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(71) Applicant: **Sugatsune Kogyo CO., LTD.**  
**Tokyo 101-8633 (JP)**

(72) Inventor: **Kashiwaguma, Kazuaki**  
**Tokyo 101-8633 (JP)**

(74) Representative: **Klunker . Schmitt-Nilson . Hirsch**  
**Patentanwälte**  
**Destouchesstrasse 68**  
**80796 München (DE)**

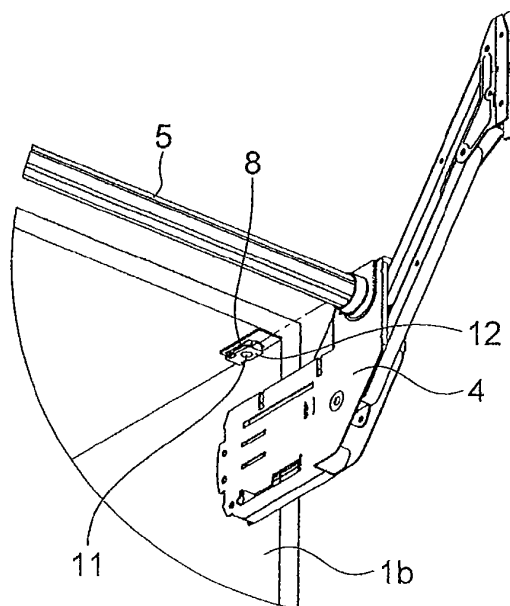
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(54) **Door Opening/Closing Device With Support Member And Support Member For Door Opening/Closing Device**

(57) Provided is a door opening/closing device with a support member capable of positioning the door opening/closing device at a proper position of a housing and facilitating the mounting work of the door opening/closing device to the housing. The door opening/closing device with a support member has the support member 8 which is mountable on a housing 1; and a door opening/closing

device which is mounted on the support member 8 and configured to move a door 2 relative to the housing 1. The support member 8 has a first positioning part 10a for positioning at a front surface of one of an upper plate 1a and a side wall 1b of the housing 1, and a second positioning part 10b which is able to be placed against the other of the upper plate 1a and the side wall 1b of the housing 1.

**FIG.2(b)**



**DETAIL VIEW OF PORTION II**

## Description

### BACKGROUND OF THE INVENTION

#### Field of the Invention

**[0001]** The present invention relates to a door opening/closing device configured to move a door relative to a housing.

#### Related Art

**[0002]** There is known a cabinet of which a door is moved by a door opening/closing devices mounted on an inner surface of a side wall of a housing in order to facilitate the opening and closing operation of the door relative to the housing (see Japanese Patent Application Laid-Open No. 2008-538938 and Japanese Patent Application Laid-Open No. 2004-339906). The door opening/closing device has two links between the housing and the door and serves to determine the attitude of the door when opening and closing the door.

**[0003]** When the mounting position of the door opening/closing device onto the side wall of the housing, the door in the closed state may be displaced from the housing or skewed. In order to solve this problem, the door opening/closing device needs to be mounted at the proper position of the housing. While a measuring rod is used to measure the position of the door opening/closing device, the door opening/closing device is fixed to the side wall of the housing. Or, a positioning part is provided in the door opening/closing device and used to fix the door opening/closing device to the side wall of the housing. With such a work, the door opening/closing device can be mounted at the proper position of the housing.

**[0004]** However, the mounting work while measuring the position of the door opening/closing device is troublesome. If a positioning part is provided in the door opening/closing device, the positioning work is facilitated. However, while the door opening/closing device is mounted on the housing with use of a fastening member such as screw, the door opening/closing device needs to be held continuously so as not to be displaced, and the door opening/closing device may be displaced during this work.

**[0005]** Then, the present invention aims to provide a door opening/closing device with a support member and a support member for a door opening/closing device, the support member being capable of positioning the door opening/closing device at a proper position in the housing and facilitating the mounting work of the door opening/closing device onto the housing.

**[0006]** Further embodiments of the invention are set out in the following numbered paragraphs:

1. A door opening/closing device with a support member comprising:

the support member which is mountable on a housing; and

a door opening/closing device which is mounted on the support member and configured to move a door relative to the housing, wherein the support member has a first positioning part for positioning at a front surface of one of an upper plate and a side wall of the housing or one of a bottom plate and a side wall of the housing, and a second positioning part which is able to be placed against the other of the upper plate and the side wall of the housing or the other of the bottom plate and the side wall of the housing.

2. The door opening/closing device with the support member of paragraph 1, wherein the support member has a plate-shaped body part and an engaging part which is fit to the door opening/closing device, and the first positioning part and the second positioning part are provided on the plate-shaped body part.

3. The door opening/closing device with the support member of paragraph 1 or 2, wherein the engaging part of the support member has an engaging part elongated in one direction, the door opening/closing device has an engaged part which is fit to the engaging part of the support member and is elongated in the one direction, and the door opening/closing device is mounted onto the support member by sliding the door opening/closing device in the one direction relative to the support member.

4. The door opening/closing device with the support member of paragraph 3, wherein in order to position the door opening/closing device relative to the support member in the one direction, one of the engaging part and the engaged part has a positioning projection and the other of the engaging part and the engaged part has a positioning recess for fitting to the positioning projection.

5. The door opening/closing device with the support member of any one of paragraphs 1 to 4, wherein the support member is fixable to a lower surface of the upper plate of the housing or to an upper surface of the bottom plate of the housing with use of a fastening member and the door opening/closing device is fixable to an inner surface of the side wall of the housing with use of a fastening member.

6. A support member for a door opening/closing device for moving a door relative to a housing, wherein the support member is mountable on the housing and comprises a first positioning part for positioning at a front surface of one of an upper plate and a side

wall of the housing or one of a bottom plate and a side wall of the housing, and a second positioning part which is able to be placed against the other of the upper plate and the side wall of the housing or the other of the bottom plate and the side wall of the housing.

#### BRIEF SUMMARY OF THE INVENTION

**[0007]** In order to solve the above-mentioned problems, an aspect of the present invention is a door opening/closing device with a support member comprising: the support member which is mountable on a housing; and a door opening/closing device which is mounted on the support member and configured to move a door relative to the housing, wherein the support member has a first positioning part for positioning at a front surface of one of an upper plate and a side wall of the housing or one of a bottom plate and a side wall of the housing, and a second positioning part which is able to be placed against the other of the upper plate and the side wall of the housing or the other of the bottom plate and the side wall of the housing.

**[0008]** Another aspect of the present invention is a support member for a door opening/closing device for moving a door relative to a housing, wherein the support member is mountable on the housing and comprises a first positioning part for positioning at a front surface of one of an upper plate and a side wall of the housing or one of a bottom plate and a side wall of the housing, and a second positioning part which is able to be placed against the other of the upper plate and the side wall of the housing or the other of the bottom plate and the side wall of the housing.

**[0009]** According to the present invention, the support member is able to be positioned at the proper position in the housing and thereby, the door opening/closing device mounted on the support member is also able to be positioned at the proper position in the housing. Besides, as the door opening/closing device is mounted on the housing via the support member, it is possible to facilitate the mounting work of the door opening/closing device onto the housing.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

**[0010]** The above and other objects and features of the invention will appear more fully hereinafter from a consideration of the following description taken in connection with the accompanying drawing wherein one example is illustrated by way of example, in which;

Figs. 1(a) and 1(b) are perspective views of a shelf on which a door opening/closing device with a support member according to an embodiment of the present invention is mounted (Fig. 1(a) illustrating the door open and Fig. 1(b) illustrating the door

closed);

Figs. 2(a) and 2(b) are process charts of mounting the door opening/closing device with a support member (Fig. 2(a) illustrating the step of mounting a pair of door opening/closing devices connected by a connecting rod on a support member and Fig. 2(b) being a detail view of the portion II of Fig. 2(a));

Fig. 3 is a process chart of mounting the door opening/closing device with a support member (step of fixing the paired door opening/closing devices to the side walls of the housing);

Figs. 4(a) and 4(b) are perspective views of a support member mounted on the housing (Fig. 4(a) is an overall view and Fig. 4(b) is a detail view of the portion IV of Fig. 4(a));

Figs. 5(a) to 5(C) are detail views of a support member (Fig. 5(a) being a perspective view, Fig. 5(b) being a front view and Fig. 5(c) being a side view);

Figs. 6(a) to 6(C) are detail views of another example of the support member (Fig. 6(a) being a perspective view, Fig. 6(b) being a front view and Fig. 6(c) being a side view);

Figs. 7(a) and 7(b) are perspective views illustrating an engaged groove 21 of the door opening/closing device (Fig. 7(a) being a detail view of the portion VII of Fig. 7(b) and Fig. 7(b) being an overall view);

Fig. 8 is a cross sectional view illustrating the engaged part of the door opening/closing device to the engaging part of the support member (cross section orthogonal to the depth direction of the housing);

Figs. 9(a) and 9(b) are cross sectional views of the engaged part of the door opening/closing device which is fit to the engaging part of the support member (cross sectional views taken along the depth direction of the housing, Fig. 9(a) illustrating the engaged part sliding and Fig. 9(b) illustrating the engaged part after being slid);

Fig. 10 is a view illustrating the inside structure of the door opening/closing device;

Figs. 11(a) and 11(b) are exploded perspective views of the paired door opening/closing devices and the connecting rod (Fig. 11(a) being an overall view and Fig. 11(b) being a detail view of the portion XI of Fig. 11(a));

Figs. 12(a) to 12(c) are cross sectional views each illustrating engagement of the connecting rod, joints and rotational shafts (Fig. 12(a) being a cross sectional view taken along the axis line of the rotational shaft, Fig. 12(b) being a cross sectional view taken along the line b-b of Fig. 12(a) and Fig. 12(c) being a cross sectional view taken along the line c-c of Fig. 12(a)); and

Figs. 13(a) and 13(b) are perspective views of a shelf on which a door opening/closing device with a support member according to a second embodiment of the present invention is mounted (Fig. 13(a) illustrating the door open and Fig. 13(b) illustrating the door closed).

## DETAILED DESCRIPTION OF THE INVENTION

**[0011]** With reference to the drawings, a door opening/closing device with a support member according to an exemplary embodiment of the present invention will be described in detail below. The door opening/closing device with a support member is mounted on a housing 1 of furniture such as a cupboard in such a manner that a door can open and close relative to the housing 1. The housing 1 is open in a front surface and this opening is closed by the door 2 indicated by the chain double-dashed line in Fig. 1(a). Fig. 1(a) illustrates the door 2 open and Fig. 1(b) illustrates the door 2 closed.

**[0012]** The door 2 has a door knob (not shown) so that a person moves the door 2 upward to open the door 2 and downward to close the door 2. In order to open a heavy door 2 by a small force, the door opening/closing device 4 has a built-in spring for generating a force to assist the opening operation of the door 2. Besides, in order to attenuate the impact when opening and closing the door 2, the door opening/closing device 4 is provided with a damper for damping the opening and closing operations of the door 2. When opening and closing the door 2, the door 2 moves upward and downward while keeping its own attitude approximately in parallel with the housing 1. In order to parallel movement of the door 2, the door opening/closing device 4 has two links (auxiliary arm 6 and arm 7) that are approximately in parallel with each other and equal in length. The detailed structure of the door opening/closing device 4 will be described later.

**[0013]** The housing 1 is formed like a box and has an upper plate 1a, a pair of (left and right) side walls 1b, bottom plate 1c and a back plate 1d. On inner surfaces of the left and right side walls 1b of the housing 1, a pair of left and right door opening/closing device 4 is mounted, respectively. In order to synchronize the operations of the door opening/closing devices 4, the paired door opening/closing device 4 are connected by a connecting rod 5 as a connecting member.

**[0014]** As illustrated in Figs. 2(a) and 2(b), when mounting the paired door opening/closing devices 4 on the respective side walls 1b of the housing 1, the door opening/closing devices 4 are first connected to each other by the connecting rod 5, and then, the door opening/closing devices 4 in a connected state are mounted on the housing 1. Left and right support members 8 in a pair are mounted at corner portions of the upper plate 1a. Each support member 8 has a through hole 11 for inserting a fastening member 15 such as a screw (see Fig. 4). The support member 8 is fixed to the lower surface of the upper plate 1a by the fastening member 15. In the support member 8, an engaging part 12 is formed which has an inverted T shaped cross section. Each door opening/closing device 4 has a groove-shaped engaged part 21 formed therein for fitting the engaging part 12 (see Fig. 6). The detailed structure of the support member 8 will be described later.

**[0015]** The paired door opening/closing devices 4 are

mounted on the housing in the following manner. First, a worker fixes the left and right support members 8 to the lower surface of the upper plate 1a of the housing 1 with use of a fastening member such as a screw. At this time, the worker positions the support members 8 in such a manner that the front surface side of each of the support members 8 is flush with the front surface of the upper plate 1a (arranged in the same plane) and the side surface side of the support member 8 abuts to the side wall 1b. Then, the worker takes with both hands the door opening/closing devices 4 in pair which are already connected to each other by the connecting rod 5, fit the engaged part 21 of each of the door opening/closing devices 4 to the engaging part 12 of the support member 8 and slides the door opening/closing devices 4 in one direction (in the depth direction of the housing 1). Then, the paired door opening/closing devices 4 are mounted on the paired support members 8. When the door opening/closing devices 4 are mounted on the support members 8, the door opening/closing devices 4 are positioned at the proper positions of the housing 1. After that, as shown in Fig. 3, the worker fixes the door opening/closing devices 4 to the inner surfaces of the side walls 1b of the housing 1 by the fastening members 13 such as screws. In each of the door opening/closing devices 4, for example, two through holes 22 are formed for inserting the two fastening members 13. After being fixed to the side walls 1b, the door opening/closing devices 4 are covered with dressing covers.

**[0016]** According to the present embodiment, when fixing the door opening/closing devices 4 to the side walls 1b of the housing 1 with use of the fastening members 13, the paired door opening/closing devices 4 are supported by the paired support members 8. Therefore, the paired door opening/closing devices 4 can be prevented from falling down even if they get off the worker's hands and the screwing work can be performed by one worker. On the other hand, if the door opening/closing devices 4 are directly mounted on the housing 1 without the support members 8, the worker has to keep holding one door opening/closing device 4 while screwing the door opening/closing device 4 to the side wall of the housing 1. Therefore, the screwing work is difficult.

**[0017]** The structure of the support member 8 is described below. As illustrated in Figs. 4(a) and 4(b), the paired support members 8 are mounted at the respective corner portions of the upper plate 1a of the housing 1. Each support member 8 has a plate-shaped body part 10 and the engaging part 12 that juts from the body part 10 downward. The support member 8 has a through hole 11 that passes through vertically in Fig. 4(b) so as to be fixed to the lower surface of the upper plate 1a by the fastening member 15 such as a screw.

**[0018]** The body part 10 is formed like a rectangular plate. This body part 10 serves to position the support member 8 relative to the housing 1. Specifically, one front-side side (first positioning part) 10a of the body part 10 is positioned to be flush with the front surface of the

upper plate 1a of the housing 1. As this one side 10a is positioned to be flush with the front surface of the upper plate 1a of the housing 1, the support member 8 can be positioned in the depth direction of the housing 1. Besides, one lateral-side side 10b (second positioning part) of the body part 10 is placed to abut against the side wall 1b in such a manner that the support member 8 is in parallel with the side wall 1b. The front-side side 10a and the lateral-side side 10b of the body part 10 form a right angle. As the lateral-side side 10b of the body part 10 abuts to the side wall 1b of the housing 1, the support member 8 is positioned in the horizontal direction of the housing 1. Needless to say, the support member 8 is positioned in the vertical direction of the housing 1 by attaching the body part 10 to the lower surface of the upper plate 1a.

**[0019]** Here, as far as the support member 8 can be positioned relative to the housing 1, the front-side side 10a and the lateral-side side 10b of the body part 10 need not be formed linearly. For example, a recess may be formed in the front-side side 10a of the body part 10, or the front-side side 10a may be formed protruding. Or, a plurality of jutting parts may be formed in the lateral-side side 10b of the body part 10 so that the jutting parts can abut against the side wall 1b. With these plural jutting parts, the support member 8 can be positioned in parallel with the side wall 1b.

**[0020]** Figs. 5(a) to 5(c) are detail views of the support member 8. The engaging part 12 having an inverted T shaped cross section juts downward from the body part 10 of the support member 8. The engaging part 12 extends in one direction (depth direction of the housing 1) while it keeps the inverted T shaped cross section. As illustrated in the perspective view of Fig. 5(a), the front end of the engaging part 12 is pointed toward its tip end so as to facilitate fitting of the engaged part 21 of the door opening/closing device 4. As illustrated in the front view of Fig. 5(b), when seen from the front side, the engaging part 12 is provided with an overhanging part 12a that overhangs left and right. In the upper surface of the overhanging part 12a, a positioning projection 12a1 is provided protruding upward. The horizontal size of the overhanging part 12a is smaller than the horizontal size of the body part 10. The support members 8 are provided symmetrical with respect to the center line in the horizontal direction and the size S from the end in the horizontal direction of the overhanging part 12a to the end of the body part 10 in the horizontal direction is equal at both ends in the horizontal direction. Accordingly, the left and right support members provided at respective left and right corners of the upper plate 1a of the housing 1 may be used interchangeably. As illustrated in the side view of Fig. 5(c), the overhanging part 12a provided with the positioning projection 12a1 is formed thinner than the other part so that it can be deformed.

**[0021]** Figs. 6(a) to 6(c) illustrate another example of the support member 8. The support member 51 of this example has a body part 52 which is bent into L shape.

The structure of the engaging part 12 is the same as that of the support member shown in Fig. 5, and it is denoted by the like reference numeral and its explanation is omitted here. As illustrated in Fig. 6(a), the L-shaped body part 52 has a front end 52a bent upward. The back side 52a1 of this front end 52a abuts to the front surface of the upper plate 1a of the housing. As the back side 52a1 of the front end 52a is flush with the front surface of the upper plate 1a of the housing, the support member 8 is positioned in the depth direction. Besides, one side 52b at the side surface side of the body part 52 is made to abut against the side wall 1b of the housing 1 thereby to position the support member 8 in the horizontal direction of the housing 1.

**[0022]** Figs. 7(a) and 7(b) illustrates the engaged part 21 of the door opening/closing device 4 for fitting the engaging part 12 of the support member 8. In each of the door opening/closing devices 4, the engaged part 21 is formed which is an inverted T shaped groove conforming to the cross sectional shape of the engaging part 12 of the support member 8. The groove of the engaged part 21 extends in one direction (in the depth direction of the housing 1) while keeping the inverted T shape cross section. In the lower surface of an upper wall that defines the engaged part 21, a positioning recess 22a is formed.

**[0023]** Fig. 8 illustrates the engaged part 21 of the door opening/closing device 4 fit to the engaging part 12 of the support member 8. Fig. 8 is a cross sectional view taken along the direction perpendicular to the depth direction of the housing 1. As illustrated in Fig. 8, the engaging part 12 of the support member 8 has an inverted T shaped cross section, the engaged part 21 of the door opening/closing device 4 has a reversed T shaped cross section and, which shapes are approximately in agreement with each other so that the engaging part 12 and the engaged groove 21 fit to each other. When the engaged part 21 of the door opening/closing device 4 is fit to the engaging part 12 of the support member 8, the door opening/closing device 4 is positioned relative to the support member 8 in the front direction and vertical direction of the housing 1. The door opening/closing device can be mounted on the support member 8 by fitting the engaged part 21 of the door opening/closing device 4 to the engaging part 12 of the support member 8 and then sliding the door opening/closing device 4 in the depth direction of the housing 1. Therefore, the mounting work of the door opening/closing device 4 onto the support member 8 can be facilitated.

**[0024]** Figs. 9(a) and 9(b) are cross sectional views of the engaging part 12 of the support member 8 and the engaged part 21 of the door opening/closing device 4, taken along the depth direction of the housing 1. Fig. 9(a) illustrates the door opening/closing device 4 that has just started sliding and Fig. 9(b) illustrates the door opening/closing device 4 that has finished sliding. As illustrated in Fig. 9(a), the positioning projection 12a1 is formed in the upper surface of an overhanging part 12a of the support member 8. The overhanging part 12a in which

the positioning projection 12a1 is formed is formed partially thin. When inserting the positioning projection 12a1 of the support member 8 into the engaged part 21 of the door opening/closing device 4, the thin part is deformed in the vertical direction. With this deformation, the overhanging part 12a of the support member 8 can be inserted into the engaged part 21 of the door opening/closing device 4.

**[0025]** As illustrated in Fig. 9(b), once the door opening/closing device 4 has finished sliding relative to the support member 8, the positioning projection 12a1 of the support member 8 returns into its original shape by the resilient restoration action and is fit in the positioning recess 22a of the door opening/closing device 4 so that the door opening/closing device 4 can be positioned relative to the support member 8 in the depth direction of the housing 1. With this positioning, the door opening/closing device 4 is prevented from getting out of the support member 8. The support member 8 is positioned in the front direction and depth direction relative to the housing 1 by the body part 10 of the support member 8. Besides, as the door opening/closing device 4 is positioned in the depth direction of the housing 1 relative to the support member 8, the door opening/closing device 4 can be positioned at the proper position relative to the housing 1.

**[0026]** Fig. 10 illustrates the inside structure of the door opening/closing device 4. The door opening/closing device 4 has, as fundamental elements, a body part 31 which is mounted on the housing 1, two links (arm 7 and auxiliary arm 6) which are in parallel with each other and mounted rotatable on the body part 31, and a connecting member 32 which is fixed to the door 2. The arm 7 and auxiliary arm 6 have respective one ends in the longitudinal direction, which are fixed to the body part rotatable. The other ends are fixed rotatable to the connecting member 32. The body part 31, arm 7, auxiliary arm 6 and connecting member 32 form a parallel motion mechanism such that the door 2 moves approximately in parallel with the housing 1. Needless to say, the door 2 may not be in parallel as far as the attitude of the door 2 is stable during the opening and closing operations.

**[0027]** The arm 7 is connected to a running member 34 via a link arm 33. As the arm 7 rotates, the running member 34 moves linearly in the left and right direction in Fig. 10. The running member 34 is biased in one direction by a coil spring 35 and when the door 2 in the closed state gets open and the link arm 33 goes beyond the change point, the coil spring 35 gives the door 2 a biasing force in the closing direction. This force assists the opening and closing operations of the door 2.

**[0028]** On an upper part of the running member 34, a damper 36 is provided for attenuating the impact which is generated by opening the door 2. The damper 36 may be a linear damper using viscous fluid or a friction damper using friction. On a lower part of the running member 34, a damper 37 is provided for attenuating the impact which is generated by closing the door 2. This damper 37 may be also a linear damper or friction damper.

**[0029]** On the connecting member 32, a door-side mounting piece 38 fixed to the door 2 is mounted detachably. The door-side mounting piece 38 has a built in lever 39 which is biased by a coil spring (not shown). The lever 39 is configured to be movable vertically relative to the door-side mounting piece 38. When the door-side mounting piece 38 is attached to or detached from the connecting member 32, the lever 39 moves upward or downward automatically so as to enable mounting of the door 2 through one-touch operation.

**[0030]** Figs. 11(a) and 11(b) are exploded perspective views of the connecting rod 5 and paired door opening/closing devices 4. The auxiliary arm 6 of the door opening/closing device 4 has a rotational shaft 41, which protrudes from the body part 31. This rotational shaft 41 rotates together with the auxiliary arm 6. The rotational shaft 41 has an tip end 41a which has a rectangular cross section. Between the connecting rod 5 and the rotational shaft 41, a joint 42 is provided. The joint 42 has a cylindrical body part 42a and, for example, four protrusions 42b that protrude from the body part 42a toward the connecting rod 5. The body part 42a has a rectangular hole 42a1 formed therein (see Fig. 12(b)). The body part 42a is fit to the tip end 41a of the rotational shaft 41 and rotates together with the rotational shaft 41. In the body part 42a, a screw hole 42a2 is formed for screwing a stop screw 44. As illustrated in Fig. 11(a), the rotational shaft 41 is fit to the body part 42a of the joint 42 and the stop screw 44 is screwed to abut to the rotational shaft 41, thereby connecting the joint to the rotational shaft 41 unrotatably.

**[0031]** At an axial end of the connecting rod 5, four recesses 5a are formed for fitting the four protrusions 42b of the joint 42 thereinto (see Fig. 12(c)). As the projections 42b of the joint 42 are fit into the recesses 5a of the connecting rod 5, the connecting rod 5 rotates together with the joint 42. The joint 42 is provided at each end of the connecting rod 5 and the connecting rod 5 is prevented from getting out of the joint 42. The axial length of the connecting rod 5 is determined in accordance with the distance between the paired side walls 1b of the housing 1 and the horizontal size between the door opening/closing devices 4. Here, the connecting rod 5 of this embodiment is configured to be detachable after the door opening/closing devices 4 are mounted on the housing 1.

**[0032]** Figs. 13(a) and 13(b) are perspective views of a door opening/closing device with a support member according to the second embodiment of the present invention. Fig. 13(a) illustrates the door 2 open and Fig. 13(b) illustrates the door 2 closed. The door opening/closing device with a support member according to the second embodiment is different from that of the first embodiment in that the paired, left and right, door opening/closing devices are not connected by the connecting rod. Other elements are the same as those in the first embodiment. For example, the support 8 is mounted on the housing 1 and the door opening/closing device 4 is mounted on the support member 8 like in the first embodiment. Therefore, the like elements are denoted by the like reference nu-

merals and their explanation is omitted. When the horizontal size of the housing 1 is small, the connecting rod needs not be provided between the paired door opening/closing devices 4.

**[0033]** The present invention is not limited to the above-described embodiment and may be embodied in various modified forms without departing from the scope of the present invention. For example, the support member is not limited to be mounted on the upper plate of the housing, but may be mounted on a side plate of the housing. In addition, the support member may be mounted at a corner of the bottom plate of the housing for positioning at the bottom plate and the side wall. Further, the door opening/closing device may be slid in the vertical direction thereby to be mounted on the support member. Furthermore, the support member may be formed like a hook so that the door opening/closing device can be hooked and mounted on the support members.

**[0034]** The step of mounting the door opening/closing device on the side wall of the housing by a fastening member such as a screw may be omitted. When the door is light or door front is narrow, the door opening/closing device may be supported only by the support member.

**[0035]** The structure of the door opening/closing device is not limited to those according to the above-described embodiment as far as the attitude of the door is fixed. For example, a door opening/closing device may be used which has one link mounted rotatable on the housing, a slider sliding relative to the one link and a door mounted rotatable on the slider (see International Publication No. WO2010/097996).

**[0036]** The present invention is not limited to the above described embodiments, and various variations and modifications may be possible without departing from the scope of the present invention.

**[0037]** This application is based on the Japanese Patent application No. 2011-166256 filed on July 29, 2011, entire content of which is expressly incorporated by reference herein.

## Claims

1. A support member for a door opening/closing device for moving a door relative to a housing, wherein the support member is mountable on the housing and comprises a first positioning part for positioning at a front surface of one of an upper plate and a side wall of the housing or one of a bottom plate and a side wall of the housing, and a second positioning part which is able to be placed against the other of the upper plate and the side wall of the housing or the other of the bottom plate and the side wall of the housing.
2. A door opening/closing device with a support member of claim 1 comprising:

a door opening/closing device which is mounted on the support member and configured to move a door relative to the housing.

3. The door opening/closing device with the support member of claim 2, wherein the support member has a plate-shaped body part and an engaging part which is fit to the door opening/closing device, and the first positioning part and the second positioning part are provided on the plate-shaped body part.
4. The door opening/closing device with the support member of claim 2 or 3, wherein the engaging part of the support member has an engaging part elongated in one direction, the door opening/closing device has an engaged part which is fit to the engaging part of the support member and is elongated in the one direction, and the door opening/closing device is mounted onto the support member by sliding the door opening/closing device in the one direction relative to the support member.
5. The door opening/closing device with the support member of claim 4, wherein in order to position the door opening/closing device relative to the support member in the one direction, one of the engaging part and the engaged part has a positioning projection and the other of the engaging part and the engaged part has a positioning recess for fitting to the positioning projection.
6. The door opening/closing device with the support member of any one of claims 2 to 5, wherein the support member is fixable to a lower surface of the upper plate of the housing or to an upper surface of the bottom plate of the housing with use of a fastening member and the door opening/closing device is fixable to an inner surface of the side wall of the housing with use of a fastening member.

FIG.1(a)

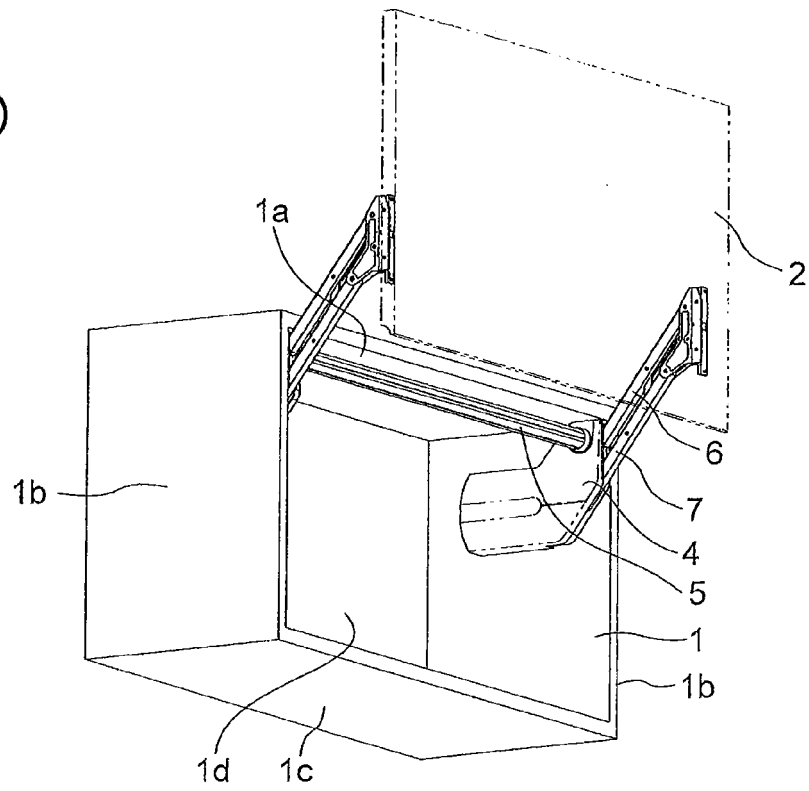


FIG.1(b)

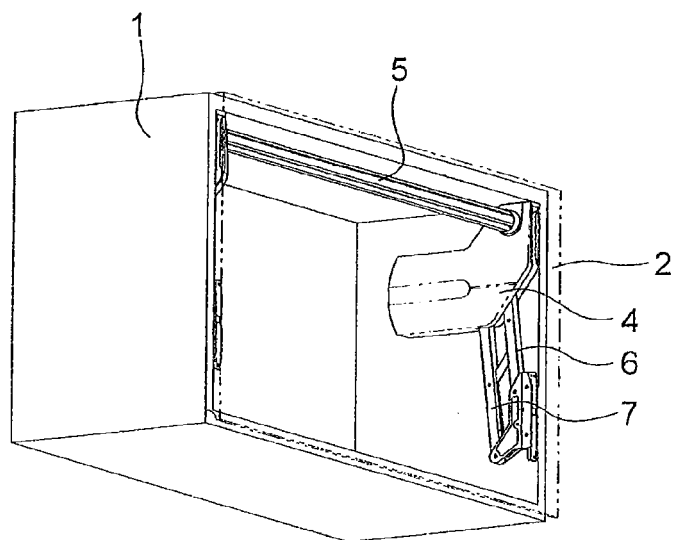


FIG.2(a)

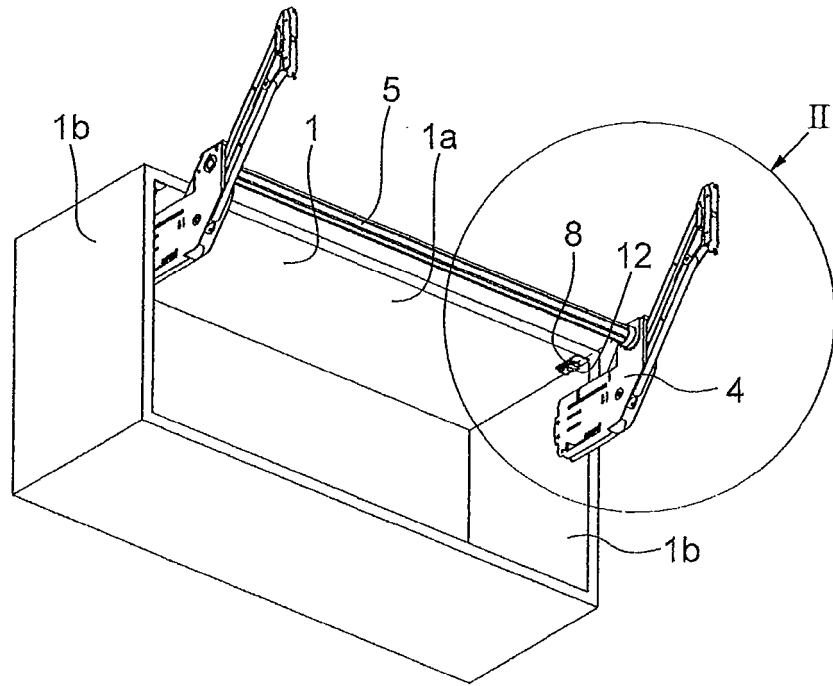
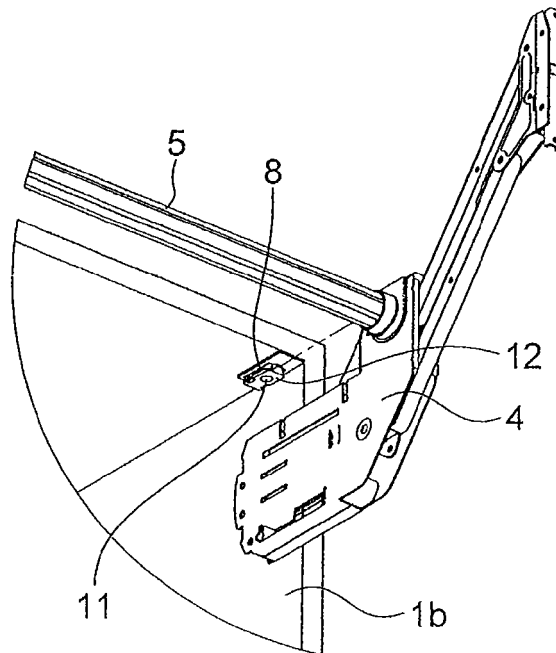


FIG.2(b)



DETAIL VIEW OF PORTION II

FIG.3

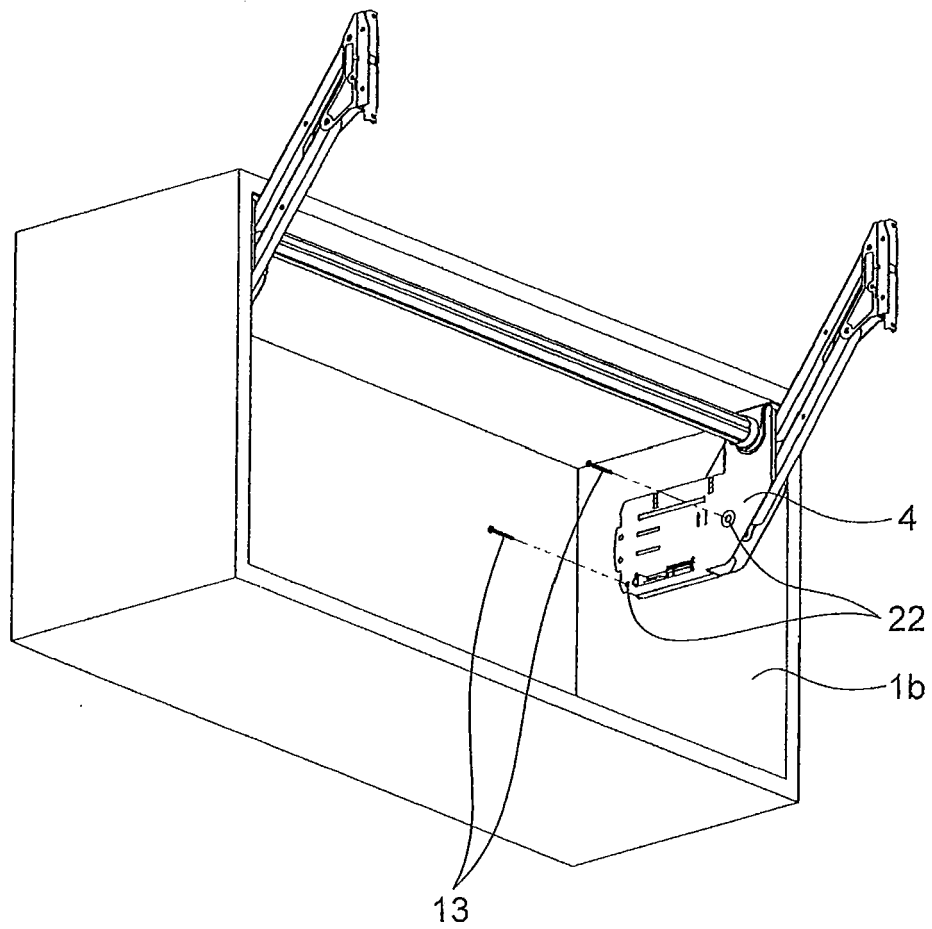


FIG.4(a)

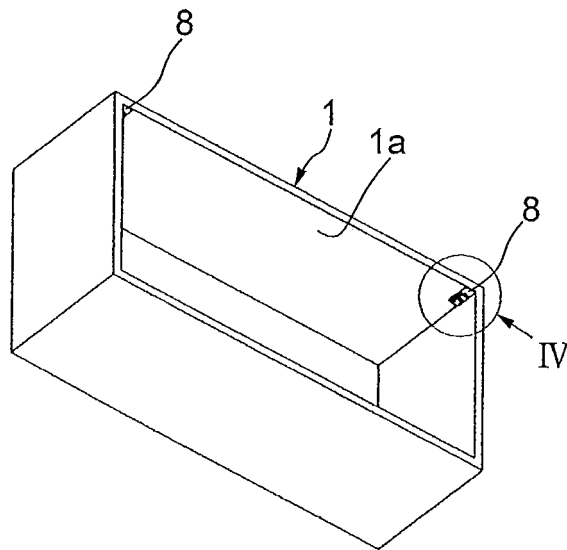
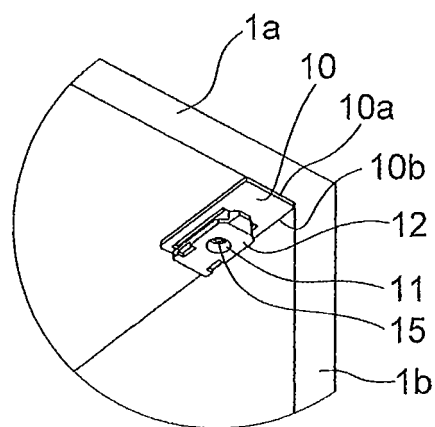


FIG.4(b)



DETAIL VIEW OF PORTION IV

FIG.5(a)

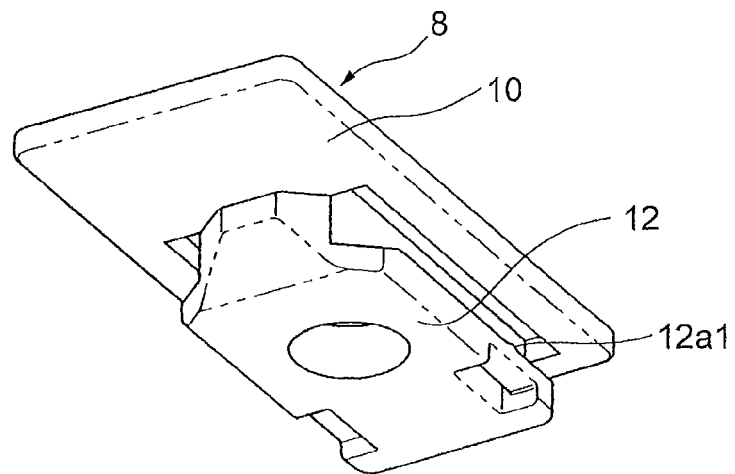


FIG.5(b)

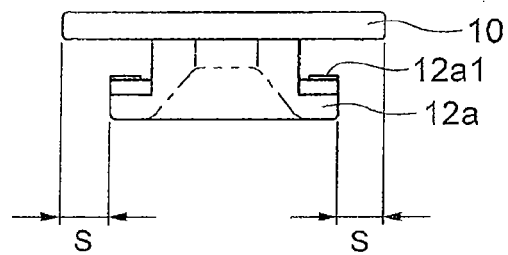


FIG.5(c)

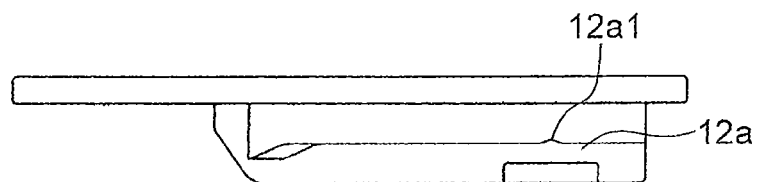


FIG.6(a)

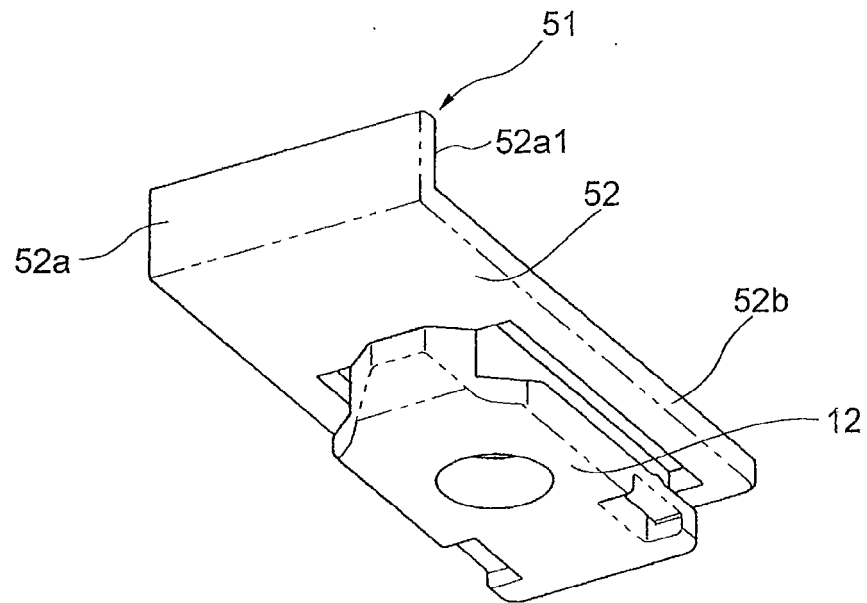


FIG.6(b)

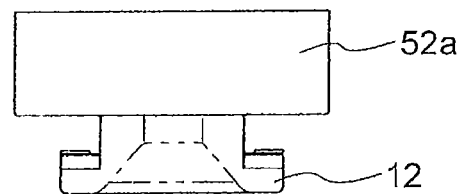


FIG.6(c)

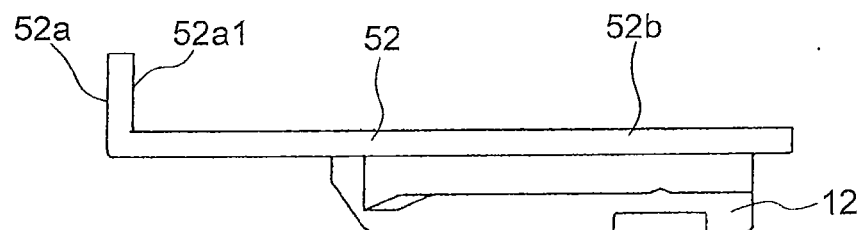
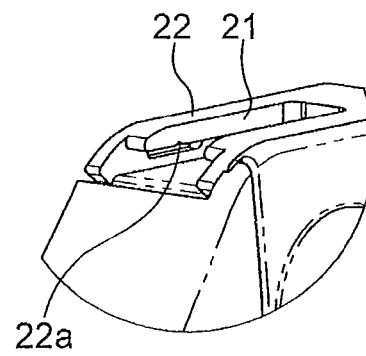


FIG.7(a)



DETAIL VIEW OF PORTION VII

FIG.7(b)

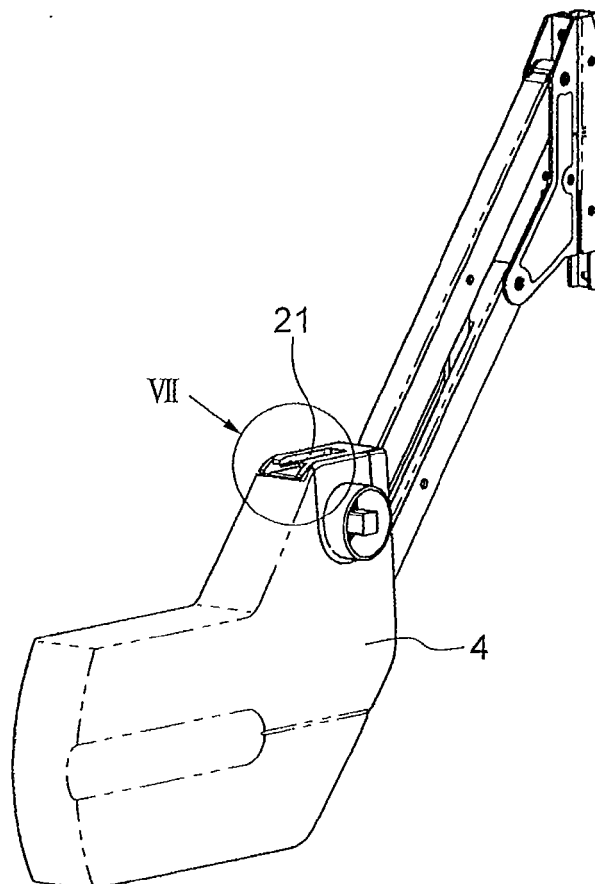


FIG.8

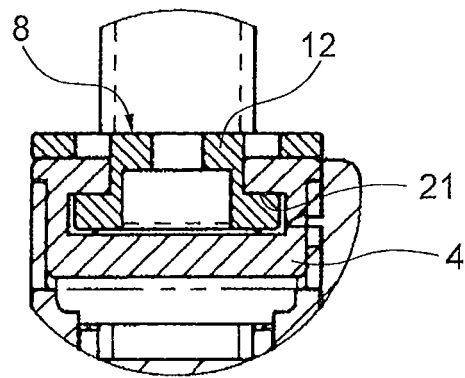


FIG.9(a)

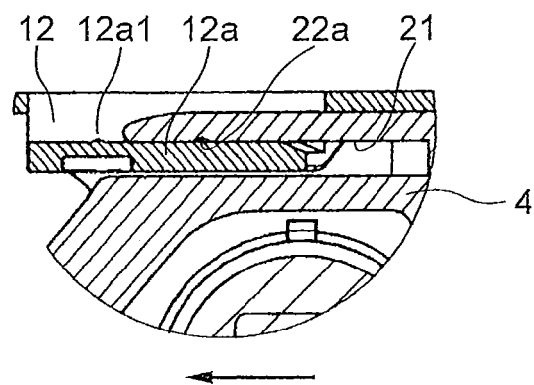


FIG.9(b)

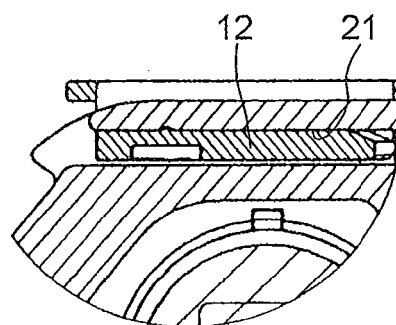


FIG.10

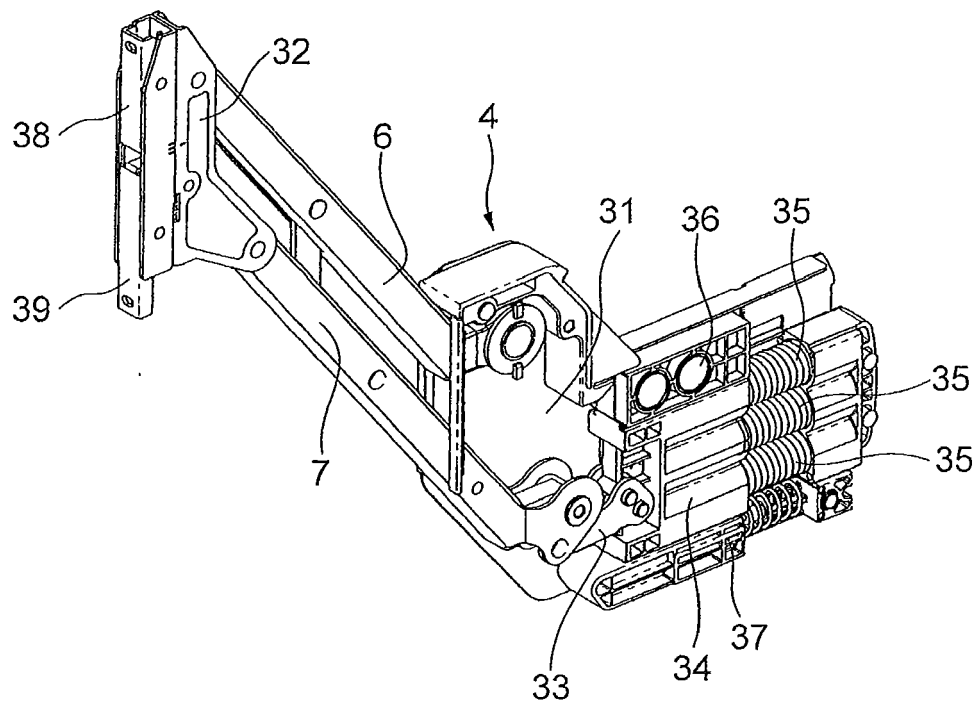


FIG.11(a)

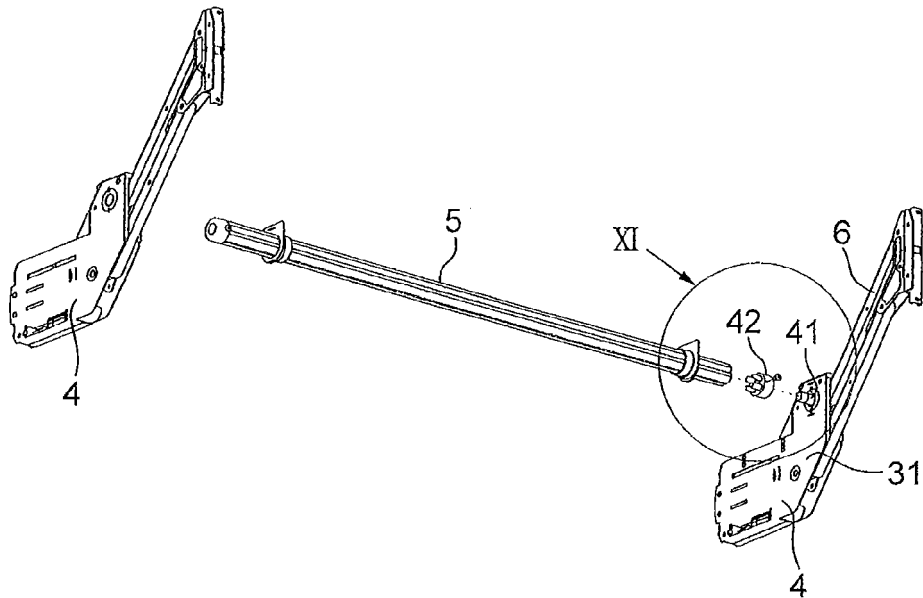
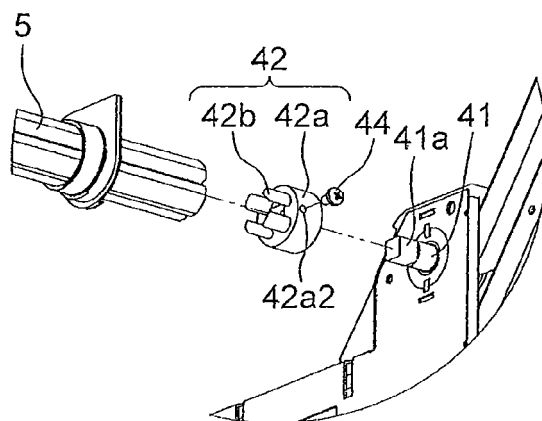


FIG.11(b)



DETAIL VIEW OF PORTION XI

FIG.12(a)

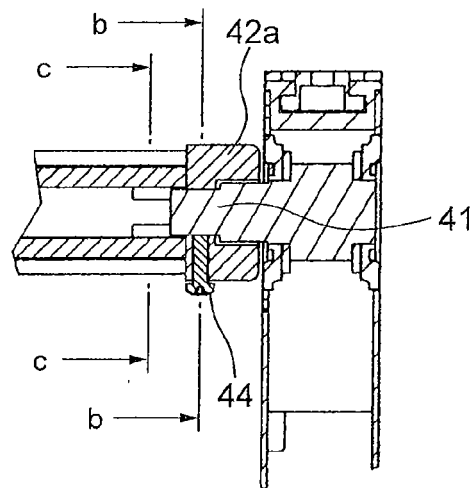
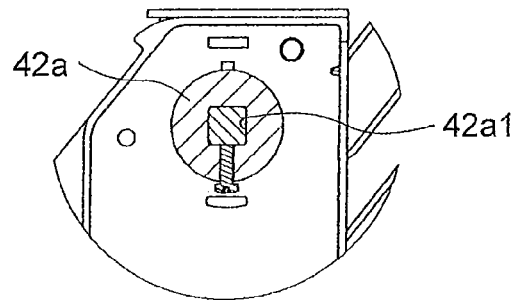
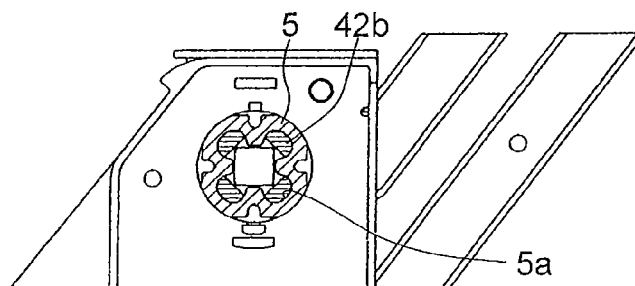


FIG.12(b)



CROSS SECTIONAL VIEW ALONG LINE b-b

FIG.12(c)



CROSS SECTIONAL VIEW ALONG LINE c-c

FIG.13(a)

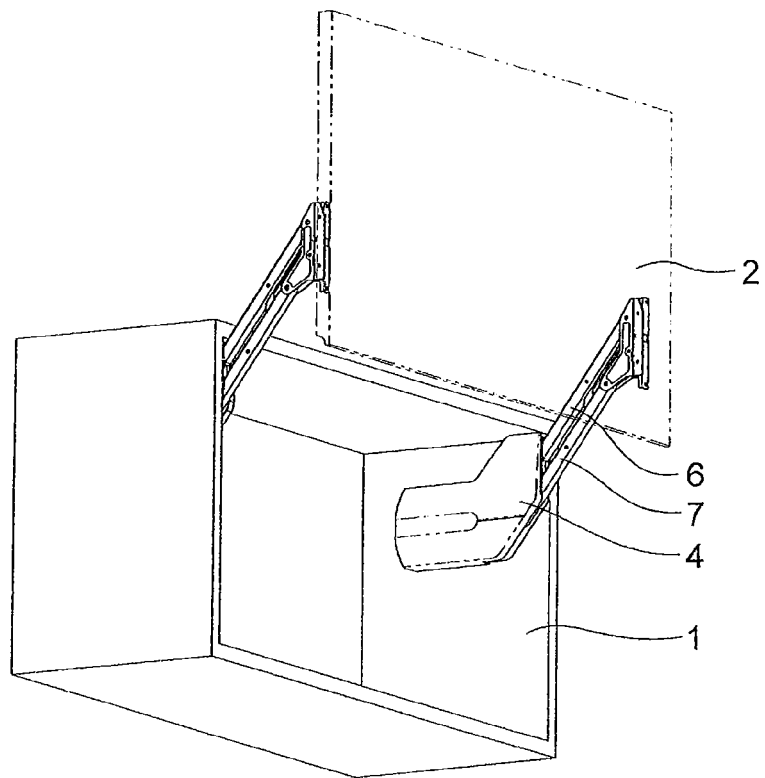
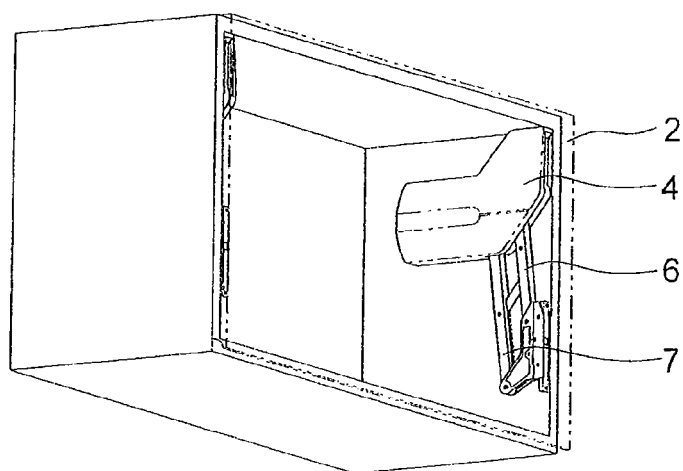


FIG.13(b)



**REFERENCES CITED IN THE DESCRIPTION**

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