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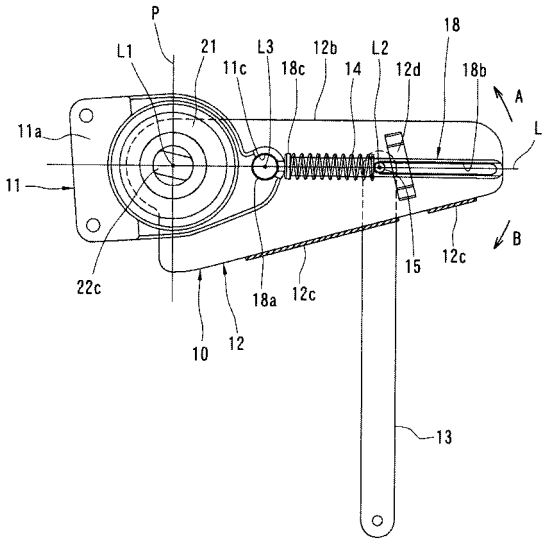
(54) DEVICE FOR OPENING AND CLOSING DOOR

(57) The basal end of the first arm 12 is turnably connected to an apparatus main body 11 about a first turning axis L1. The basal end of a second arm 13 is turnably connected to the distal end of the first arm 12 about a second turning axis L2 parallel to the first turning axis L1. A compression coil spring 14 for biasing the first arm 12 toward the closing position when the first arm 12 is located between the neutral position and the closing position and toward the opening position when the first arm 12 is located between the neutral position and the opening position. The compression coil spring 14 is arranged between the first turning axis L1 and the second turning axis L2 on a line L intersecting with the first and second turning axes L1, L2 at right angles.

FIG. 1



EP 1 847 671 A1

Description

TECHNICAL FIELD

[0001] This invention relates to a door opening and closing apparatus which is to be disposed between a skeleton body and a door.

BACKGROUND ART

[0002] In general, a door opening and closing apparatus, as described in the patent document 1 as listed hereunder, comprises an apparatus main body attached to a skeleton body, a first arm whose basal end is turnably connected to the apparatus main body about a first turning axis, a second arm whose basal end is turnably connected to the distal end of the first arm about a second turning axis parallel to the first turning axis and whose distal end is turnably connected to a door, and a compression coil spring disposed between the apparatus main body and the first arm. The compression coil spring biases the first arm so that the door is turned toward a closing position when the door is located between a predetermined neutral position and the closing position and biases the first arm so that the door is turned toward an opening position when the door is located between the neutral position and the opening position.

PATENT DOCUMENT 1: Japanese Patent Application Laid-Open No. H09-303037

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0003] In the above-mentioned conventional door opening and closing apparatus, the first arm is arranged at one end of the apparatus main body in the longitudinal direction of the first arm and the compression coil spring is arranged at the other end of the apparatus main body. Thus, the compression coil spring and the second arm are arranged on the opposite sides with the first turning axis disposed therebetween. In the arrangement as just mentioned, the other end of the apparatus main body becomes longer by a portion equal to the compression coil spring and as a result, the entire opening and closing apparatus becomes extensively large in size.

MEANS FOR SOLVING THE PROBLEM

[0004] In order to solve the above-mentioned problem, the present invention provides a door opening and closing apparatus comprising an apparatus main body, a first arm whose basal end is turnably supported by the apparatus main body between a closing position and an opening position about a first turning axis, a second arm whose basal end is turnably connected to a distal end of the first arm about a second turning axis parallel to the first turning axis, and a compression elastic body disposed between the apparatus main body and the first arm, an action line of biasing force of the compression elastic body, when the first arm is located in the neutral position, being intersected with the first turning axis so that the compression elastic body, when the first arm is located between a predetermined neutral position, which is located between the closing position and the opening position, and the closing position, causes the first arm to turn toward the closing position from the neutral position, and when the first arm is located between the neutral position and the opening position, causes the first arm to turn toward the opening position from the neutral position, characterized in that the compression elastic body, when the first arm is located in the neutral position, is arranged in the same region as one of the two regions obtained through division by a plane including the first turning axis and intersecting, at right angles, with a line connecting the first and second turning axes together, the one region including the second turning axis.

It is preferable that the compression elastic body, when the first arm is located in the neutral position, is arranged nearly along the line connecting the first and second turning axes together.

The compression elastic body is preferably formed in a sleeve-like shape.

It is preferable that a basal end of a guide rod is turnably connected to the apparatus main body about a third turning axis parallel to the first turning axis, a distal end of the guide rod is movably connected to an engaging part disposed at the first arm in a longitudinal direction of the guide rod, the compression elastic body is externally inserted to the guide rod, and the compression elastic body biases the apparatus main body through the guide rod and also biases the first arm through the engaging part.

The basal end of the second arm is preferably turnably connected to the first arm through the engaging part.

A compression coil spring is preferably used as the compression elastic body.

It is preferable that the first arm includes a pair of flat plate parts intersecting with the first turning axis at right angles and a connection plate part for connecting one sides of the pair of flat plate parts together, and the apparatus main body is inserted between the basal ends of the pair of flat plate parts.

It is also preferable that the first arm includes a pair of flat plate parts intersecting with the first turning axis at right angles and a connection plate part for connecting one sides of the pair of flat plate parts together, and the apparatus main body and the guide rod to which the compression elastic body is externally inserted are inserted between the pair of flat plate parts.

Preferably, the apparatus main body is provided with a turning damper mechanism including a rotor turnably disposed at the apparatus main body about the first turning axis, and the basal end of the first arm is non-turnably connected to the rotor, thereby the basal end of the first arm is turnably connected to the apparatus main body

through the rotor.

EFFECT OF THE INVENTION

[0005] According to the present invention thus constructed, the compression elastic body is arranged in the same region as one of the two regions obtained through division by a plane including the first turning axis and intersecting, at right angles, with a line connecting the first and second turning axes together. The one region is the same region which includes the second turning axis between the first arm and the second arm. When compared with the conventional door opening and closing apparatus comprising the compression coil spring arranged on the opposite side to the second turning axis with the first turning axis disposed between the compression coil spring and the second turning axis, the end of the apparatus main body on the opposite side to the second turning axis is not required to be made longer by a portion equal to the compression coil spring. Therefore, the apparatus main body can be made smaller in size to that extent and thus the door opening and closing apparatus can be made small in size.

BRIEF DESCRIPTION OF DRAWINGS

[0006]

[FIG. 1] is a plan view, partly cutaway, showing one embodiment of the present invention in which a first arm is located in a neutral position.
[FIG. 2] is a similar view as FIG. 1 but in which the first arm is located in a closing position.
[FIG. 3] is a similar view as FIG. 1 but in which the first arm is located in an opening position.
[FIG. 4] is a sectional view taken on line X-X of FIG. 3.
[FIG. 5] is a perspective view of the above embodiment.
[FIG. 6] is an exploded perspective view of the above embodiment.
[FIG. 7] is a perspective view showing an essential part of a mailbox in which a door opening and closing apparatus according to the above embodiment is used.
[FIG. 8] is a plan view showing the above mailbox but with a top plate removed therefrom.

DESCRIPTION OF THE REFERENCE NUMERALS

[0007]

L1 first turning axis
L2 second turning axis
L3 third turning axis
10 door opening and closing apparatus
11 apparatus main body
12 first arm
13 second arm
14 compression coil spring (compression elastic body)
18 guide rod
20 damper mechanism
22 rotor

BEST MODE FOR CARRYING OUT THE INVENTION

[0008] The best mode for carrying out the invention will be described hereinafter with reference to the drawings.
FIGS. 7 and 8 show a mailbox 1 in which a door opening and closing apparatus 10 according to the present invention is used. The mailbox 1 includes a skeleton body 2 and a door 3. The skeleton body 2 is in the shape of a box and it has an opening part at its front surface 2a. The right part of the door 3 in FIG. 8 is mounted on the right part of the front surface 2a of the skeleton body 2 such that the door 3 is turnable about an axis extending in an up and down direction. It is also accepted that the left part of the skeleton body 2 is turnably mounted on the left part of the skeleton body 2. The turning range of the door 3 is restricted between a closing position as indicated by one-dot chain line of FIG. 8 and an opening position as indicated by two-dot chain line of FIG. 8. An angle between the closing position and the opening position is set about 90 degrees in this embodiment but it may be set larger than that. The closing position of the door 3 is restricted by abutment of the rear surface 3a with the front surface 2a of the skeleton body 2. When the door 3 is brought to the closing position, the front surface opening part of the skeleton body 2 is closed by the door 3. The opening position of the door 3 is restricted by abutment of the right surface 3b of the door 3 with the front surface 2a of the skeleton body 2. When the door 3 is brought to the opening position, the front surface opening part of the skeleton 2 is opened.

[0009] The door opening and closing apparatus 10 is disposed between the skeleton body 2 and the door 3. This door opening and closing apparatus 10 biases the door 3 toward the closing position, when the door 3 is located in a position offset toward the opening position from a predetermined neutral position as indicated by a solid line of FIG. 8 between the closing position and the opening position. And the apparatus 10 keeps the door 3 in the closing position where the rear surface 3a is abutted with the front surface 2a of the skeleton body 2. On the other hand, when the door 3 is located between the neutral position and the opening position, the apparatus 10 biases the door 3 toward the opening position. And the apparatus 10 keeps the door 3 in the opening position where the right surface 3b is abutted with the front surface 2a of the skeleton body 2.

[0010] The construction of the door opening and closing apparatus 10 will be described in more detail. As shown in FIGS. 1 through 6, the door opening and closing apparatus 10 chiefly comprises an apparatus main body 11, a first arm 12, a second arm 13 and a compression

coil spring (compression elastic body) 14.

[0011] The apparatus main body 11 is in the shape of a flat plate and fixed to the end of a ceiling surface 2b of the skeleton body 2 on the opening side by machine screw (not shown) or the like with its thickness direction directed in an up and down direction. A circular receiving recess 11b with its axis directed in an up and down direction is formed in an upper surface 11a of the apparatus main body 11 and a connection hole 11c passing through the apparatus main body 11 in an up and down direction is also formed therein. The receiving recess 11b is arranged at a nearly central part of the apparatus main body 11. The connection hole 11c is arranged at one end part (the right side end part of the skeleton body 2) of the apparatus main body 11.

[0012] A damper mechanism 20 is built in the receiving recess 11b. That is, a cover body 21 is fitted and fixed to the upper end opening part of the receiving recess 11b. A rotor 22 is received in the receiving recess 11b between the cover body 21 and a bottom surface of the receiving recess 11b. Shaft parts 22a, 22b whose axes are aligned with each other are formed at central parts of vertical end surfaces of the rotor 22, respectively. The shaft parts 22a, 22b are turnably fitted, respectively, to support holes 21a, 21b which are formed in the central part of the cover body 21 and in the central parts of the bottom surface of the receiving recess 11b, respectively, thereby, the rotor 22 is turnably received in the receiving recess 11b about the first turning axis L1 directed in the up and down direction. A viscous fluid (not shown) is received in the receiving recess 11b. The turning speed of the rotor 22 is restricted to low by viscous fluid which is present between the rotor 22 and the apparatus main body 11 and between the rotor 22 and the cover body 21.

[0013] The first arm 12 is formed in the shape of letter "U" in section by a pair of flat plate parts 12a, 12b which are opposed to each other in the up and down direction and a connection plate part 12c connecting the respective one sides, in the short direction, of the flat plate parts 12a, 12b. A part of the apparatus main body 11 ranging from the central part to the one end where the connection hole 11c is formed, is inserted between the basal end of the flat plate part 12a and the basal end of the flat plate part 12b. The basal end of the upper flat plate part 12a is non-turnably connected to a connection shaft part 22c which is formed on a tip surface of the shaft part 22a and projects upwardly from the support hole 21a. The basal end of the lower flat plate part 12b is non-turnably connected to a lower end of a shaft part 22b which projects downwardly from the support hole 11d. Owing to this arrangement, the basal end part of the first arm 12 is turnably connected to the apparatus main body 11 through the rotor 22. Thus, the first arm 11 is turnable about the first turning axis L1.

[0014] The pair of flat plate parts 12a, 12b are each provided at tip parts thereof with a support shaft 15 directing in the up and down direction. The lower end of the support shaft 15 projects downwardly from the lower flat plate part 12b. The basal end of the second arm 13 is turnably connected to the lower end of the support shaft 15. If the axis of the support shaft 15 is a second turning axis L2, this second turning axis L2 is parallel to the first turning axis L1, and the basal end of the second arm 13 is turnably connected to the first arm 12 about the second turning axis L2. As shown in FIGS. 7 and 8, a bracket 16 is turnably connected to the distal end of the second arm 13 through a shaft 17 parallel to the support shaft 15. The bracket 16 is attached to the upper end of the rear surface 3a of the door 3. Thus, the distal end of the second arm 13 turnably connected to the door 3 about an axis parallel to the first and second axes L1, L2.

[0015] Since the second arm 13 is connected to the door 3, the first and second arms 12, 13, when the door 3 is turned, are also turned. In other words, when the first and second arms 12, 13 are turned, the door 3 is turned in accordance therewith. Moreover, the respective turning positions of the first and second arms 12, 13 correspond the respective turning positions of the door 3, one to one. Therefore, the respective positions of the first and second arms 12, 13 corresponding to the closing position, neutral position and opening position of the door 3 are also referred to as the closing position, the neutral position and the opening position, respectively.

[0016] A guide rod 18 is inserted between the pair of flat plates 12a, 12b. A shaft part 18a is formed on the basal end of the guide rod 18. The shaft part 18a is turnably fitted to the connection hole 11c of the apparatus main body 11. Owing to this arrangement, the basal end of the guide rod 18 is turnably connected to the apparatus main body 11 about a third turning axis L3 parallel to the first and second turning axes L1, L2.

[0017] A guide hole 18b extending longitudinally is formed on the distal end of the guide rod 18. The support shaft 15 is inserted in the guide hole 18b such that the support shaft 15 is relatively movable in the longitudinal direction of the guide hole 18b and non-movable in the short direction. Thus, when the first arm 12 is turned, the support shaft 15, while moving within the guide hole 18b in the longitudinal direction, turns the guide rod 18 about the shaft part 18a. Guide element parts 12d, 12d slidably contacting the distal end of the guide rod 18 are formed on the flat plate parts 12a, 12b so that the guide rod 18 can smoothly turn at that time.

[0018] The compression coil spring 14 is externally inserted to the guide rod 18 in a compressed condition. The compression coil spring 14 is arranged between the second turning axis L2 and the third turning axis L3. One end of the compression spring 14 is abutted with an annular flange part 18c formed on the basal end of the guide rod 18 and the other end is abutted with the support shaft 15. Owing to this arrangement, the compression coil spring 14 biases the apparatus main body 11 through the shaft part 18a and also biases the first arm 12 through the shaft part 15. By this biasing force, the first arm 12, when located between the neutral position and the clos-

ing position, is turned toward the closing position and when located between the neutral position and the opening position, is turned toward the opening position.

[0019] The above will now be described in more detail. A part, of the entire outer peripheral surface, of the shaft part 18a biased by the compression coil spring 14, which part corresponds to a half periphery located forwardly in the acting direction of the biasing force of the compression coil spring 14, is press-contacted with the inner peripheral surface of the connection hole 11c of the apparatus main body 11. Therefore, the action point of the biasing force of the compression coil spring 14 with respect to the apparatus main body 11 is located more forwardly in the biasing direction of the compression coil spring 18 from the center of the shaft part 18a, i.e., nearly at the third turning axis L3. However, since an interval between the action point and the third turning axis L3 is small, the third turning axis L3 can approximately be considered as the action point of the biasing force of the compression coil spring 14 with respect to the apparatus main body 11. For the sake of convenience, therefore, it is assumed hereinafter that the biasing force of the compression coil spring 14 is acted on the apparatus main body 11 on the third turning axis L3. Likewise, it is also assumed that the biasing force of the compression coil spring 14 is acted on the first arm 12 on the second turning axis L2.

[0020] Now, it is assumed that the first arm 12 is located in the neutral position shown in FIG. 1. At that time, the third turning axis L3, which is the action point of the biasing force of the compression coil spring 14 with respect to the apparatus main body 11, is located on a line connecting the first turning axis L1 and the second turning axis L2 together, that is, located on a line L intersecting with the first and second turning axes L1, L2 at right angles. In that condition, the biasing force of the compression coil spring 14 is merely born by the apparatus main body 11 and the first arm 12, and the first arm 12 is not turned in any of the directions indicated by arrows A, B of FIG. 1 by the biasing force of the compression coil spring 14.

[0021] However, when the first arm 12 is turned, even if slightly, toward the closing position from the neutral position in the direction as indicated by the arrow A of FIG. 1, the third turning axis L3 is deviated from the line L. As shown in FIG. 2, for example, when the first arm 12 is located in the closing position, the third turning axis L3 is deviated from the line L and located on one side part with respect to the line L (one side part of the two side parts obtained through division by the line L). As a result, the acting direction of the biasing force of the compression coil spring 14 becomes to have a predetermined angle with respect to the line L, and the biasing force of the compression coil spring 14 acts on the first arm 12 as a turning torque. By this turning torque, the first arm 12 is turned about the first turning axis L1 toward the closing position with respect to the apparatus main body 11. On the contrary, when the first arm 12 is turned in the direction as indicated by the arrow B of FIG. 1 from the neutral position, the third turning axis L3, as shown in FIG. 3, is deviated to the other side from the line L and located on the other side part with respect to the line L. As a result, the biasing force of the compression coil spring 14 acts on the first arm 12 as a turning torque. By this turning torque, the first arm 12 is turned about the first turning axis L1 toward the opening position with respect to the apparatus main body 11.

[0022] In the door opening and closing apparatus 10 thus constructed, when the first arm 12 is located at least in the neutral position, the compression coil spring 14 is arranged on the same side as the second turning axis L2 that is the turning center of the second arm 13 with the first arm 12, with respect to the first turning axis L1. That is, when a plane including the first turning axis L 1 and intersecting, at right angles, with the line L connecting the first and second turning axes L1, L2 together is denoted by P (this plane P is shown as a line P in FIG. 1), the compression coil spring 14 is located in the same region as the region where the second turning axis L2 is included, of the two regions obtained through division by the plane P. Accordingly, contrary to the conventional door opening and closing apparatus wherein the compression coil spring 14 is disposed at the opposite side to the second turning axis L2 with the first turning axis L1 placed therebetween, the other end of the apparatus main body 11 is not required to be made longer by a portion equal to the compression coil spring 14. Therefore, the apparatus main body 11 can be made small in size and thus, the door opening and closing apparatus 10 can be made small in size. The third turning axis L3 that is an action point of the biasing force of the compression coil spring 14 with respect to the apparatus body 11, when the first arm 12 is located in the neutral position, is located between the first turning axis L1 and the second turning axis L2 that is the action point of the biasing force of the compression coil spring 14 with respect to the first arm 12.

[0023] In the door opening and closing apparatus 10 according to this embodiment, the compression coil spring 14 is located in the same region as the second turning axis L2 whenever the first arm 12 is located between the closing position and the opening position. Owing to this arrangement, the apparatus main body 11 can reliably be made small in size. Moreover, since the compression coil spring 14 is arranged on the line L when the first arm 12 is located in the neutral position, the apparatus main body 11 can be made much smaller in size.

[0024] Furthermore, since the guide rod 18 is passed through the compression coil spring 14 in this door opening and closing apparatus, the compression coil spring 14 can be prevented from buckling and the compression coil spring 14 can smoothly be turned about the third turning axis L3 in accordance with the turning of the first arm 12. Moreover, since the guide rod 18 and the compression coil spring 14 do not require separate installation spaces, the door opening and closing apparatus 10

can be made smaller in size to that extent. In addition, since the guide rod 18 and the compression coil spring 14 are inserted between the pair of flat plate parts 12a, 12b constituting the first arm 12, the guide rod 18 and the compression coil spring 14 can be prevented from contacting the content received in the skeleton body 2 when the first arm 12 is turned.

[0025] The present invention is not limited to the above embodiment and it can be changed and modified in accordance with necessity without departing from the gist of the invention.

For example, in the above embodiment, the door opening and closing apparatus 10 according to the present invention is applied to a laterally-opening mailbox in which the door 3 is horizontally turned. However, it can, of course, be applied to other laterally-opening furniture, etc. and it can also be applied to upward-opening or downward-opening furniture, etc. in which the door is turned in the up and down direction about a horizontal axis. In case the door opening and closing apparatus 10 is used in the upward-opening or downward-opening furniture, the apparatus main body 11 is attached to the inner surface of the left or right side of the skeleton body 2, and the first through third turning axes L1 through L3 are horizontally arranged.

Moreover, in the above embodiment, the support shaft 15 serves as a member for turnably connecting the second arm 13 to the first arm 12 and also as a member for bearing the biasing force of the compression coil spring 14. However, the two members may be separately provided. In case the two members are separately provided, the second turning axis L2, that is the center of turn of the second arm 13 with respect to the first arm 12 is preferably arranged on a line passing through the respective action points of the compression coil spring 14 with respect to the apparatus main body 11 and the first arm 12, but it may be arranged spacedly on the upper or lower side of FIG. 1 from the line.

INDUSTRIAL APPLICABILITY

[0026] A door opening and closing apparatus according to the present invention can be used as an apparatus for opening and closing a door turnably attached to a skeleton body and more particularly, as an apparatus for opening and closing a door attached to a skeleton body having a small inside space such as a skeleton body of a mailbox.

Claims

1. A door opening and closing apparatus comprising an apparatus main body, a first arm whose basal end is turnably supported by the apparatus main body between a closing position and an opening position about a first turning axis, a second arm whose basal end is turnably connected to a distal end of the first arm about a second turning axis parallel to the first turning axis, and a compression elastic body disposed between the apparatus main body and the first arm, an action line of biasing force of the compression elastic body, when the first arm is located in the neutral position, being intersected with the first turning axis so that the compression elastic body, when the first arm is located between a predetermined neutral position, which is located between the closing position and the opening position, and the closing position, causes the first arm to turn toward the closing position from the neutral position, and when the first arm is located between the neutral position and the opening position, causes the first arm to turn toward the opening position from the neutral position,
CHARACTERIZED in that said compression elastic body, when said first arm is located in the neutral position, is arranged in the same region as one of the two regions obtained through division by a plane including the first turning axis and intersecting, at right angles, with a line connecting the first and second turning axes together, said one region including the second turning axis.

2. A door opening and closing apparatus according to claim 1, wherein said compression elastic body, when said first arm is located in the neutral position, is arranged nearly along the line connecting said first and second turning axes together.

3. A door opening and closing apparatus according to claim 1 or 2, wherein said compression elastic body is formed in a sleeve-like shape.

4. A door opening and closing apparatus according to claim 3, wherein a basal end of a guide rod is turnably connected to said apparatus main body about a third turning axis parallel to the first turning axis, a distal end of said guide rod is movably connected to an engaging part disposed at said first arm in a longitudinal direction of said guide rod, said compression elastic body is externally inserted to said guide rod, and said compression elastic body biases said apparatus main body through said guide rod and also biases said first arm through said engaging part.

5. A door opening and closing apparatus according to claim 4, wherein the basal end of said second arm is turnably connected to said first arm through said engaging part.

6. A door opening and closing apparatus according to one of claims 2 through 5, wherein a compression coil spring is used as said compression elastic body.

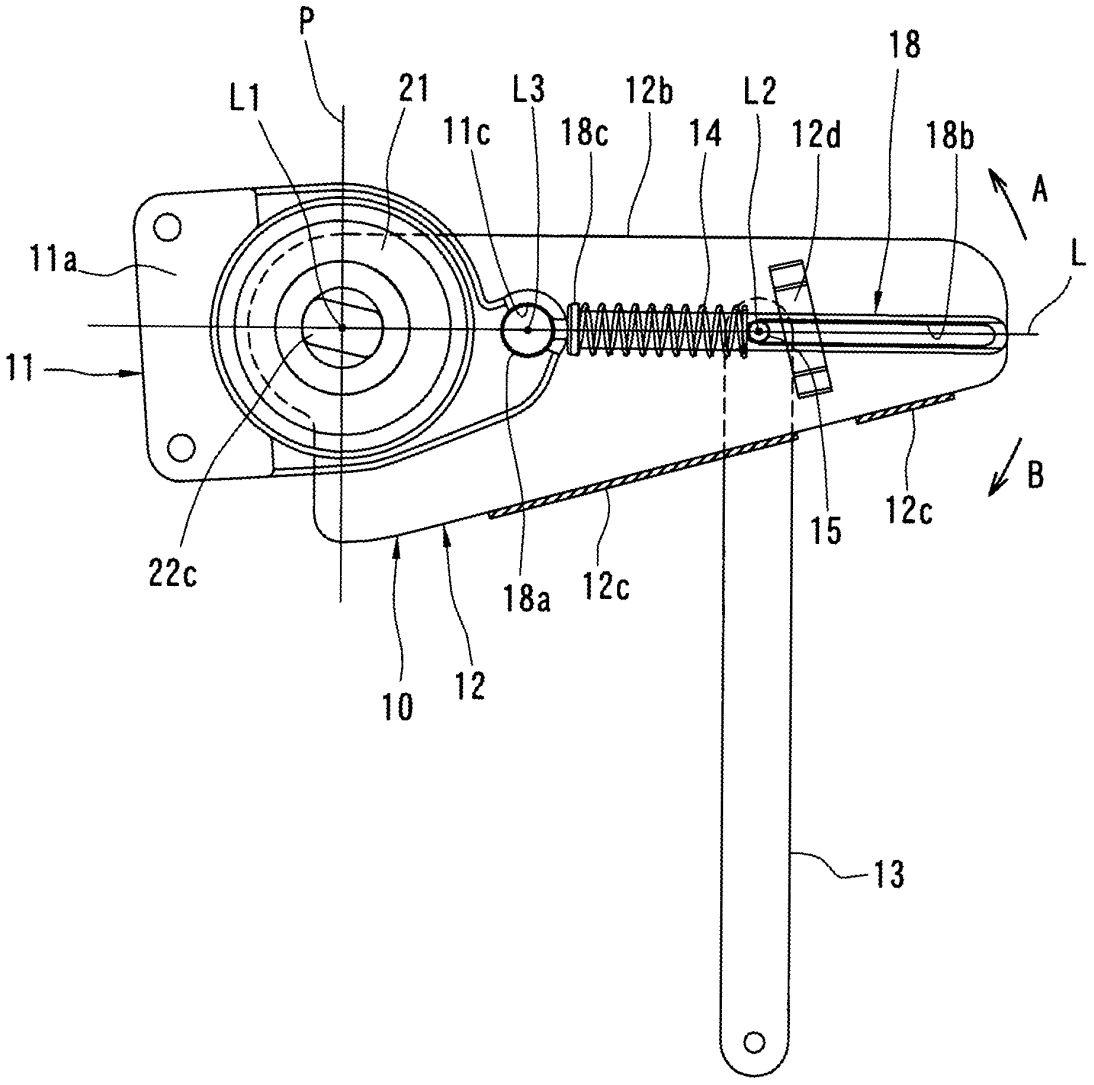
7. A door opening and closing apparatus according to one of claims 1 through 3, wherein said first arm in-

cludes a pair of flat plate parts intersecting with said first turning axis at right angles and a connection plate part for connecting one sides of said pair of flat plate parts together, and said apparatus main body is inserted between the basal ends of said pair of flat plate parts.

8. A door opening and closing apparatus according to one of claims 4 through 6, wherein said first arm includes a pair of flat plate parts intersecting with said first turning axis at right angles and a connection plate part for connecting one sides of said pair of flat plate parts together, and said apparatus main body and said guide rod to which said compression elastic body is externally inserted are inserted between said pair of flat plate parts.

9. A door opening and closing apparatus according to one of claims 1 through 8, wherein said apparatus main body is provided with a turning damper mechanism including a rotor turnably disposed at said apparatus main body about said first turning axis, and the basal end of said first arm is non-turnably connected to said rotor, thereby the basal end of said first arm is turnably connected to said apparatus main body through said rotor.

FIG. 1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L2
18
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18c
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FIG. 2

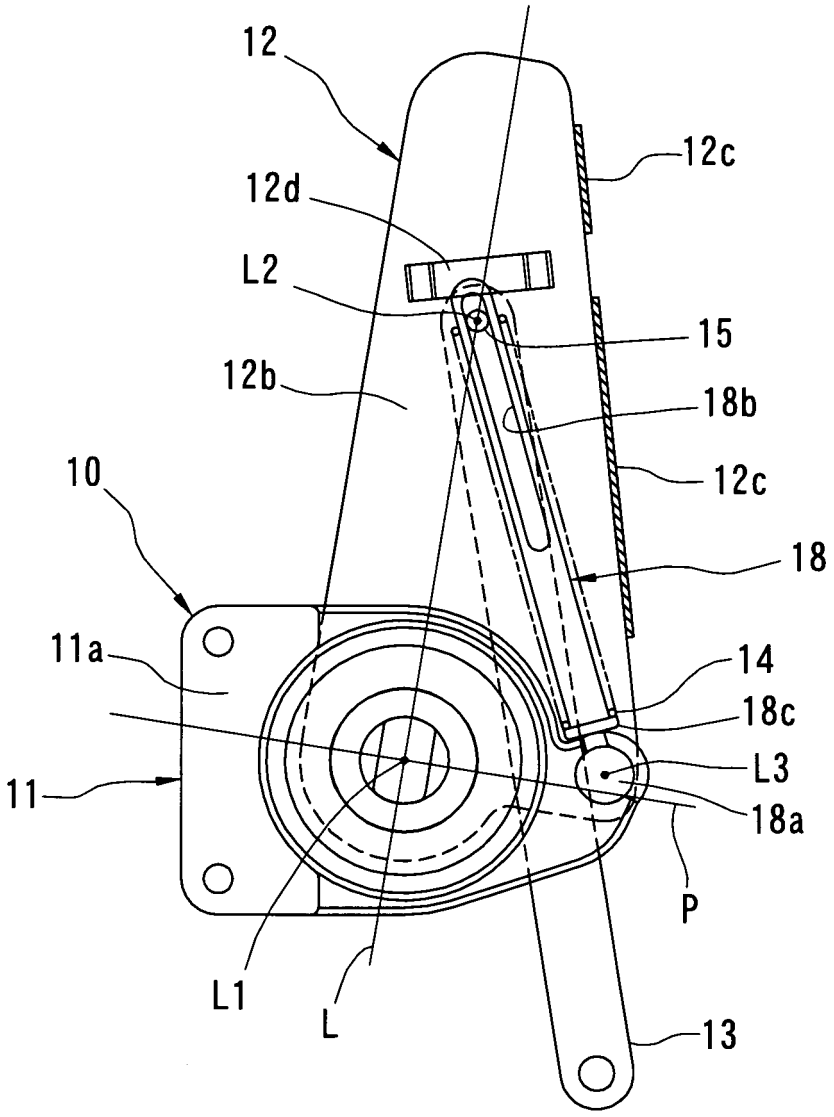

FIG. 3

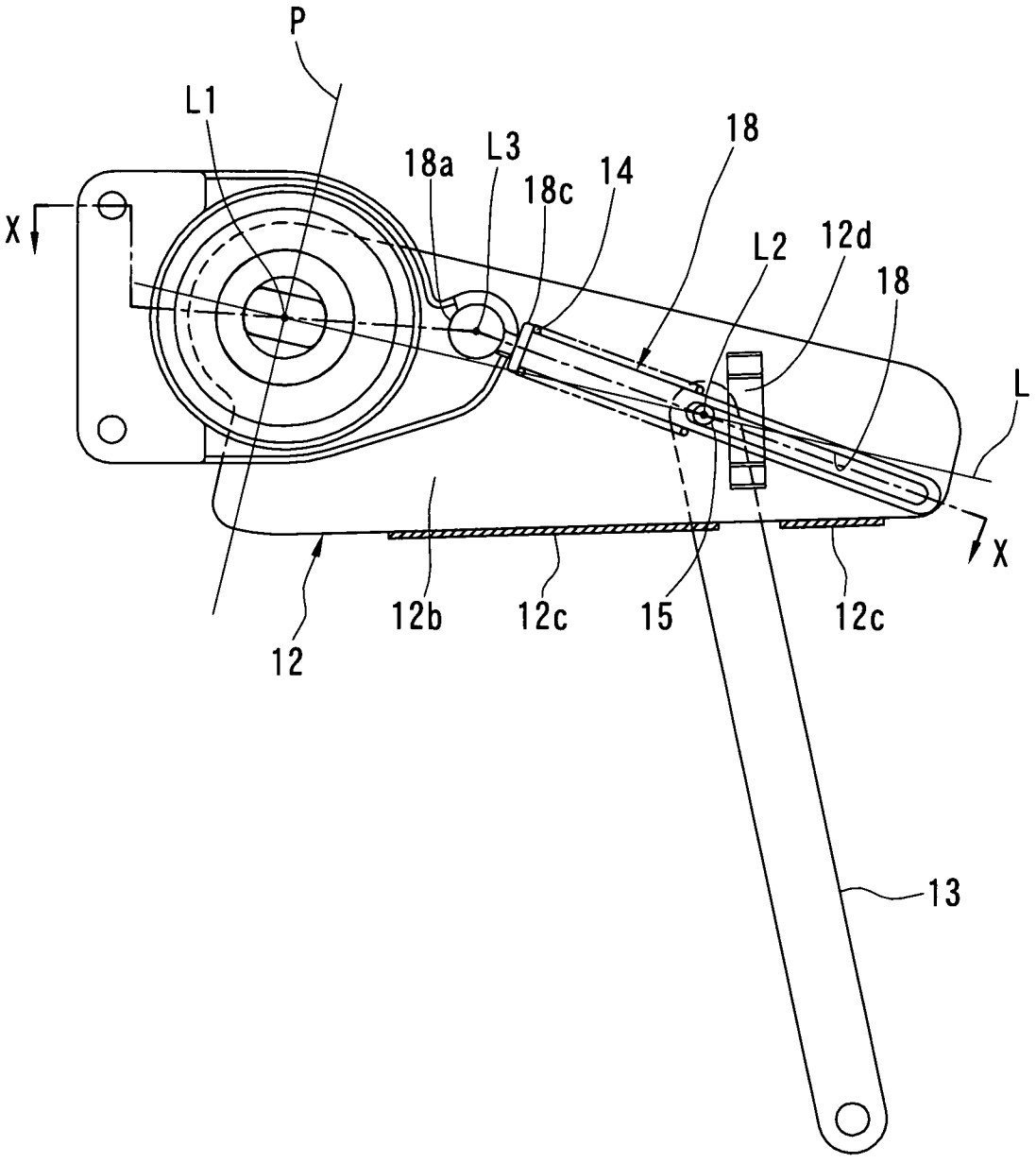

FIG. 4

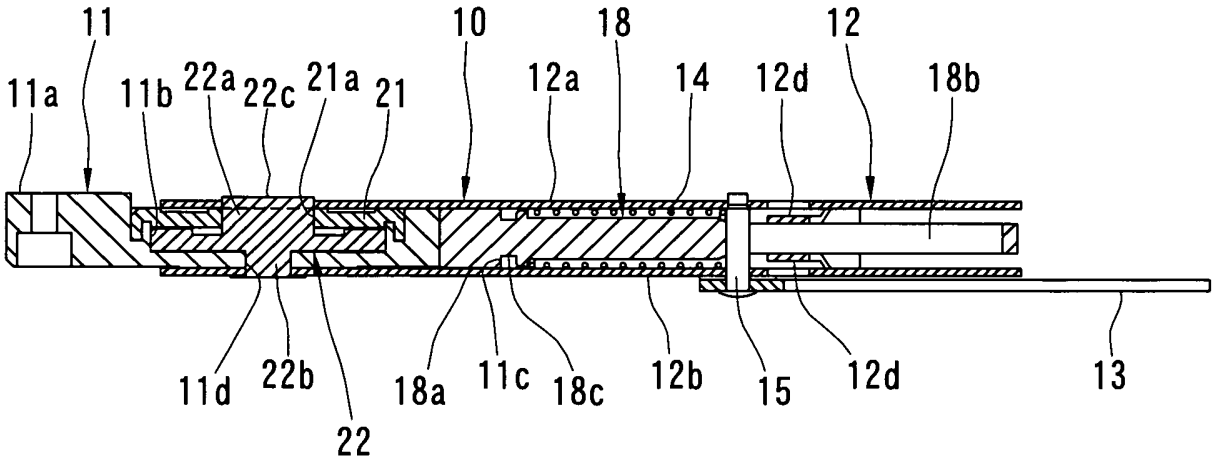
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FIG. 5

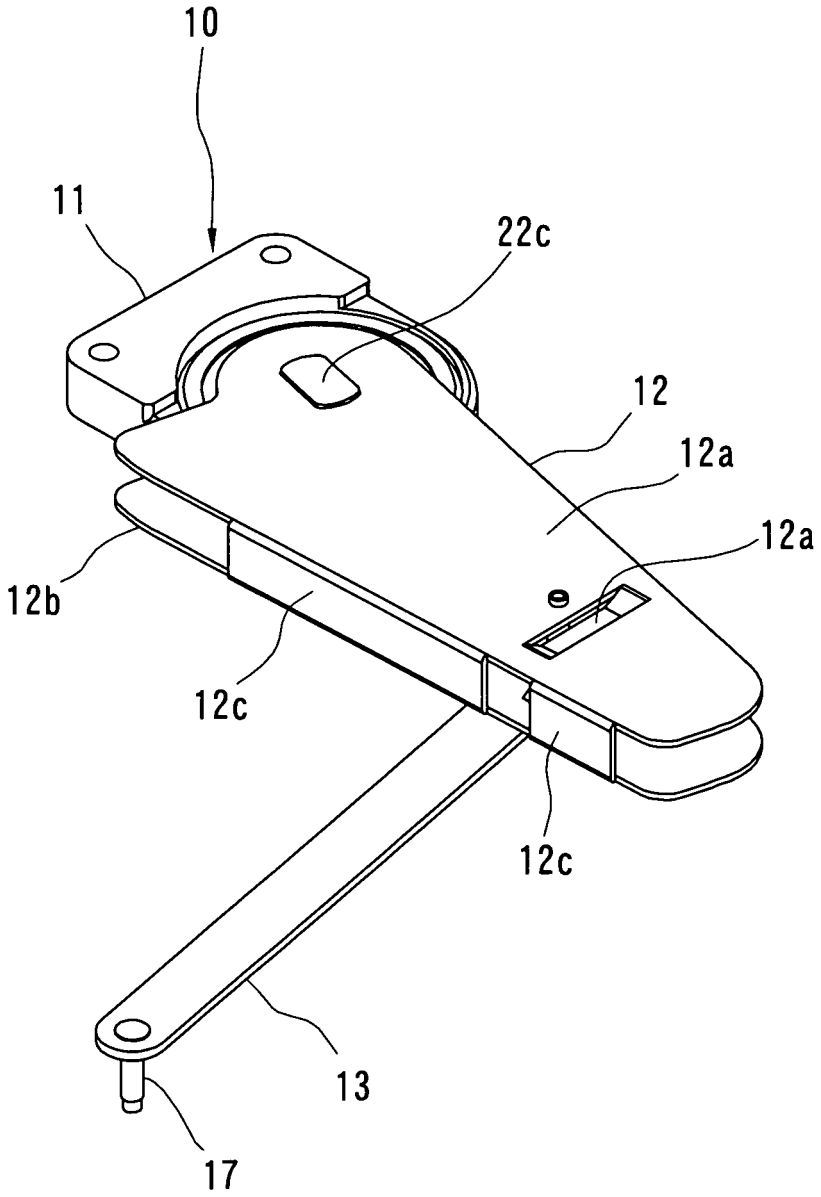
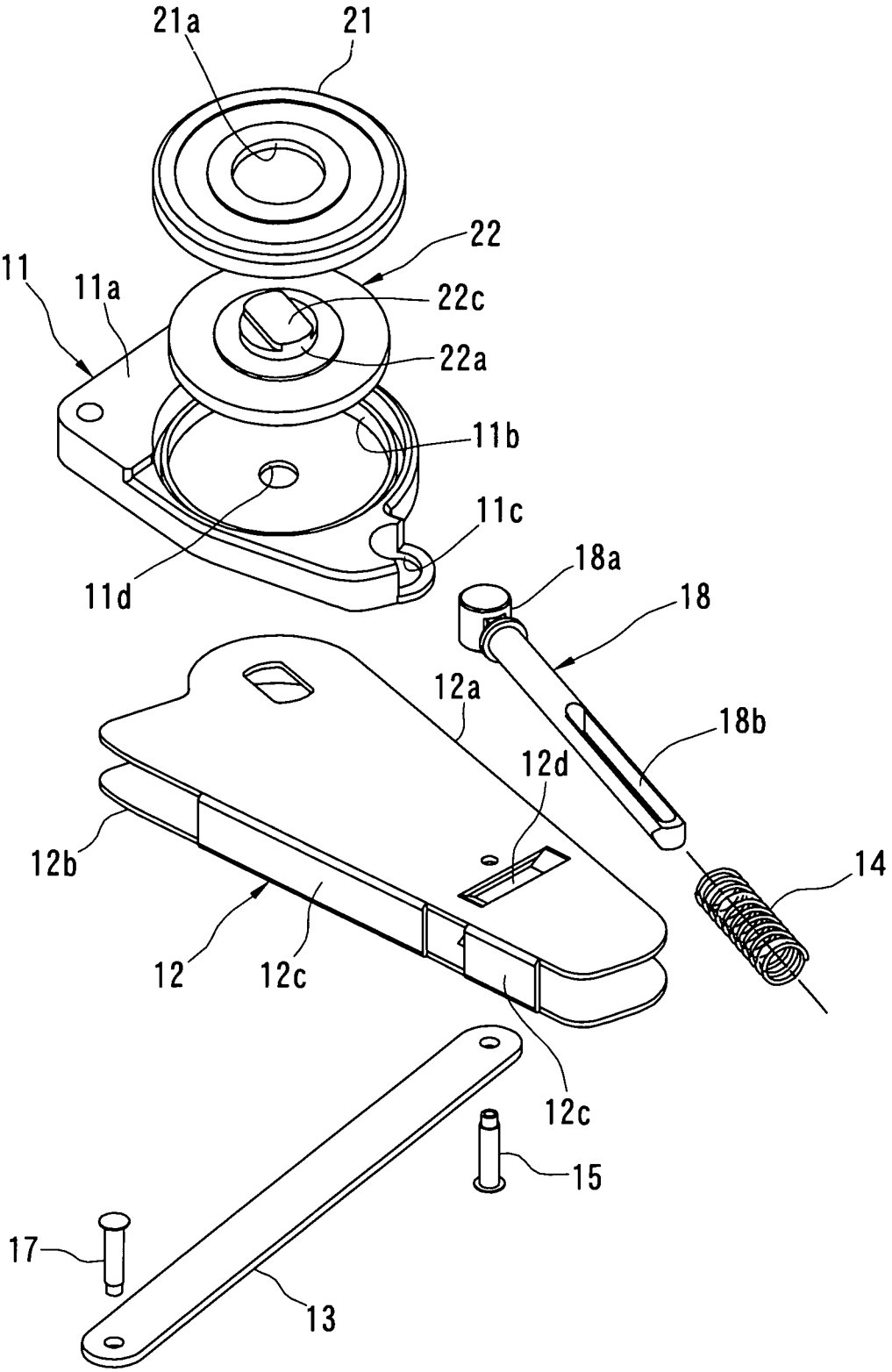


FIG. 6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12c
12c
15
17
13

FIG. 7

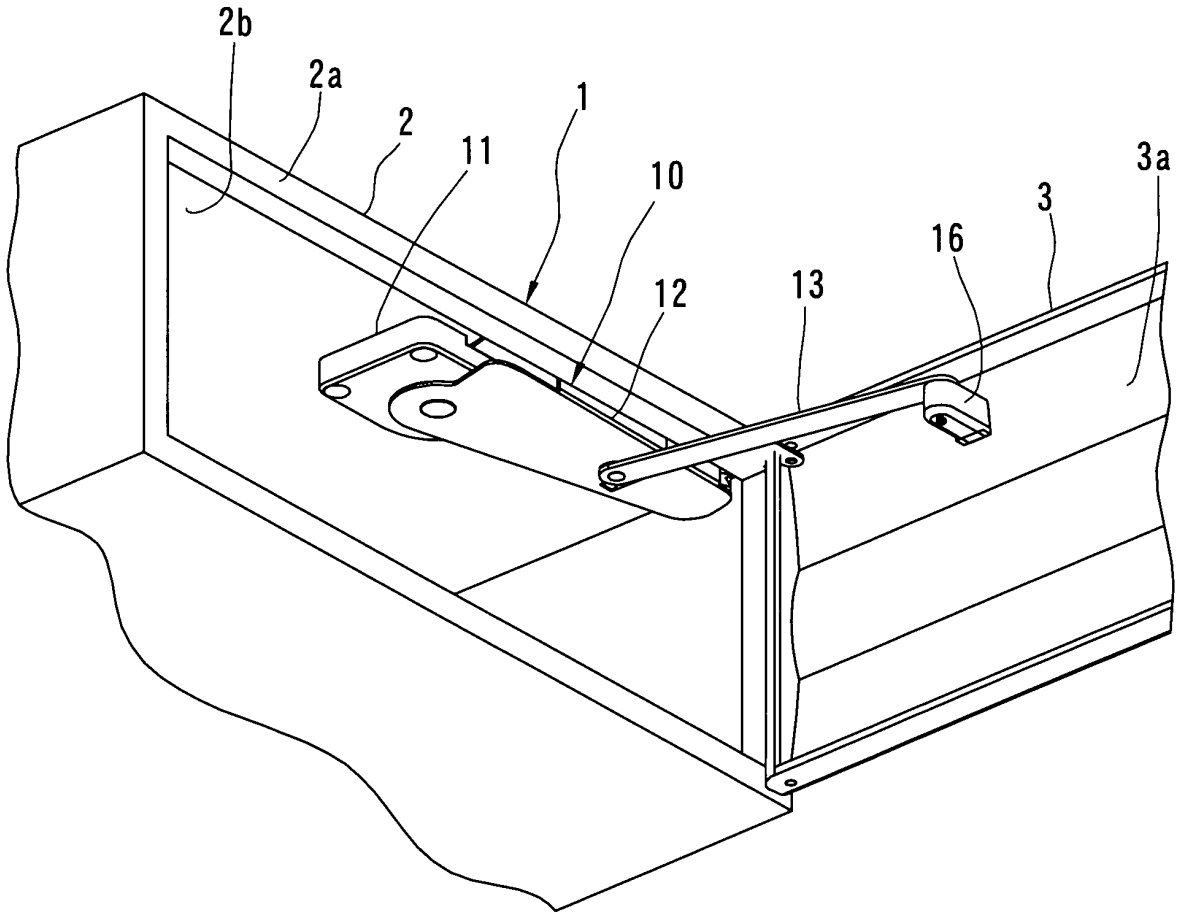
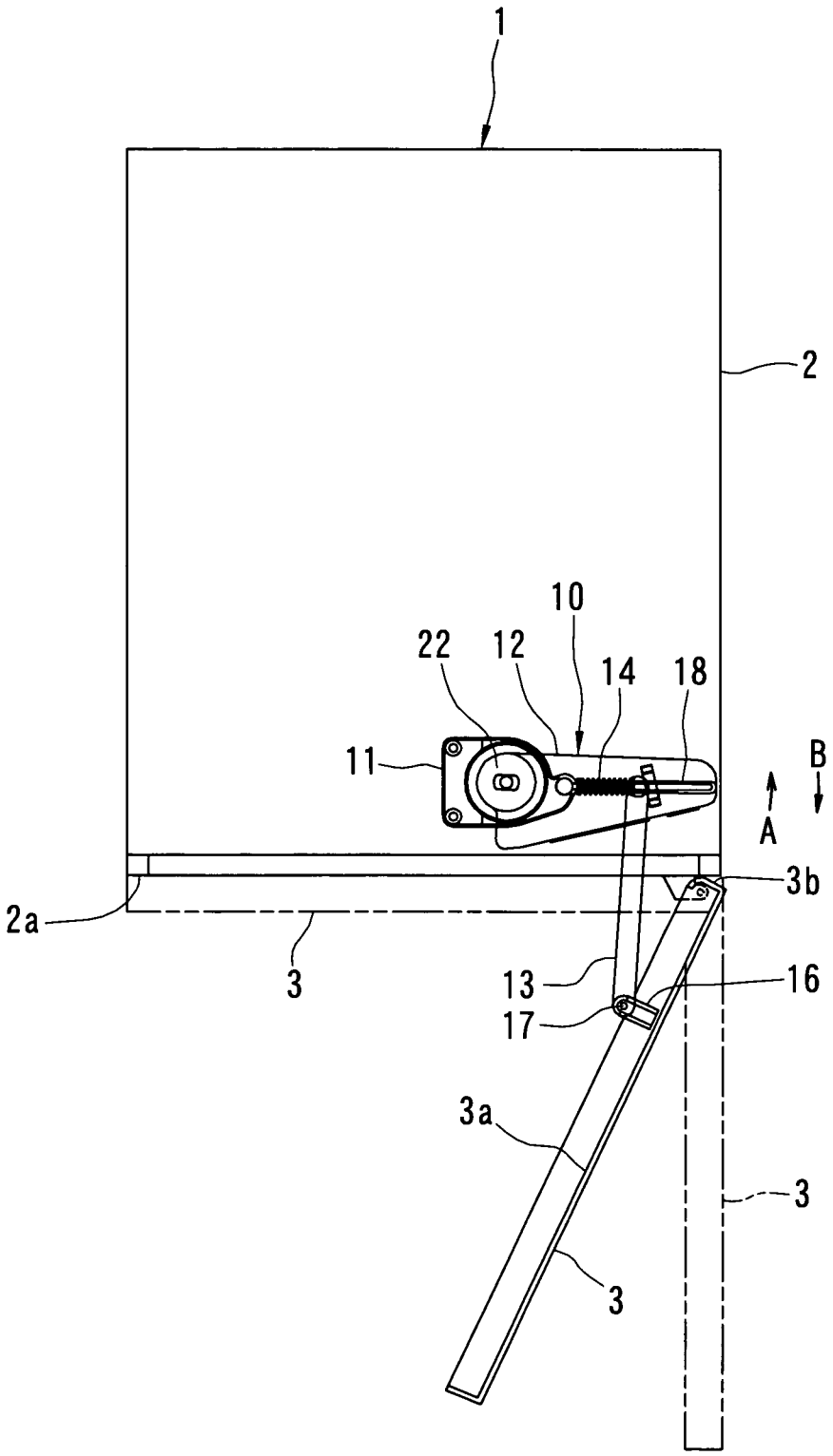


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/301657

A. CLASSIFICATION OF SUBJECT MATTER
E05F1/14(2006.01), ***E05F1/10***(2006.01)

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)
E05F1/14(2006.01), ***E05F1/10***(2006.01), ***E05F1/12***(2006.01), ***E05D7/081***(2006.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2006
Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-27544 A (Sugatsune Kogyo Co., Ltd.), 25 January, 2000 (25.01.00), Claims; Par. No. [0042]; Fig. 1 (Family: none)	1-9
A	JP 2003-129741 A (Kabushiki Kaisha Inaba Seisakusho), 08 May, 2003 (08.05.03), Claims; Par. No. [0048]; Fig. 7 (Family: none)	1-9
A	JP 07-48970 A (Sugatsune Kogyo Co., Ltd.), 21 February, 1995 (21.02.95), Claims; Par. No. [0032]; Fig. 2 (Family: none)	1-9

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
21 April, 2006 (21.04.06)	02 May, 2006 (02.05.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2006/301657

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 03-14278 U (Central Glass Co., Ltd.), 13 February, 1991 (13.02.91), Claims; Fig. 2 (Family: none)	1-9

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H09303037 A **[0002]**