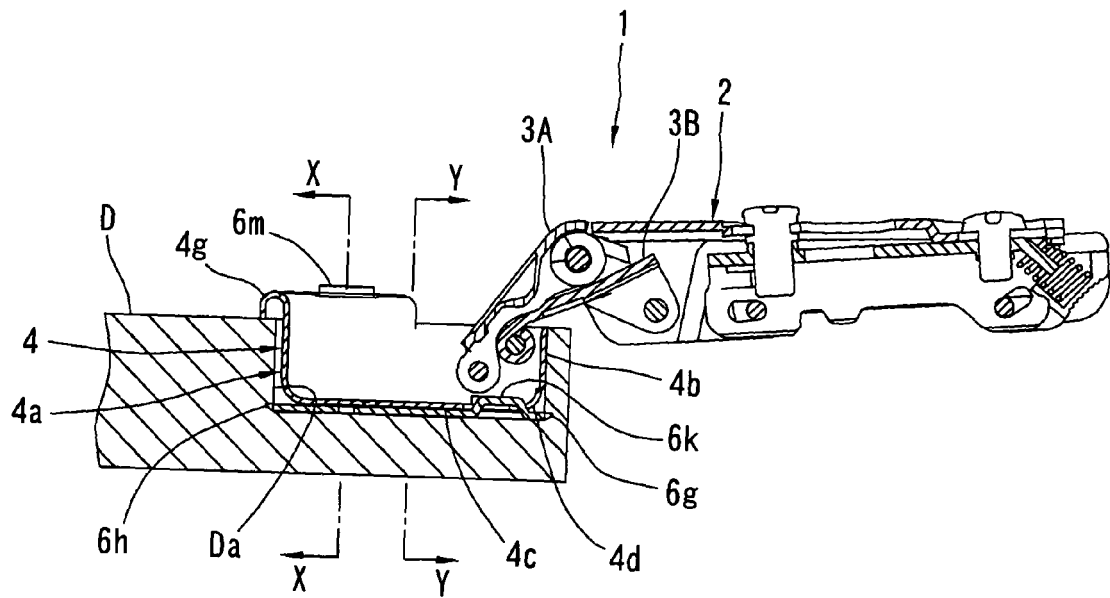


FIG. 3

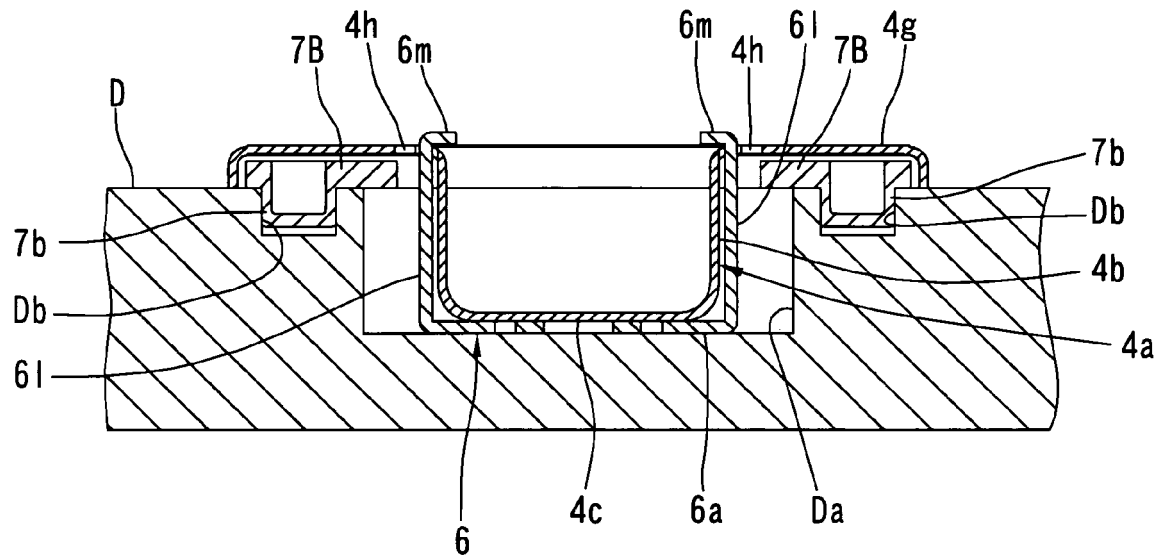


FIG. 4

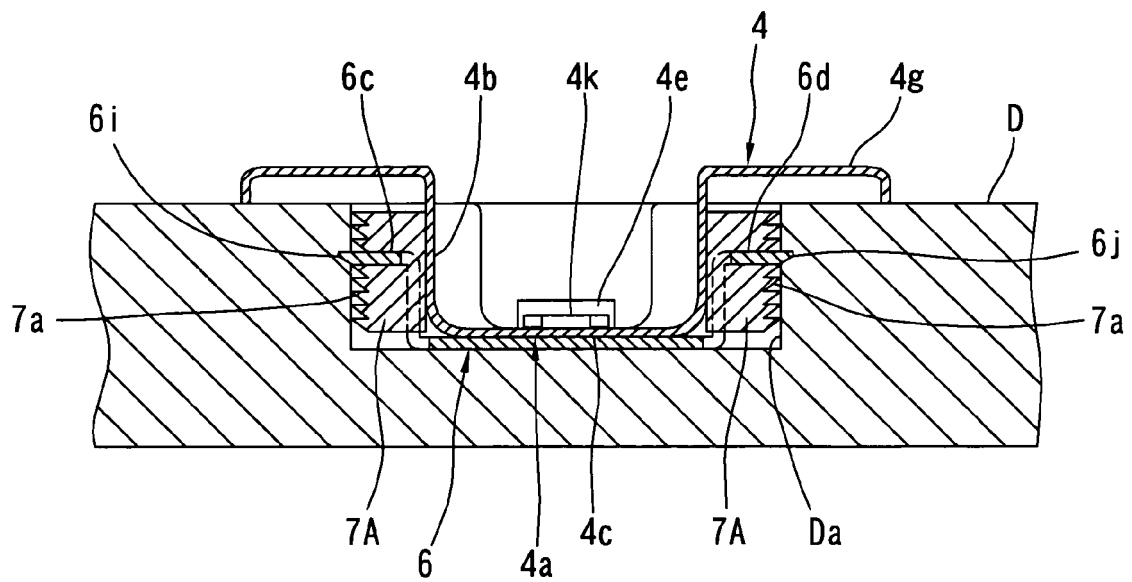


FIG. 5

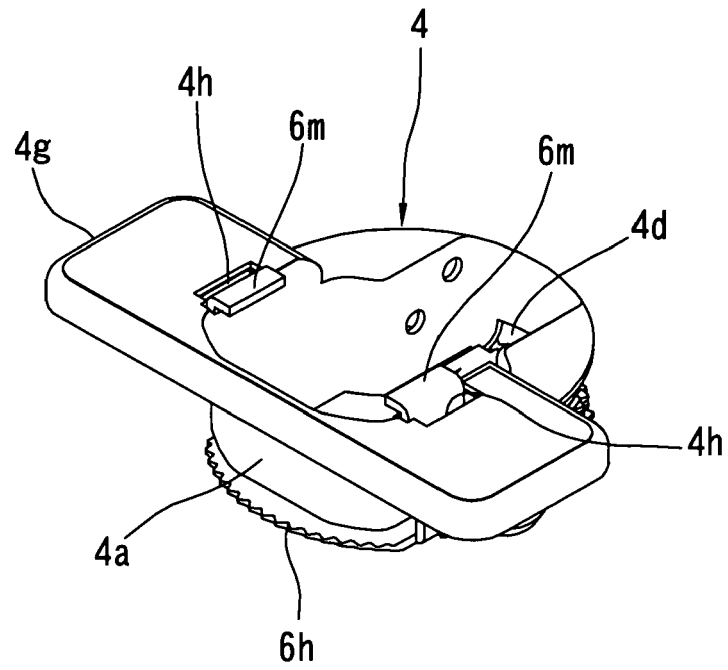


FIG. 6

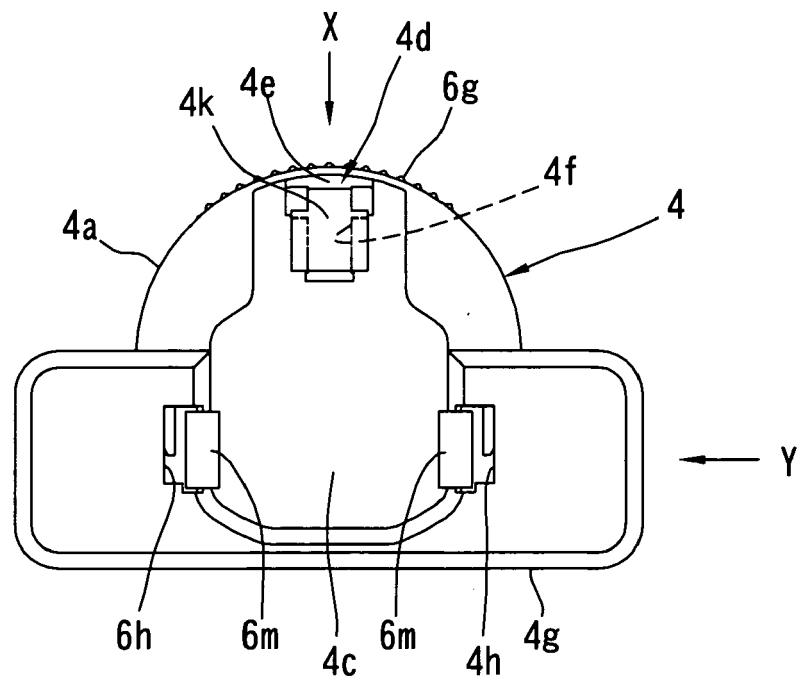


FIG. 7

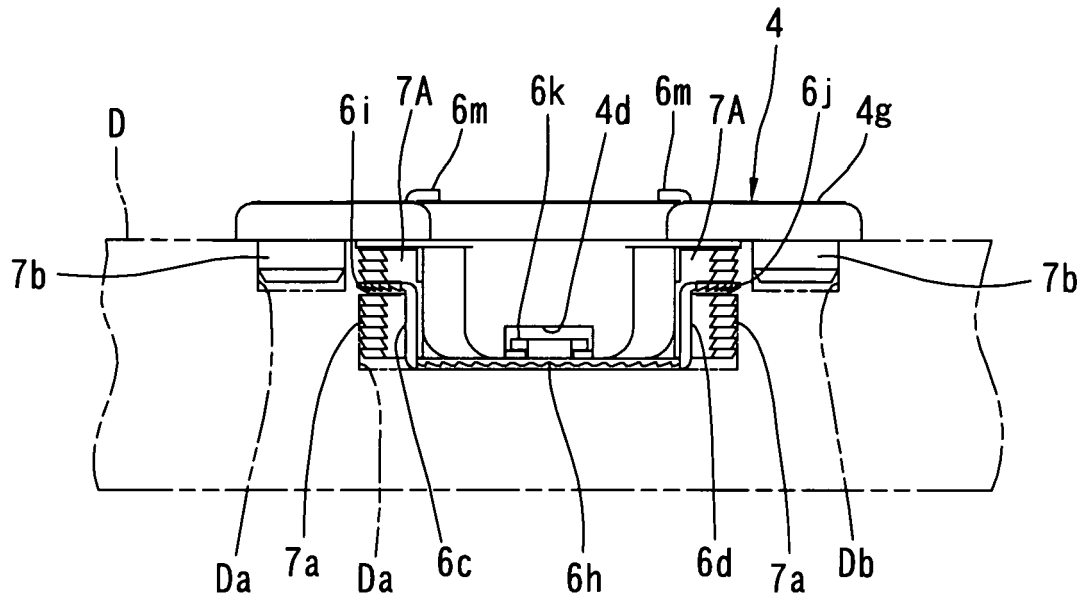


FIG. 8

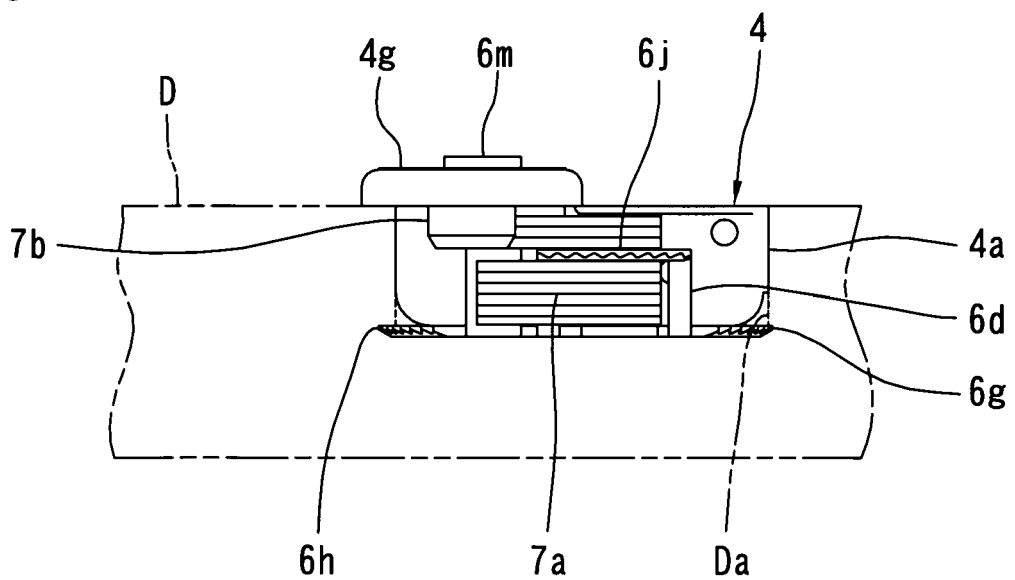


FIG. 9

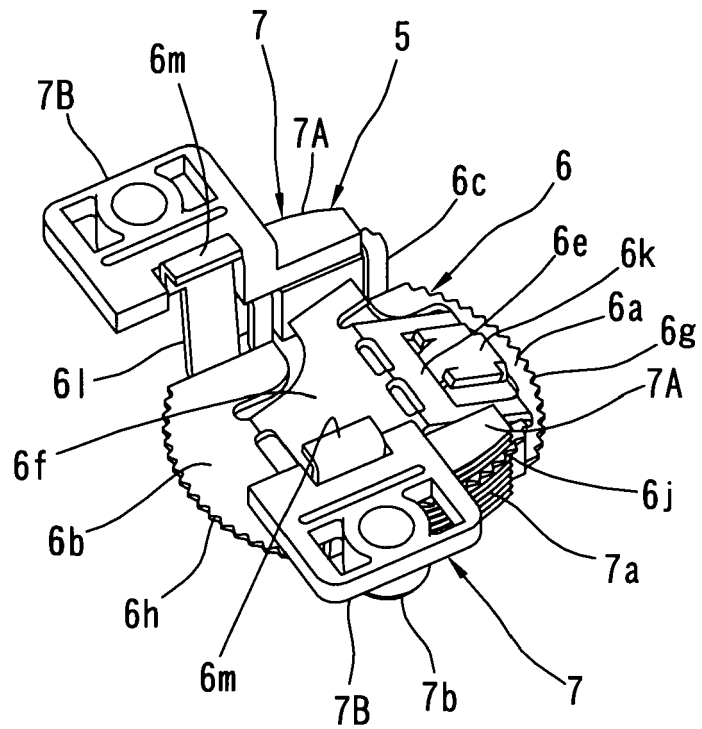


FIG. 10

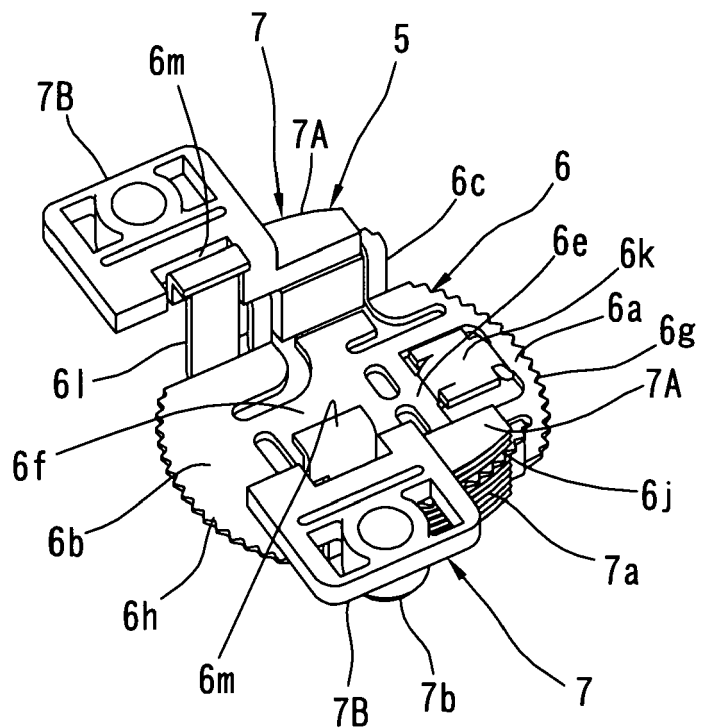


FIG. 11

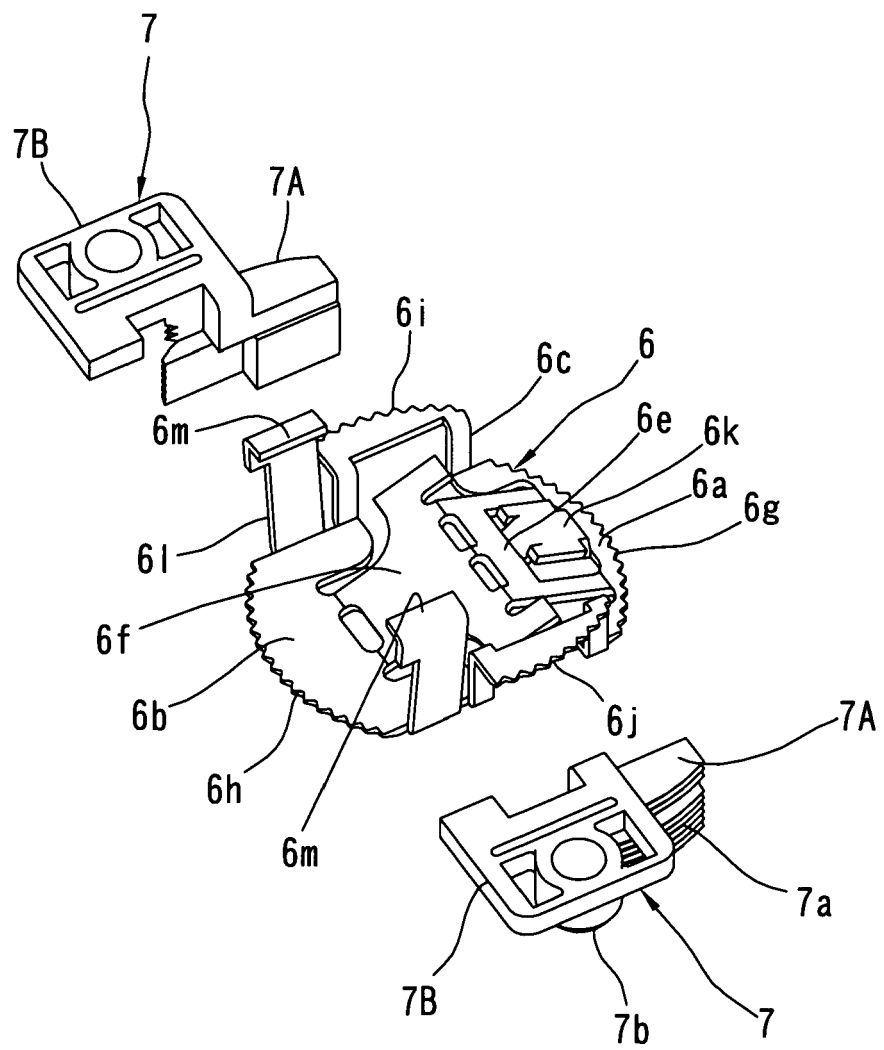


FIG. 12

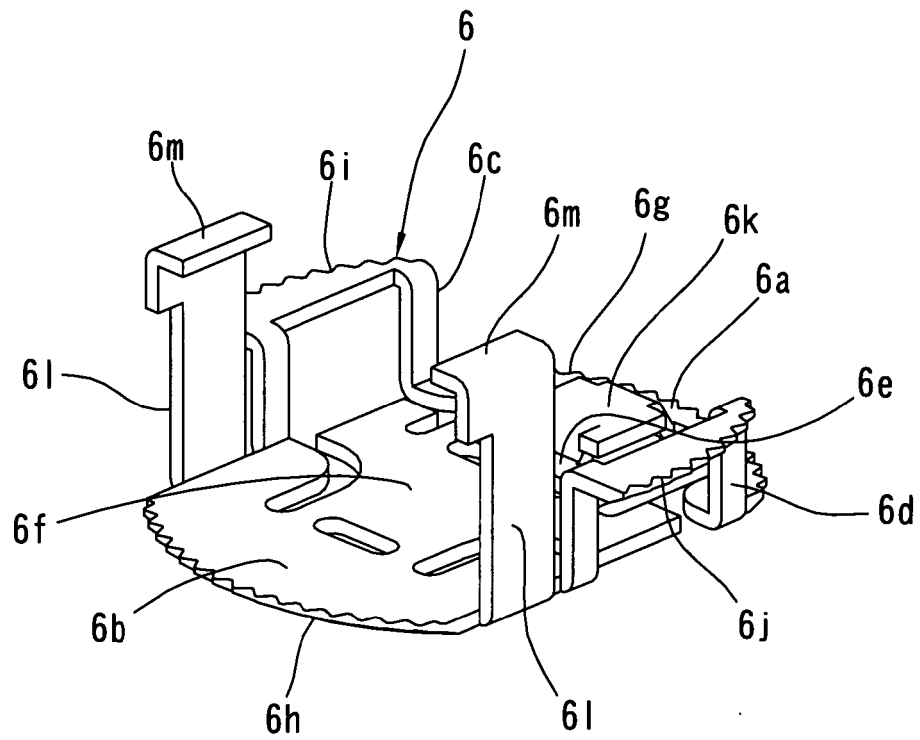


FIG. 13

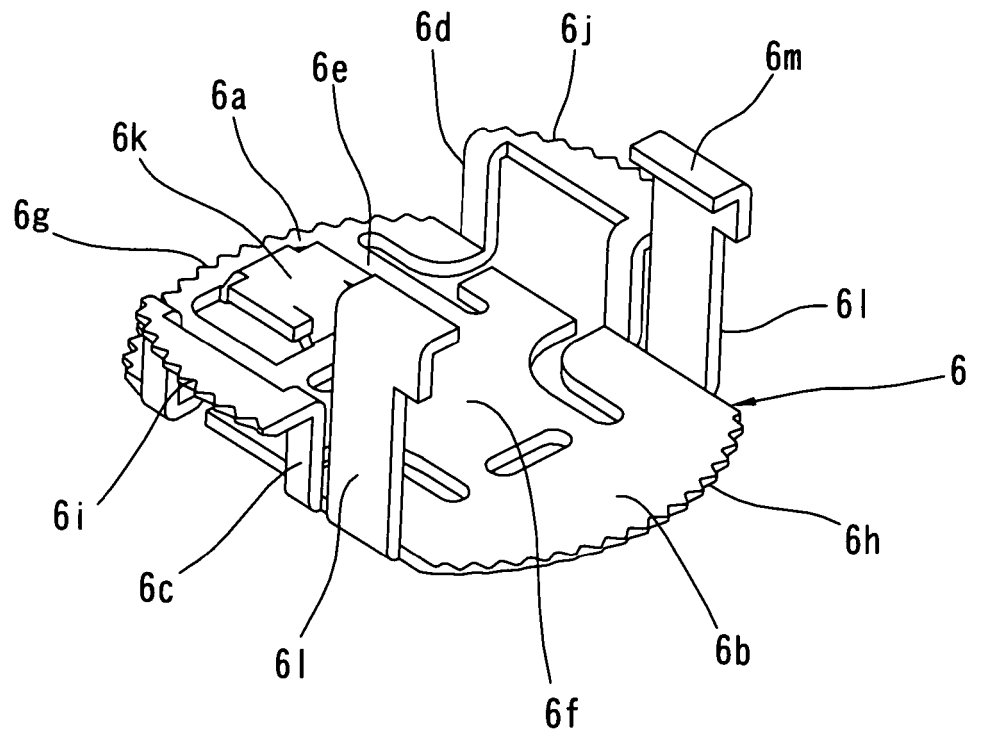


FIG. 14

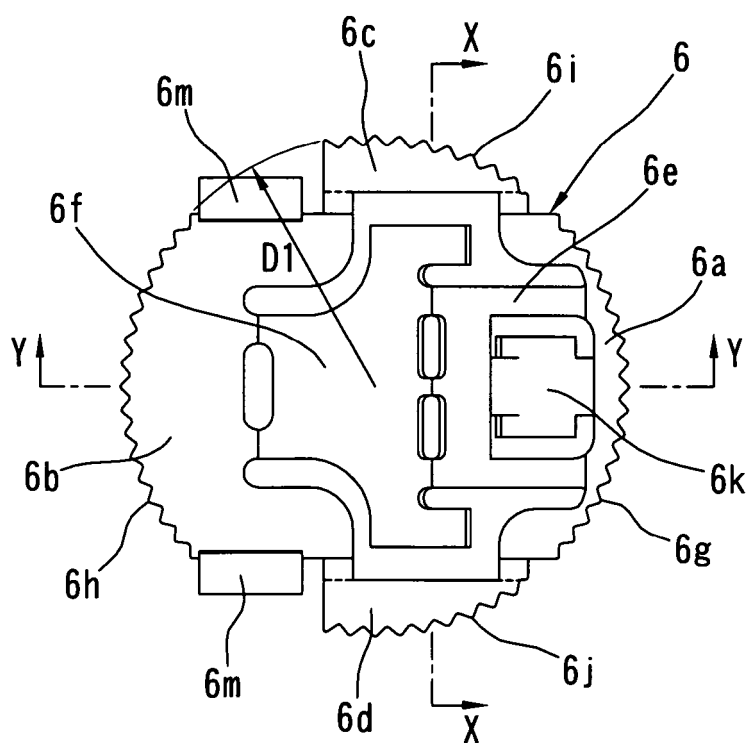


FIG. 15

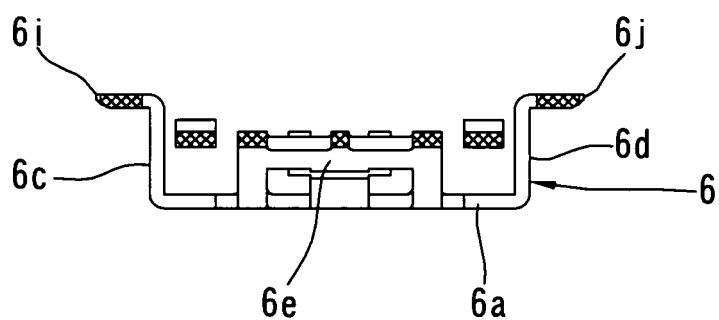


FIG. 16

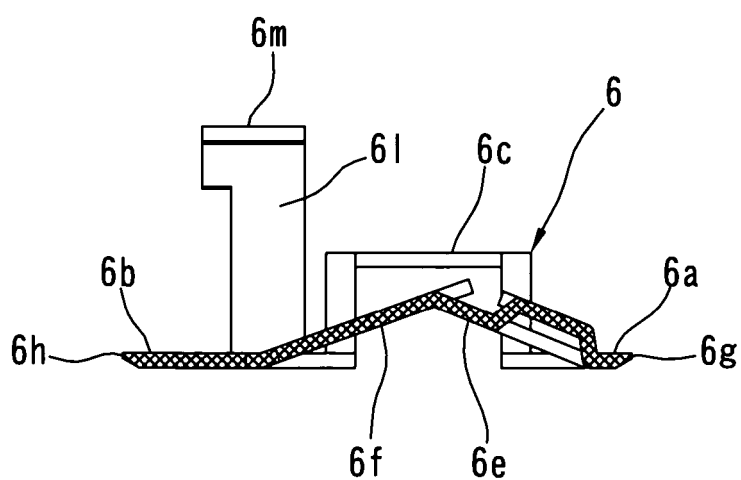


FIG. 17

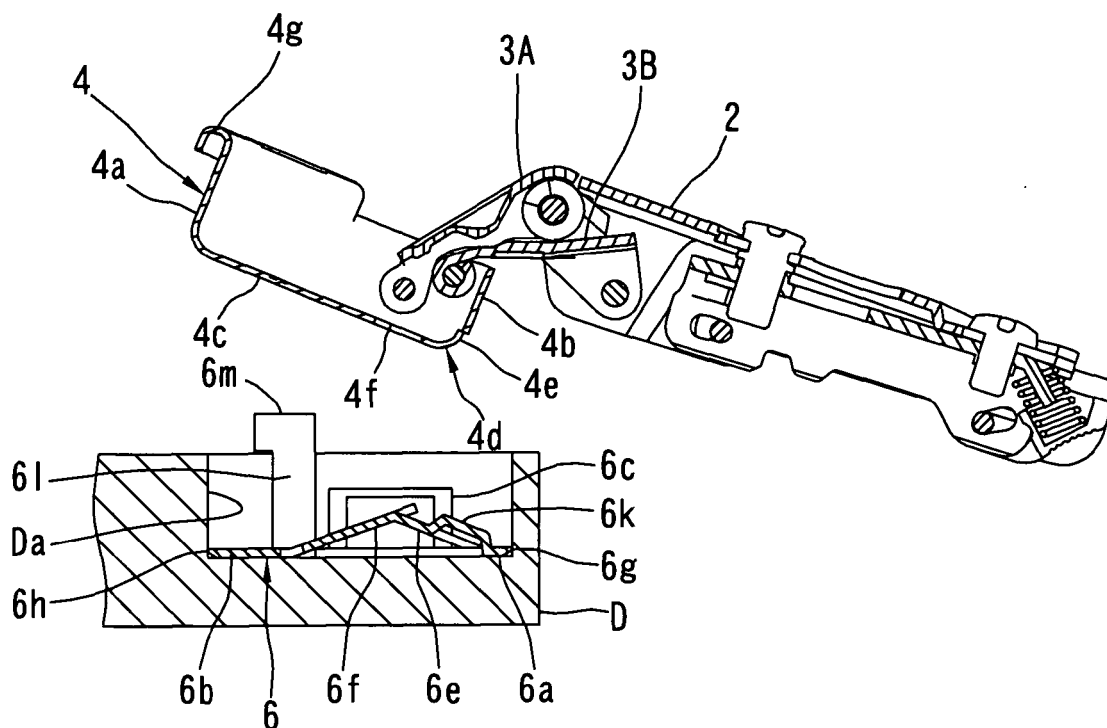


FIG. 18

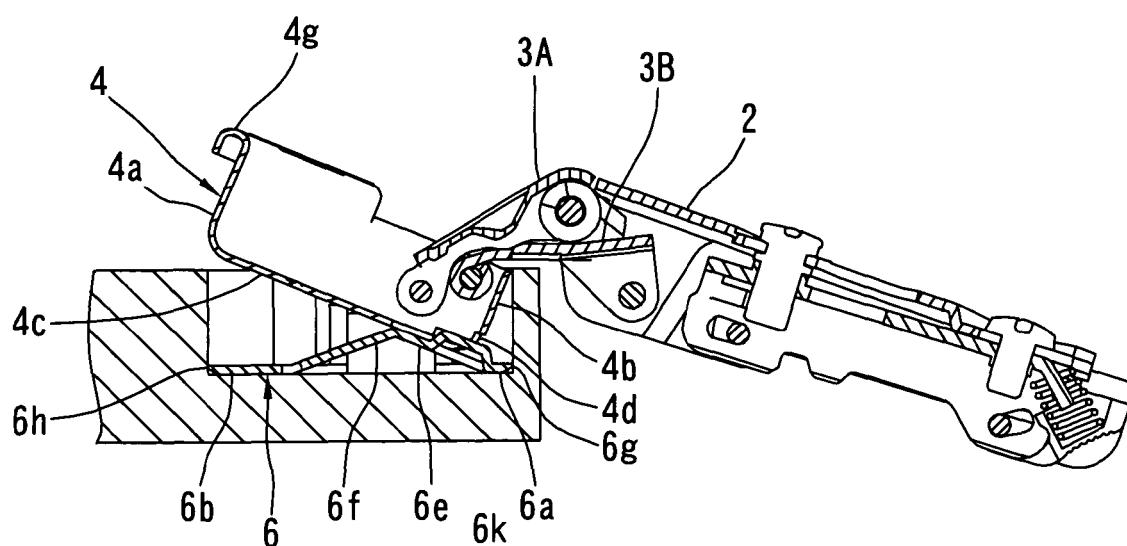
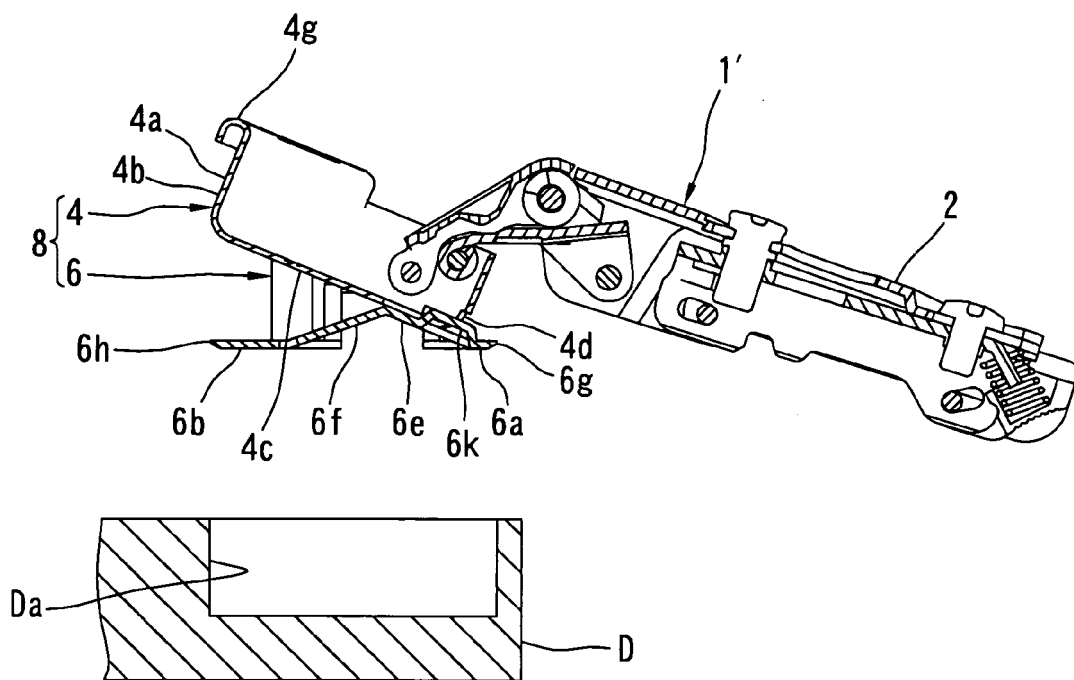


FIG. 19



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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