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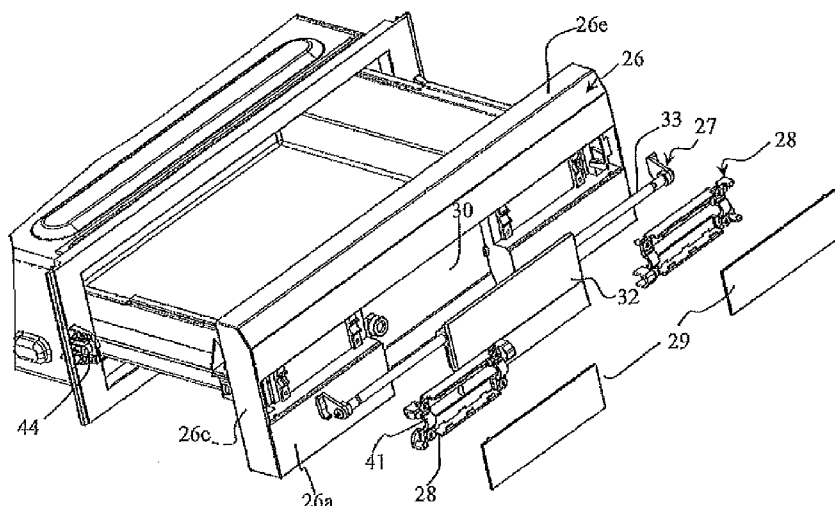


Fig. 6

(57) Abstract: A household appliance, particularly a cooling appliance (1), comprising: a rotational shaft lever (33) capable of rotating around a central axis (X) thereof; and at least one mounting hole (53), wherein the rotational shaft lever (33) penetrates the at least one mounting hole (53) and is rotatable in the mounting hole (53), characterized in that, the mounting hole (53) is encircled and formed by at least two members (26, 28), at least one of the members (26, 28) has a first limit portion (40, 40'), the rotational shaft lever (33) has a second limit portion (39), and the first limit portion (40, 40') and the second limit portion (39) cooperate with each other to prevent the rotational shaft lever (33) from moving in a direction of the central axis (X).





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ELECTRIC APPLIANCE

FIELD OF THE INVENTION

5 The present invention relates to an electric appliance, especially to a household or commercial refrigeration appliance.

BACKGROUND ART

10 It is known in the art that a movement can be transmitted from one component to another component via a rotational shaft. The rotational shaft rotates around its central axis in the shaft transmission procedure, and the rotational shaft should be reliably fixed in an axial direction to prevent any axial displacement of the rotational shaft during its rotation.

SUMMARY OF THE INVENTION

15 Thus, an object of the present invention is to provide an electric appliance having a rotational shaft, in which the axial movement of the rotational shaft can be restricted in a simple and reliable manner.

20 To this end, the present invention in one aspect relates to an electric appliance (household appliance) comprising a rotational shaft capable of rotating around a central axis thereof; and at least one mounting hole, wherein the rotational shaft penetrates the at least one mounting hole and is rotatable in the mounting hole; characterized in that the mounting hole is encircled and formed by at least two members, at least one of the members has a first retention portion, the rotational shaft has a second retention portion, and the first retention portion and the second retention portion cooperate with each other to prevent the rotational shaft from moving in a direction of the central axis.

25 By providing at least two components to define the mounting hole for the rotational shaft, the advantages include not only facilitating the mounting of the rotational shaft, but also providing axial retention features directly on the rotational shaft and these

components, which solves the axial locating problem of the rotational shaft in a simple and reliable manner.

According to a preferred embodiment of the present invention, the first retention portion and the second retention portion are connected in a form fitting manner.

5 According to a preferred embodiment of the present invention, one of the first retention portion and the second retention portion comprises a retention slot, and the other one of the first retention portion and the second retention portion comprises a retention protrusion extending into the retention slot.

10 According to a preferred embodiment of the present invention, the second retention portion is formed by the retention slot.

According to a preferred embodiment of the present invention, the members are two semicircular receiving grooves, and the two receiving grooves are relatively connected to encircle and form the mounting hole.

15 According to a preferred embodiment of the present invention, the electric appliance comprises a storage unit, wherein the storage unit comprises a main body for defining a storage chamber and a door for selectively opening or closing the storage chamber, and the rotational shaft is located on the door.

20 According to a preferred embodiment of the present invention, the storage unit comprises a handle rotatably mounted on the door, and the handle rotates around the central axis.

25 According to a preferred embodiment of the present invention, the storage unit comprises a locking mechanism for locking the door and the main body when the door is at a closed position, the locking mechanism comprises a first matching portion located on the door and a second matching portion located on the main body; and the handle transmits movement to the first matching portion through the rotational shaft.

According to a preferred embodiment of the present invention, the handle, the rotational shaft and the first matching portion are fixed to the door together in a form of a pre-assembled unit.

According to a preferred embodiment of the present invention, the storage unit is a low pressure storage unit capable of maintaining a low pressure state.

According to a preferred embodiment of the present invention, the electric appliance is a refrigeration appliance.

5 The configuration of the present invention and other objectives and beneficial effects thereof will be well understood from description of preferred embodiments in accompany of the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Provided as a part of the description and for further explaining the present invention, the drawings illustrate preferred embodiments of the present invention and disclose the principle of the present invention together with the detailed description below. In the drawings:

15 Figure 1 is a schematic perspective view of a refrigeration appliance according to a preferred embodiment of the present invention, wherein the appliance door of the refrigeration appliance is not shown.

Figure 2 is a schematic assembled perspective view of a storage unit according to a preferred embodiment of the present invention.

Figure 3 is a schematic perspective view of the storage unit in an opened state according to a preferred embodiment of the present invention.

20 Figure 4 is a schematic perspective view of a main body of the storage unit according to a preferred embodiment of the present invention.

Figure 5a is an enlarged view of section A in Figure 4, and Figure 5b is an exploded schematic view of a second matching portion of the locking mechanism shown in Figure 5a.

25 Figure 6 is an exploded schematic view of the storage unit according to a preferred embodiment of the present invention, wherein the door is in the opened state and is exploded.

Figure 7 is a perspective view of a door body according to a preferred embodiment of the present invention.

Figure 8 is a perspective view of the door body according to a preferred embodiment of the present invention, taken in another direction.

5 Figure 9 is an assembled perspective view of a brake unit according to a preferred embodiment of the present invention.

Figure 10a is an enlarged view of section B in Figure 7, and Figure 10b is a schematic sectional view of a rotational shaft which is fixed behind the door.

10 Figure 11a is a schematic partial sectional view of a low pressure storage unit according to a preferred embodiment of the present invention, showing a state when the door is in a closed position and a first matching portion is not engaged with a second matching portion of the locking mechanism, and Figure 11b is a schematic partial sectional view of the low pressure storage unit according to a preferred embodiment of the present invention, showing a state when the door and the main body are locked together.

15 **DETAILED DESCRIPTION OF THE INVENTION**

With reference to Figure 1, a refrigeration appliance 1 comprises a thermally insulated cabinet 2, with the cabinet 2 comprising an outer shell 2a, an inner shell 2b, and a thermal insulation layer (not shown) therebetween. The cabinet 2 defines several thermally insulated storage compartments 3, 4 and 5 for storing articles such as foods
20 therein. In this embodiment, these storage compartments comprise an upper refrigeration compartment 3, a lower freezing compartment 5, and a preservation compartment 4 which is located between the upper and lower compartments and is maintained at a temperature slightly higher than zero degree Celsius. These storage compartments 3, 4 and 5 can be closed by corresponding doors (not shown).

25 It should be understood that the present invention is not limited to specific arrangements of the storage compartments of the refrigeration appliance. The present invention can be applied for other types of refrigeration appliance well, such as a refrigerator having refrigerating and freezing compartments arranged one above the other, a side-by-side combination refrigerator, a refrigerator having a drawer type door, a

refrigerator having French type doors, and the like.

The refrigeration appliance 1 has a closed-loop evaporative refrigeration system. The refrigeration system comprises at least a compressor (not shown), a condenser (not shown), a throttling device (not shown) and an evaporator (not shown). Since this type of refrigeration system is well known in the prior art, its detailed explanation is omitted here. Of course, the refrigeration appliance 1 may also adopt other types of refrigeration systems (such as an absorption refrigeration system or a thermoelectric refrigeration system).

The refrigeration appliance 1 is provided with a low pressure storage unit 7 which can be maintained in a low pressure state, and an evacuation device (not shown) which is adapted for evacuating air from the storing chamber. The evacuation device may comprise a vacuum pump and pipelines (not shown) connected between the vacuum pump and the low pressure storage unit 7.

In this embodiment, the low pressure storage unit 7 is provided in the preservation compartment 4. It should be understood that, in an alternative embodiment, the low pressure storage unit 7 can be provided in other storage compartments, such as the refrigerating compartment 3, or a variable compartment whose temperature zone can be changed between a refrigerating temperature zone and a freezing temperature zone.

The low pressure storage unit 7 is located at a bottom of the preservation compartment 4, and is supported on a bottom wall of the preservation compartment 4. In this embodiment, a preservation container 6 may be provided above the low pressure storage unit 7, which preservation container has a higher humidity and is adapted for storing foods such as vegetables.

The low pressure storage unit 7 may be constructed separately from the cabinet 2 and then assembled in the cabinet 2. With reference to Figure 2 and Figure 3, in this embodiment, the low pressure storage unit 7 is substantially of a flat rectangular parallelepiped shape, having a width slightly smaller than the width of the preservation compartment 4, so that the low pressure storage unit 7 can be inserted into the preservation compartment 4 and drawn out of the preservation compartment 4.

The low pressure storage unit 7 comprises a main body 8 which is fixed in the

preservation compartment 4, and a door 10 which is coupled to the main body 8 and is configured to be pushed into and retracted out of the preservation compartment 4.

With reference to Figure 2 to Figure 4, the main body 8 has a box shaped structure, defining a flat storage chamber 15 having a food access opening 15a. The access
5 opening 15a is preferably formed in the front end of the main body 8 to face towards users.

In a preferred embodiment, the main body 8 comprises at least one first member formed of a metal (such as sheet steel) having relatively high strength and at least one second member formed of a plastic material, the first member and the second member
10 forming respectively walls which receive outside pressure when the interior of the storage chamber 15 is in the low pressure state. In this embodiment, the first member forms a top wall 20, a bottom wall 21 and right and left side walls 22 of the main body 8, so that a box body 11 having front and rear openings is produced. The second member comprises a
15 rear cover 23 closing the rear opening of the box body 11, the rear cover 23 being provided with an evacuation passage connected to the evacuation device, and an evacuation valve 60 for opening and closing the evacuation passage. The second member may also comprise a front jointing frame 17 fixed to the front opening of the box body 11. The front jointing frame 17 may comprise a smooth adjoining surface 18 which extends substantially perpendicular to the horizontal plane and is configured for abutting
20 with the door 10.

The door 10 may be provided with a ring shaped sealing element 16 (see Figure 8), so that, when the door 10 in a closed position, airtightness engagement is formed between the main body 8 and the door 10 to prevent air from entering into the storage chamber 15 through the interface between the main body 8 and the door 10. The sealing
25 element 16 may alternatively be provided on the front end of the main body 8, for example, fixed to the front jointing frame 17.

When the storage chamber 15 is closed by the door 10 and the evacuation device is activated, air within the storage chamber 15 is evacuated, and the storage chamber 15 comes to the low pressure state. According to a preferred embodiment of the present
30 invention, when the evacuation procedure is finished, the pressure in the storage chamber 15 is in a range between one standard atmosphere pressure (atm) and absolute vacuum,

for example, having an absolute pressure lower than 690 mbar. The storage chamber 15 is generally referred to as "vacuum chamber" by those skilled in the art, since air pressure inside it can be lower than the standard atmosphere pressure.

The backside of the door 10 is connected with a tray shaped container 12 for
5 containing articles therein. A user may push or pull the tray shaped container 12 into or out of the storage chamber 15 to get an article contained in the low pressure storage unit 7 or to put articles into the low pressure storage unit 7. The door 10 and the tray shaped container 12 form a drawer unit which can be pushed into and pulled out of the main body 8.

10 A telescopic guide unit 14 may be provided between the tray shaped container 12 and the main body 8, such that the door 10 and the tray shaped container 12 can be smoothly pulled out of the main body 8 or pushed into the main body 8.

The low pressure storage unit 7 comprises a pair of locking mechanisms for locking
15 the door 10 which is in the closed position with the main body 8. As shown in Figures 3, 6, 11a and 11b, each locking mechanism comprises a first matching portion 34 provided on the door 10 and a second matching portion 44 provided on the main body 8. By means of the cooperation of the first matching portion 34 and the second matching portion 44, the door 10 is locked in the closed position. Meanwhile, the sealing element 16 between the main body 8 and the door 10 is fully deformed under a locking force created by the locking
20 mechanism, so that airtightness between the door 10 and the main body 8 is increased.

As shown in Figure 3 to Figure 6, the second matching portion 44 is connected to the adjoining surface 18 of the main body 8 and protrudes forwards therefrom. The second matching portion 44 comprises a base 45 connected to the adjoining surface 18 and extending forwards, and a column shaped locking portion 46 provided in front of the
25 adjoining surface 18. The locking portion 46 is separated from the adjoining surface 18 by a predetermined distance and has an axis which extends transversely and is parallel to both the horizontal plane and the adjoining surface 18. The locking portion 46 is located on the inner side of the base 45.

As shown in Figure 5a and Figure 5b, the locking portion 46 comprises an inner
30 column 46a fixed to the base 45, and an outer wheel 46b surrounding the inner column 46a and being able to roll around the inner column 46a. By using the rolling outer wheel

46b, engaging friction force between the locking portion 46 and the first matching portion 44 is reduced, so that they can come into a locking position more quickly. The inner column 46a may either be integrally formed with the base 45 or formed separately from the base 45 and then connected to the base 45. In a particularly simple embodiment, the inner column 46a is formed by a screw fixed to the base 45.

With reference to Figure 3 and Figure 6, the door 10 comprises a door body 26, a brake unit 27 fixed to the door body 26, fixing members 28 for fixing the brake unit 27 to the door body 26, and a decorative cover 29 connected to the door body 26 to cover a corresponding portion of the brake unit 27.

As shown in Figure 6 and Figure 9, the brake unit 27 comprises a handle 32 of a substantially plate shape, a cylindrical rotational shaft 33 fixed to the handle 32, and a pair of first matching portions 34 fixed opposite ends of the rotational shaft 33 respectively.

The rotational shaft 33 is fixed to the back side of the handle 32. The handle 32 has several fixing portions 35 protruded from its back surface, the fixing portions 35 being provided on an upper portion of the handle 32. Each fixing portion 35 has a cylindrical fixing hole 61 extending transversely to allow the rotational shaft 33 to extend through the fixing holes 61 so as to be connected to the handle 32.

In this embodiment, the rotational shaft 33 and the handle 32 are fixed to each other, with no relative movement between them being allowed then. This can be done by screws 37 which fasten the rotational shaft 33 to the fixing portions 35.

Opposite ends of the rotational shaft 33 are each fixed with a corresponding first matching portion 34. In this embodiment, once the first matching portion 34 is inserted through by a corresponding end of the rotational shaft 33, it is fixed to the rotational shaft 33 without being able to move with respect to the rotational shaft 33 then, by means of a fixing member such as a screw, so that, after the rotational shaft 33 is fixed to a door plate 26, when the rotational shaft is rotated around its central axis X, the first matching portion 34 also rotates around the central axis X of the rotational shaft 33.

In this embodiment, the first matching portion 34 has a substantially sector shaped shape, which gradually becomes larger in an outward direction. A camming curve surface 34a adapted for cooperating with the locking portion 46 is formed on the free end of the

first matching portion 34. The camming curve surface 34a is provided as facing towards the rotational shaft 33. The camming curve surface 34a comprises a leading-in curve segment 341 separated by a larger distance from the central axis X, and a locking curve segment 342 separated by a smaller distance from the central axis X.

5 A transition protrusion 343 can be formed between the leading-in curve segment 341 and the locking curve segment 342, protruding towards the rotational shaft 33. The transition protrusion 343 prevents the locking portion 46 from sliding out of the locking curve segment 342. Further, when the locking portion 46 is moved to slide over the transition protrusion 343 to come onto the locking curve segment 342, a user needs to
10 overcome a maximum resistance. Then, locking is established after the locking portion 46 comes onto the locking curve segment 343, which provides a function of informing the user that the door 10 and the main body 8 are locked together.

 The rotational shaft 33 is provided with two ring shaped retention recesses 39 near the first matching portions 34. Each of the retention recesses 39 is recessed in a radial
15 direction from the outer periphery of the rotational shaft 33 and is adapted to be cooperated with a corresponding mechanism on the door 10 to restrict the axial movement of the rotational shaft 33 in the door 10.

 The back side of the handle 32 may be provided with an air charging valve 25 for closing and opening an air charging passage 19 (as shown in Figures 7 and 8), the air
20 charging passage being provided through the door body 26 for releasing the low pressure state in the storage chamber 15. To this end, the air charging valve 25 is kinetically coupled with the handle 32, so that the air charging passage 19 can be opened or closed by manipulating the handle 32.

 With reference to Figure 7 and Figure 8 in combination with Figure 6, the door body
25 26 has a substantially rectangular plate shape and is preferably formed of a plastic material.

 The door body 26 is formed with an accommodating space 30 recessed from its front surface 26a for receiving at least a portion of the brake unit 27. On the back side of the door body 26, the door body 26 is formed with a protrusion 31 having a shape
30 corresponding to that of the accommodating space 30, for compensating a thickness loss resulted from forming the accommodating space 30 on the front side of the door body 26.

The accommodating space 30 is substantially T shaped, comprising a first accommodating space 30a in the central area of the door body 26 and a second accommodating space 30b extending in the width direction of the door body 26. The first accommodating space 30a and the second accommodating space 30b are partly overlapped.

The first accommodating space 30a is adapted for receiving the handle 32 of the brake unit 27. One side of the first accommodating space 30a extends towards and opens into an end surface of the door body 26, forming an opening in this end surface to allow a user to insert his or her hand into the backside of the handle 32. In this embodiment, the lower end of the first accommodating space 30a extends to the lower end surface 26b of the door body 26, to allow a user to hold the lower end of the handle 32 so as to manipulate the handle 32. The lower end of the handle 32 may be separated from the lower end surface 26b of the door body 26 by a distance to facilitate a user to insert his or her hand into the back side of the handle 32. The back side of the lower end edge of the handle 32 may be provided with a row of tooth shaped protrusions for facilitating a user to insert his or her hand into the back side of the handle 32 and then grasp the lower end edge to manipulate the handle 32.

The outer end of the air charging passage 19 is in fluid communication with the first accommodating space 30a. When the handle 32 is in the position shown in Figure 2, the air charging passage 19 is tightly closed by the air charging valve 25, and when the handle 32 is in a position shown in Figure 11a, the air charging passage 19 is opened, and outside air is allowed to flow into the storage chamber 15 through the air charging passage 19 to release the low pressure state in the storage chamber 15. It should be understood that, in other embodiments, the air charging passage and the air charging valve may be provided independently from the handle 32. As an example, a knob may be provided on the door 10. The air charging passage is opened when the knob is pressed down, and then a user may manipulate the handle 32 to open the door 10.

The rotational shaft 33 is received in the second accommodating space 30b. Right and left ends of the second accommodating space 30b are located near right and left end surfaces 26c and 26d of the door body 26 respectively, but are still separated from the right and left end surfaces 26c and 26d rather than exposed out from them. The second accommodating space 30b is similarly not exposed from upper and lower end surfaces

26b and 26e of the door body 26.

A plurality of half-ring shaped first recesses 37, separated from each other, are provided in the second accommodating space 30b. These first recesses 37 are arranged in a common horizontal plane, for receiving corresponding portions of the rotational shaft 33. The first recesses 37 may alternatively be provided in mounting blocks 36 arranged inside the second accommodating space 30b.

As shown in Figure 6, a half-ring shaped second recess 41 is formed in each fixing member 28, corresponding to the first recess 37. The first recess 37 and the second recess 41 are connected in a way that they face towards each other, so that a fixing hole 53 for fixing the rotational shaft 33 is encircled by them.

As shown in Figure 10a, a half-ring shaped protrusion 40 is formed in at least one of the first recesses 37. When the rotational shaft 33 is mounted to the door body 26, the protrusion 40 is aligned with the retention recess 39 in the rotational shaft 33. As shown in Figure 10b, a similar half-ring shaped retention protrusion 40' may be formed in the second recess 41, for cooperating with the retention recess 39.

When the rotational shaft 33 is fixed between the first recess 37 and the second recess 41, the radial movement of the rotational shaft 33 is restricted. By providing a retention mechanism between the rotational shaft 33 and the door body 26 and/or the fixing members 28, axial movement of the rotational shaft 33 during rotation is restricted, and precise locating of the rotational shaft 33 and the fixing members 28 during assembling is facilitated.

It should be understood that, in other embodiments, retention recesses of the axial retention mechanism of the rotational shaft 33 may be alternatively provided on the door body and/or the fixing member, while the rotational shaft is provided with retention protrusions. Further, it is obvious that the locating solution of the rotational shaft according to the present invention can be adopted in other applications, such as other electric appliances having such a rotational shaft, as well as those not listed here.

Opposite ends of the door body 26 are each formed with a through slot 42 which is in communication with the second accommodating space 30b and extends through the door body 26 from front to back. The first matching portion 34 is inserted through the through

slot 42 and extends to the back side of the door body 26. Each through slot 42 is preferably provided in a loop shaped area encircled between the ring shaped sealing element 16 and the peripheral end surfaces 26b to 26e of the door body 26, so that the airtightness between the door 10 and the main body 8 is not affected. In addition, since
5 the through slots 42 are separated from respective end surfaces 26b to 26d of the door body 26, the first matching portion 34 is not exposed outside the door 10 when the door 10 is closed.

When assembling, first, the rotational shaft 33 is fixed to the handle 32, and then, the first matching portion 34 is fixed to the rotational shaft 33. Thus, the brake unit 27 is
10 formed in a form of a pre-assembled unit.

Then, the pre-assembled brake unit 27 is fixed to the door body 26. In this procedure, after the first matching portions 34 are inserted through the through slots 42, the retention recesses 39 of the rotational shaft 33 are engaged by the protrusions 40, so that the rotational shaft 33 is received in the accommodating space 30. Then, the rotational shaft
15 33 is fixed in the door 10 by the fixing members 28. Each fixing member 28 may be provided with a screw which is to be inserted through the fixing member 28 and engaged with the mounting block 36. The handle 32 and the first matching portion 34, which are connected to the rotational shaft 33, are fixed to the door body 26. By fixing the handle 32, the first matching portion 34 and the rotational shaft 33 as a pre-assembled unit to the
20 door body 26, the assembling of these components is significantly simplified.

Then, the decorative cover plate 29 is fixed to the door body 26 to shield the brake unit 25, except the handle 32, from the front surface of the door 10. In this way, the rotational shaft 33 is located inside the door 10 as a whole.

The front surface of the decorative cover plate 29 is preferably flush with the front
25 surface 26a of the door body 26. The decorative cover plate 29 may adopt a color and/or a material different from that of the door body 26.

Once fixed to the door body 26, the handle 32 is rotatably connected to the door 10. When the handle 32 is rotated, the rotational shaft 33 inside the door body 26 is also rotated around its central axis X while driving the first matching portion 34 to rotate. The
30 rotational shaft 33 defines a rotation axis for the handle 32 and the first matching portion 34. In this procedure, when the rotational shaft 32 is rotated, the rotational shaft also acts

as a rotation shaft of the handle 32 and the first matching portion 34, with the central axis X of the rotational shaft having no displacement with respect to the door body 26.

The handle 32 is rotatable around the central axis X of the rotational shaft 33 between a first position and a second position. In the first position, a maximum angle is formed between the handle 32 and the front surface 26a of the door body 26, with a maximum distance being formed between the lower end of the handle and the front surface 26a of the door body 26, and thus the first position is also referred to as extended position. In the second position, a minimum angle is formed between the handle 32 and the front surface 26a of the door body 26, with a minimum distance being formed between the lower end of the handle and the front surface 26a of the door body 26, and thus the second position is also referred to as retracted position. Correspondingly, the first matching portion 34, which is kinetically coupled with the handle 32, is restricted to be able to rotate between a first extreme position and a second extreme position. When the handle 32 is in the first position, the first matching portion 34 is in the first extreme position (as shown in Figure 11a), and when the handle is in the second position, the first matching portion 34 is in the second extreme position (as shown in Figure 11b).

Figure 11a shows the door 10 in the closed position but still in an unlocked state, now the handle 32 being in the first position. When a user pushes the handle 32 in a front lower direction, the handle 32 rotates inwards around the central axis X of the rotational shaft 33. Meanwhile, the rotational shaft 33 rotates around its central axis X to drive the first matching portion 34 to rotate upwards, and the camming curve surface 34a of the first matching portion 34 gradually approaches the locking portion 46 of the second matching portion 44.

Figure 11b shows that the door 10 and the main body 8 are in the locked state, now the handle 32 being in the second position. As shown in Figure 11b and Figure 2, when the handle 32 is rotated to the second position, the locking portion 46 comes to the locking curve segment 342 of the first matching portion 34a and closely contacts with it. Meanwhile, the air charging valve 25 inside the handle 32 abuts against the air charging passage 19 in the door body 26 to close the air charging passage 19.

By the engagement between the first matching portion 34 and the second matching portion 44 in the locked position, a locking force is applied between the door 10 and the

main body 8 to fully deform the sealing element 16, so that airtightness between the door 10 and the main body 8 is increased.

According to a preferred embodiment of the present invention, when the handle 32 is in the second position (the first matching portion 34 and the second matching portion 44 are in the locked position), the front surface of the handle 32 is in a vertical position substantially perpendicular to a horizontal plane, which is particularly advantageous for retracting the handle 32 into the first accommodating space 30a. Preferably, in the second position, at least a majority of the handle 32 is received in the accommodating space 30 to reduce the space occupied by the low pressure storage unit 7. Particularly preferably, in the second position, the handle 32 is wholly received in the door body 26, without extending out beyond the front surface of the door 10.

The door 10 is provided with a second retention structure 47 for restricting the handle 32 from further rotated after it is rotated to the vertical plane (the second position), so as to prevent the handle 32 from being continuously rotated which may cause the upper end of the handle 32 to protrude out of the accommodating space 30. In this way, the door 10 may have a further smoothed appearance.

The second retention structure 47 is provided between the handle 32 and the door body 26. It may be formed by protrusion structures fixed to the inner side of the handle 32 and/or to the front side of the door body 26, and it is configured in the following manner: when the front surface of the handle 32 is in the vertical position, the second retention structure 47 (if it is fixed to the door body 26) just abuts against the inner side of a portion of the handle 32 which is located below the rotational shaft 33; alternatively, the second retention structure (if it is fixed to the inner side of the handle 32) just abuts against the front side of the door body 26.

When the handle 32 is in the second position, the protrusion structures are preferably located near the inner side wall of the first accommodating space 30a to reduce the possibility of interference between them and a user's hand. The second retention structure 47 may be integrally formed on the door body 26 and/or the handle 32.

When it needs to open the door 10, a user may hold the lower end of the handle 32 and lift it in an up and outward direction, so that the handle 32 is rotated around the central axis X of the rotational shaft 33 and drives the rotational shaft 33 to rotate, the first

matching portions 34 which is fixed to opposite ends of the rotational shaft 33 rotates downwards, and the locking portion 46 leaves the camming curve surface 34a of the first matching portion 34 gradually. In this procedure, the air charging valve 25 releases its closure to the air charging passage 19, and outside air enters into the storage chamber 15 through the air charging passage 19 to equalize its inner pressure with outside pressure. Then, the user may hold the handle 32 and pull it forwards, by means of which, the door 10 is opened.

The door 10 may be provided with a first retention structure 48 for restricting the handle 32 from further rotating outwards after it is rotated to the first position. In the first position, an angle formed between the handle 32 and a vertical plane is less than 90 degrees. In a preferred embodiment, when the handle 32 is rotated to form an angle of 30 degrees to 60 degrees (for example, 50 degrees) with a vertical plane, it is restricted from rotating outwards further.

The first retention structure 48 may be configured in the following manner: when the handle 32 is rotated outwards through a maximum angle to the first position, the first retention structure 48 abuts against the inner side of a portion of the handle 32 which is located above the rotational shaft 33. Preferably, the first retention structure 48 is arranged near the upper inner wall of the first accommodating space 30a but is still separated from it by a distance, so that, when the handle 32 is rotated to the first position, the inner side of the portion of the handle 32 which is located above the rotational shaft 33 abuts against the first retention structure 48, so that the handle 32 is restricted from being further rotated.

The first retention structure 48 may be formed by a protrusion structure inside the first accommodating space 30a. The protrusion structure may be integrally formed to the inner wall of the back side of the first accommodating space 30a.

CLAIMS

What is claimed is:

1. A household appliance, particularly a cooling appliance (1), comprising:

a rotational shaft lever (33) capable of rotating around a central axis (X) thereof; and
5 at least one mounting hole (53), wherein the rotational shaft lever (33) penetrates the at least one mounting hole (53) and is rotatable in the mounting hole (53),

characterized in that, the mounting hole (53) is encircled and formed by at least two members (26, 28), at least one of the members (26, 28) has a first limit portion (40, 40'), the rotational shaft lever (33) has a second limit portion (39), and the first limit portion (40, 40') and the second limit portion (39) cooperate with each other to prevent the rotational
10 shaft lever (33) from moving in a direction of the central axis (X).

2. The household appliance according to claim 1, characterized in that, the first limit portion (40, 40') and the second limit portion (39) are connected with matching shapes.

3. The household appliance according to claim 1 or 2, characterized in that, one of
15 the first limit portion (40, 40') and the second limit portion (39) comprises a limit slot, and the other one of the first limit portion (40, 40') and the second limit portion (39) comprises a limit protrusion extending into the limit slot.

4. The household appliance according to claim 3, characterized in that, the second limit portion (39) is formed by the limit slot.

20 5. The household appliance according to any one of the above claims, characterized in that, the members (26, 28) are two semicircular receiving grooves (37, 41), and the two receiving grooves (37, 41) are relatively connected to encircle and form the mounting hole (53).

6. The household appliance according to any one of the above claims, characterized
25 by comprising a storage unit (7), wherein the storage unit (7) comprises a main body (8) for defining a storage chamber (15) and a door (10) for selectively opening or closing the storage chamber (15), and the rotational shaft lever (33) is located on the door (10).

7. The household appliance according to claim 6, characterized in that, the storage unit (7) comprises a handle (32) rotatably mounted on the door (10), and the handle (32) rotates around the central axis (X).

5 8. The household appliance according to claim 7, characterized in that, the storage unit (7) comprises a fastening mechanism (34, 44) for fastening the door (10) and the main body (8) when the door (10) is at a closed position, the fastening mechanism (34, 44) comprises a first matching portion (34) located on the door (10) and a second matching portion (44) located on the main body (8); and the handle (32) transmits movement to the first matching portion (34) through the rotational shaft lever (33).

10 9. The household appliance according to claim 8, characterized in that, the handle (32), the rotational shaft lever (33), and the first matching portion (34) are fixed on the door (10) as a pre-assembled unit.

15 10. The household appliance according to any one of claims 6 to 8, characterized in that, the storage unit (7) is a low-pressure storage unit capable of maintaining a low-pressure state.

11. The household appliance according to any one of the above claims, characterized in that, the household appliance (1) is a cooling appliance.

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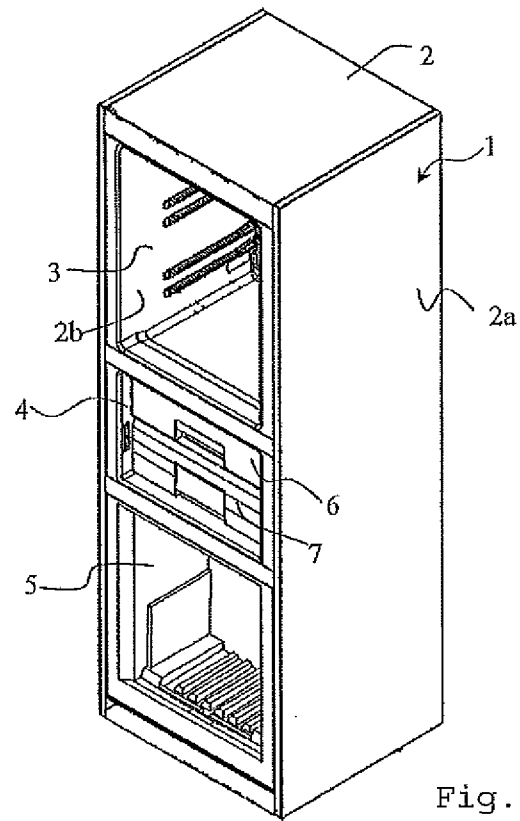


Fig. 1

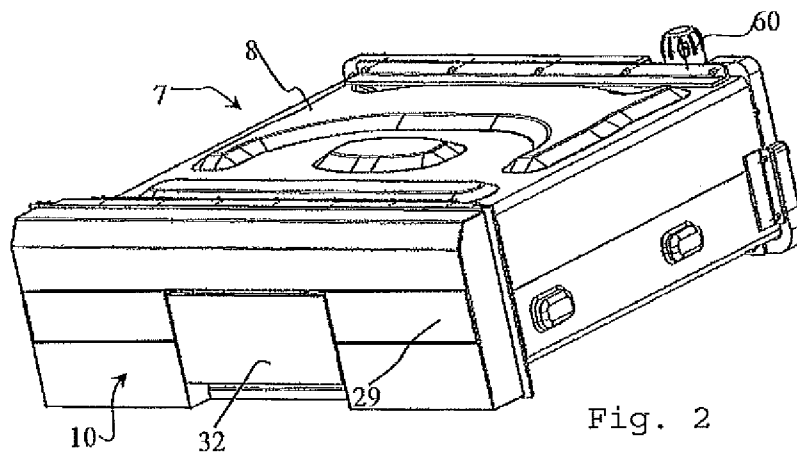
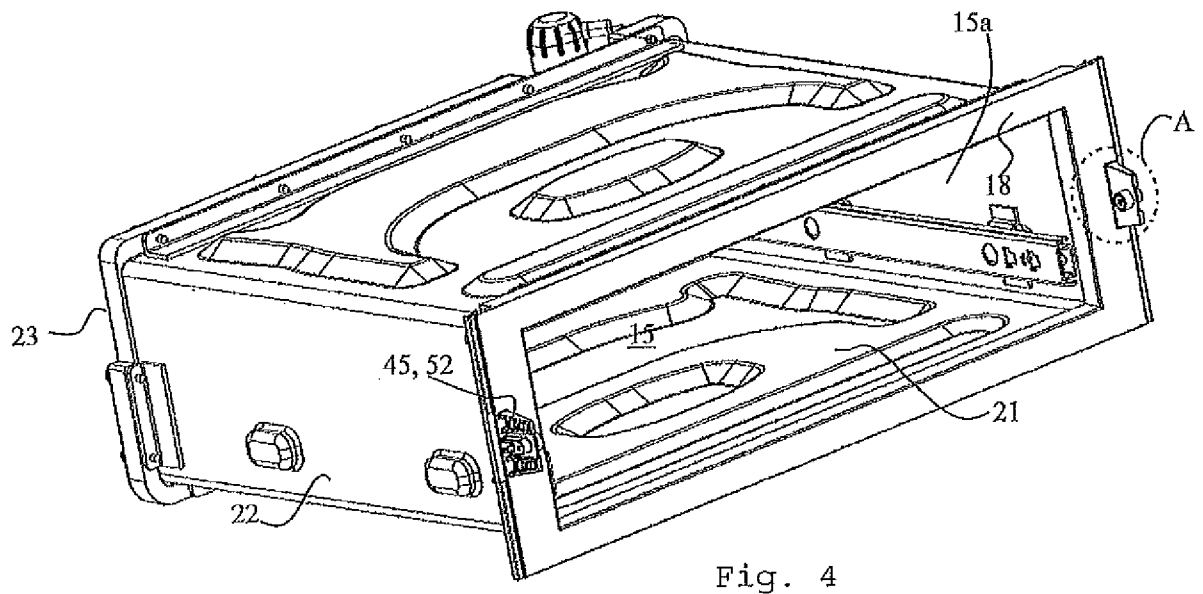
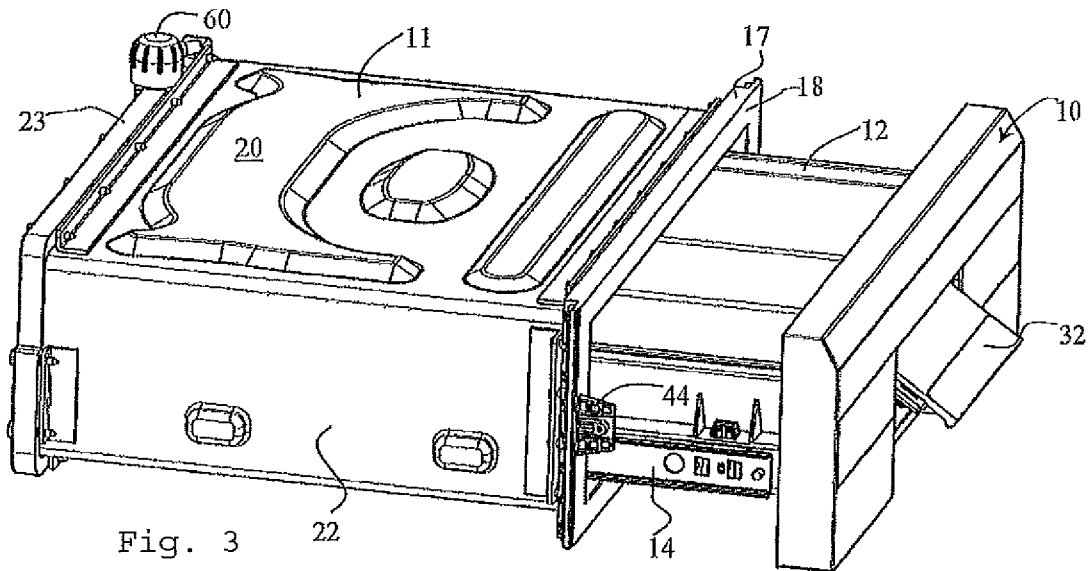


Fig. 2



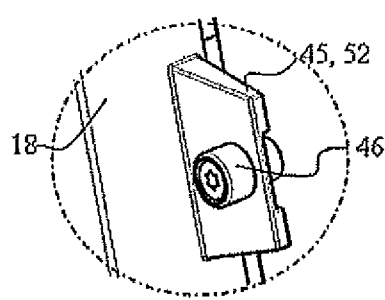


Fig. 5a

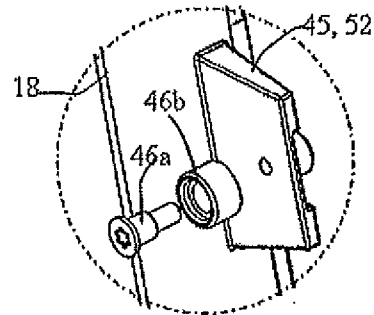


Fig. 5b

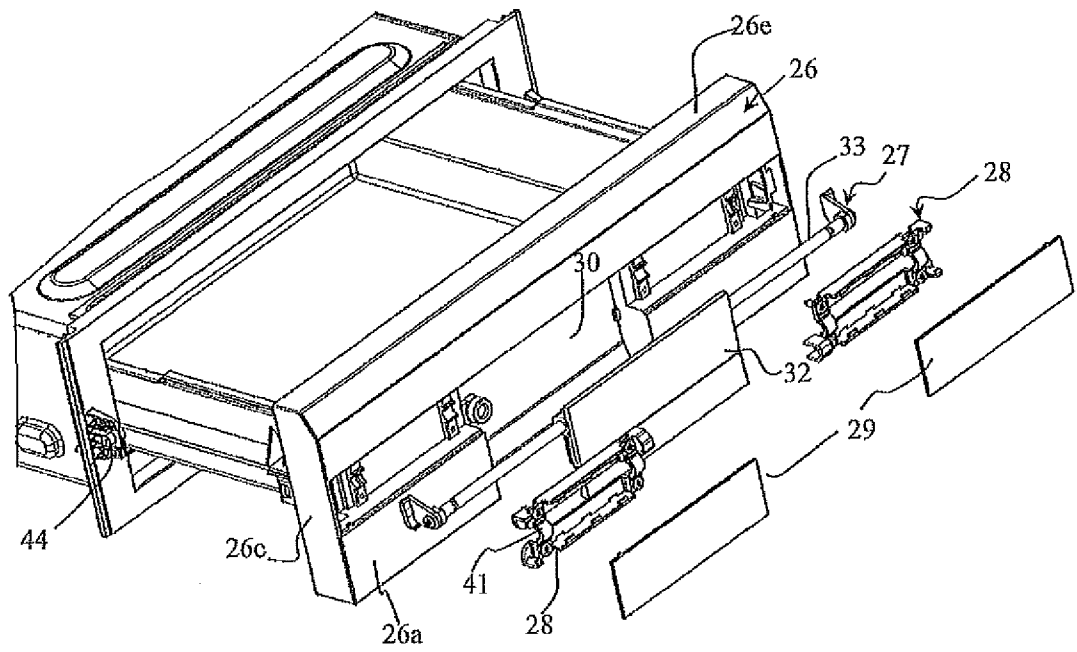


Fig. 6

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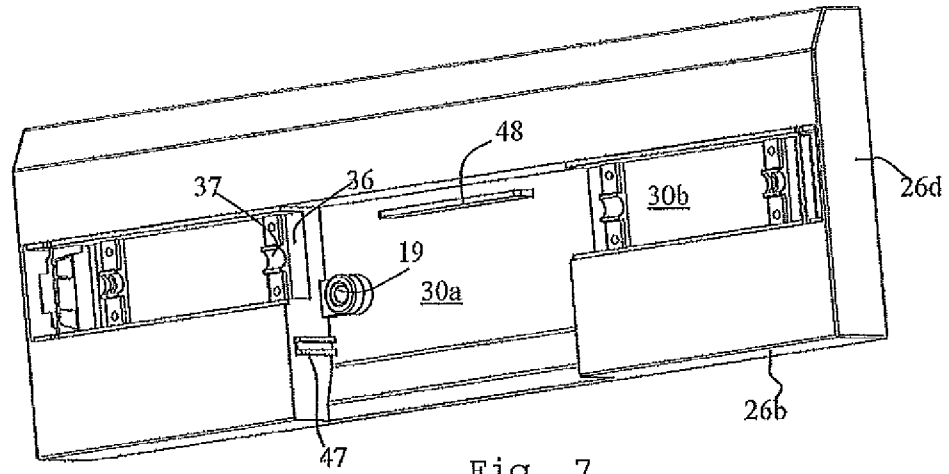


Fig. 7

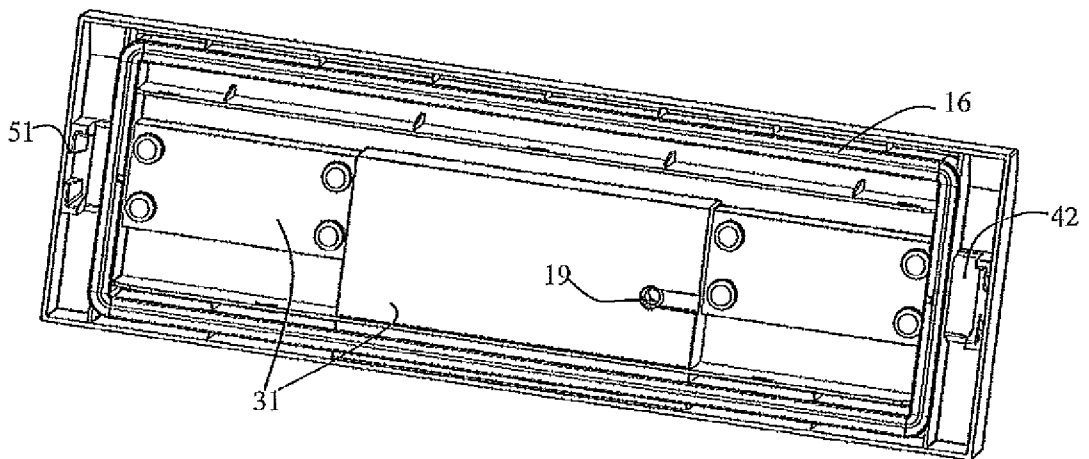
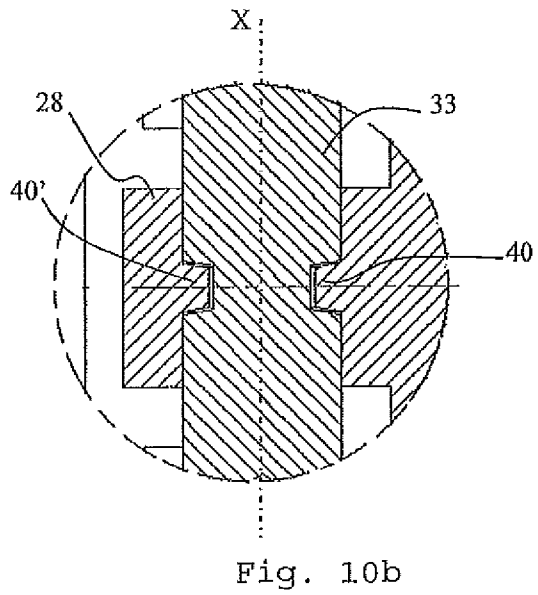
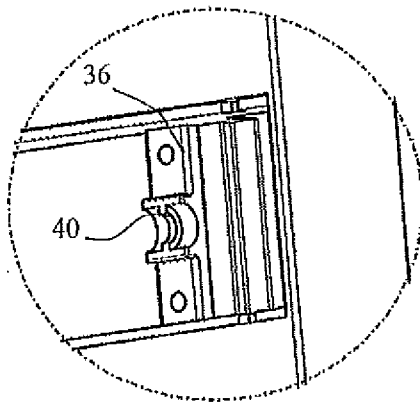
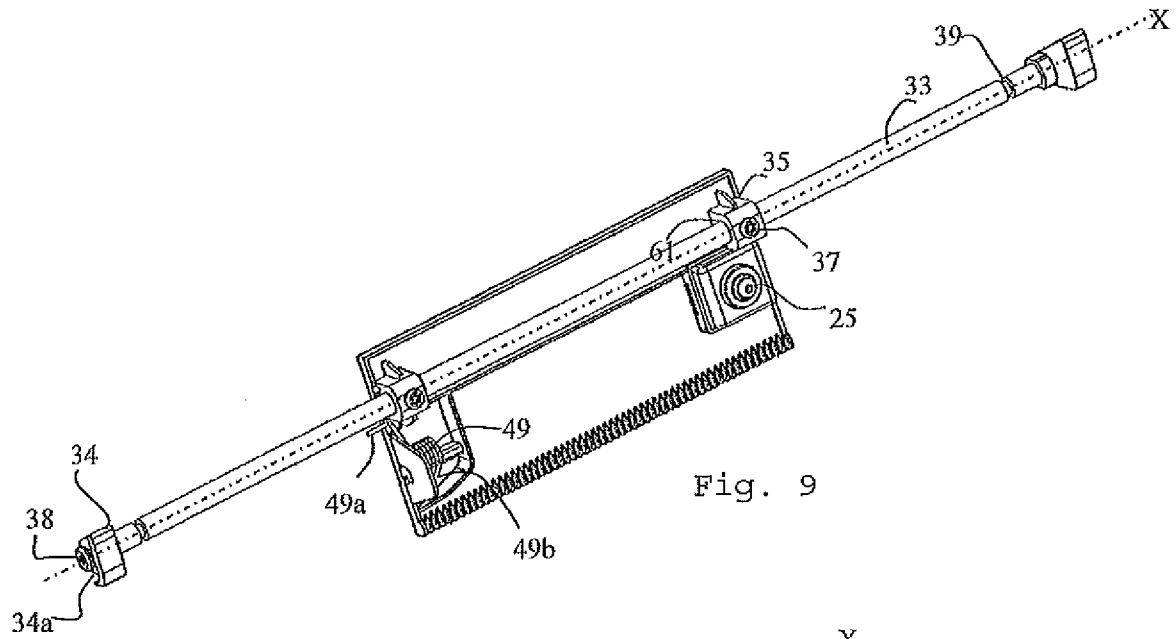


Fig. 8



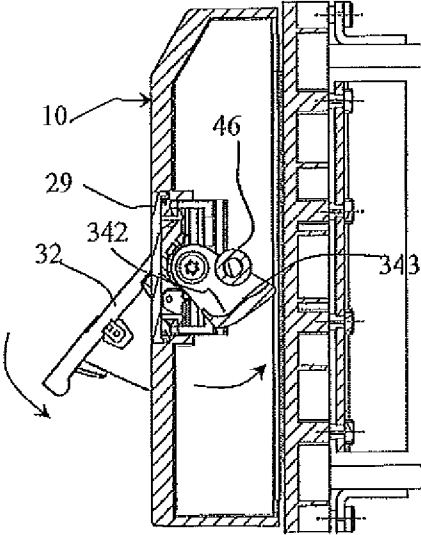


Fig. 11a

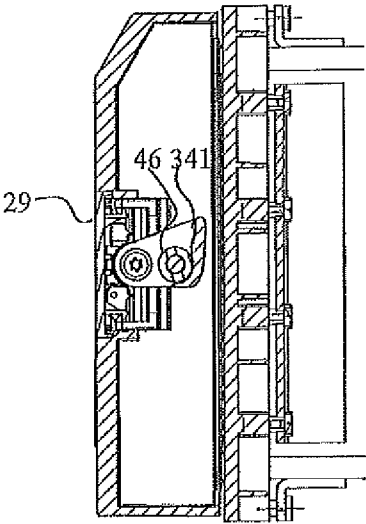


Fig. 11b