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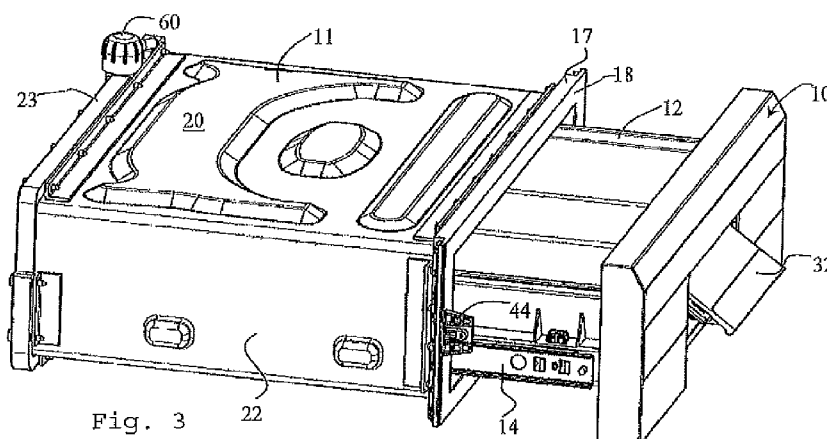
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- (54) Title:** UNIT AND REFRIGERATION APPLIANCE HAVING THE STORAGE UNIT



- (57) Abstract:** A storage unit (7), comprising: a main body (8), wherein the main body (8) defines a storage chamber (15) having an opening portion (15a) for putting in or taking out articles; a door (10), for selectively opening or closing the opening portion (15a); and a fastening mechanism (34, 44), for fastening the door (10) and the main body (8) when the door (10) is located at a closed position, wherein 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 for joint with the first matching portion (34); characterized by comprising a holding mechanism (49), wherein the holding mechanism (49) is disposed such that when the door (10) is opened, the first matching portion (34) and /or the second matching portion (44) are held at a safe position where the first matching portion (34) and the second matching portion (44) do not collide in a closing process of the door (10).

UNIT AND REFRIGERATION APPLIANCE HAVING THE STORAGE UNIT

FIELD OF THE INVENTION

The present invention relates to a storage unit and a refrigeration appliance having such a storage unit. More particularly, the present invention relates to a storage unit which
5 has an openable/closable door and is adapted to be used in a refrigeration appliance, and to a household or commercial refrigeration appliance having such a storage unit.

BACKGROUND ART

Chinese patent application publication CN1013243942A discloses a refrigeration appliance having a low pressure storage unit (also referred to as "vacuum storage unit").
10 The low pressure storage unit comprises a main body which defines a storage chamber having a food access opening, and a door which is adapted for opening and closing the access opening. A sealing element is arranged between the door and the main body around the access opening to provide the low pressure storage unit with a vacuum seal, so that, when the storage chamber is closed, air inside the storage chamber can be drawn
15 out by an evacuation device, such as a vacuum pump, to keep the storage chamber in a low pressure state, which helps to extend food storage time.

The low pressure storage unit is provided with a locking mechanism for locking the door and the main body together when the door is in a closed position, and a handle provided in association with the locking mechanism. The handle is provided on a front end
20 of the door and comprises a handle rod provided in front of the door and extending across substantially the whole width of the door, right and left supporting parts connected to opposite ends of the handle rod and extending backwards therefrom respectively, and a handle manipulating part connected to a central portion of the rod. The right and left supporting parts are pivotably connected to opposite ends of the door respectively, so that
25 the handle is able to pivot with respect to the door. The locking mechanism comprises a first matching portion provided on the tip end of each supporting part and a second matching portion provided in the outer surface of a side wall of the main body. By pivotally moving the handle, the first matching portion is rotated so as to be pushed into the second matching portion and engaged with it, so as to lock the door into the closed position. As a
30 result, airtightness of the low pressure storage unit is increased. By rotating the handle rod in a reverse direction, locking state between the first matching portion and the second

matching portion is released.

With regard to the above technical solution, when the handle is manipulated by a user, a distance must be maintained between the handle rod and the front surface of the door, so that the handle rod can rotate around a rotating axis, the rotating axis extending within the door and being defined by a support shaft which is connected with the supporting part. As a result, the space occupied by the low pressure storage unit has to be increased, while the space utilization ratio of the refrigeration appliance is decreased. On the other hand, for aesthetic considerations, exposing the handle rod in front of the storage unit is disadvantageous.

Further, the second matching portion is provided outside a side wall of the main body. When the locking mechanism is in the locking state, the first matching portion extends to the outside of the main body from the door. For this reason, in order to dispose the locking mechanism, enough distance must be maintained between the main body and an inner shell of the refrigeration appliance, which reduces the space utilization ratio of the refrigeration appliance. In addition, the first matching portion, which extends backwardly from the door to the outside of the main body, also negatively affects the whole appearance of the refrigeration appliance.

Further, in the moving direction of the door, the movable first matching portion overlaps the second matching portion in at least one location, so that the first matching portion may collide with the second matching portion during the closing action of the door, which may result in damage of the locking mechanism.

Furthermore, a gap has to be maintained between the main body and a tray which is connected backward of the door, so that the tray can be pushed into and pulled out the main body smoothly. As a result of the gap, the door and the tray will wobble when the door is opened or closed. More important, when such a gap is existed, the abutting position between the door and the main body may vary when the door is being closed, which may result in that the first matching portion and the second matching portion cannot be precisely locked into position, and that the locating of the sealing element between the door and the main body may be negatively affected.

Similar technical problems are also found in the low pressure storage unit disclosed in EP1706688B1.

SUMMARY OF THE INVENTION

Thus, an object of the present invention is to provide a storage unit which has an increased life time, and a refrigeration appliance having such a storage unit.

To this end, the present invention in one aspect relates to a storage unit comprising a
5 main body which defines a storage chamber having an opening portion for putting in or taking out articles; a door, for selectively opening or closing the opening portion; and a locking mechanism, for locking the door and the main body when the door is located at a closed position, wherein the locking mechanism comprises a first matching portion located on the door and a second matching portion located on the main body and for establishing
10 engagement with the first matching portion; characterized by comprising a holding mechanism, wherein the holding mechanism is disposed such that when the door is opened, the first matching portion and/or the second matching portion are held at a safe position which ensures that the first matching portion and the second matching portion do not collide each other during the closing of the door.

15 Thus, when the door is opened, the first and second matching portions are automatically located in safe positions to ensure that the first and second matching portions do not interfere with each other during the closing of the door, without needing any manual operation of a user. Thus, the locking mechanism is prevented from being damaged, and the life time and the convenience in use of the storage unit can be
20 increased.

Other features, which are disclosed individually or combined with each other, are to be considered as belonging to the concept of the present invention and will be described in the attached claims.

According to a preferred embodiment of the present invention, the holding
25 mechanism is disposed such that, in the closing procedure of the door, the holding mechanism causes the first matching portion and the second matching portion not to overlap in a moving direction of the door. Thus, the first and second matching portions are prevented from colliding each other during the closing of the door.

According to a preferred embodiment of the present invention, the first matching portion is movable between a first extreme position and a second extreme position, and the safe position is the first extreme position or close to the first extreme position.

5 According to a preferred embodiment of the present invention, the first matching portion is connected to the door in a manner of being able to rotate between the first extreme position and the second extreme position.

According to a preferred embodiment of the present invention, in the second extreme position, the first matching portion and the second matching portion are engaged and locked together.

10 According to a preferred embodiment of the present invention, the holding mechanism comprises at least one elastic component.

According to a preferred embodiment of the present invention, the door comprises a movable handle, and the handle and the first matching portion are disposed in a kinetically coupled manner.

15 According to a preferred embodiment of the present invention, the holding mechanism is disposed such that when the door is opened, the holding mechanism applies a force to the handle to hold the handle in a predetermined position and holds the first matching portion in the safe position.

20 According to a preferred embodiment of the present invention, the holding mechanism has a first part fixed to an unmovable component of the door and a second part fixed to the handle.

According to a preferred embodiment of the present invention, the holding mechanism comprises a torsion spring, and the torsion spring comprises a first end fixed to the unmovable component and a second end fixed to the handle.

25 According to a preferred embodiment of the present invention, the handle is limited to move between a retracted position and an extended position, wherein in the retracted position, a force is applied to the handle to cause the handle to have a movement trend of further retraction so as to hold the handle in the retracted position. In this way,

engagement reliability of the first matching portion and the second matching portion can be increased.

According to a preferred embodiment of the present invention, in the retracted position, the first matching portion and the second matching portion are engaged and locked together, and at least a majority of the handle is contained in the door. Thanks for this feature, on one hand, the occupied space of the storage unit in a normal using state (the door and the main body are compressed together) will be lowered down, and on the other hand, the possibility that the locked state being inadvertently released by a wrong operation to the handle can be decreased. Further, when the handle is in the retracted position, the handle is applied with a force that tends to impose a movement in a further retracting direction to the handle, so the handle is reliably kept in the door.

According to a preferred embodiment of the present invention, the holding mechanism is disposed such that a force causing the handle to have the movement trend of further retraction is generated. In an alternative embodiment, the storage unit comprises a second holding mechanism independent of the holding mechanism for generating a force causing the handle to have the movement trend of further retraction.

According to a preferred embodiment of the present invention, the handle is rotatably connected to the door, and in the retracted position, the handle is substantially parallel to the door.

According to a preferred embodiment of the present invention, the handle is rotatably connected to the door, and in the retracted position, a front surface of the handle is substantially aligned with a front surface of the door.

According to a preferred embodiment of the present invention, in the extended position, the first matching portion and the second matching portion are disengaged, and an angle between the handle and the door is smaller than 90 degrees.

According to a preferred embodiment of the present invention, when the handle is located in the extended position, the first matching portion is located in the safe position.

According to a preferred embodiment of the present invention, one of the first matching portion and the second matching portion comprises a cam curved surface, and

the other one of the first matching portion and the second matching portion comprises a column shaped locking portion for engaging with the cam curved surface.

The present invention in another aspect relates to a refrigeration appliance comprising a storage unit as defined in any of the above solutions.

- 5 According to a preferred embodiment of the present invention, the refrigeration appliance comprises a cabinet which defines a heat insulation storage chamber, wherein the storage unit is received in the storage chamber.

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

- 10 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

- 15 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:

- 20 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.

- 25 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.

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.

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 rod which is fixed behind the door.

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.

Figure 12a is a schematic perspective view of the door according to a preferred embodiment of the present invention, showing a state when the handle is in a second position, and Figure 12b is a partial sectional view of the door, showing a state when the handle is in the second position.

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

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).

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 32. 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 can 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 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 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 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 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 element 16 may alternatively be provided on the front end of the main body 8, for example, fixed to the front jointing frame 17.

5 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 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, 10 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.

15 The door 10 is of drawer type, which can be pushed towards the main body 8 to close the access opening 15a of the storage chamber 15, and can be pulled outwards to open the storage chamber 15. The backside of the door 10 is connected with a tray shaped container 12 for 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 20 out of the main body 8.

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.

25 The low pressure storage unit 7 comprises a pair of locking mechanisms for locking 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 30 main body 8 and the door 10 is fully deformed under a locking force created by the locking 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 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 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 rod 33 fixed to the handle 32, and a pair of first matching portions 34 fixed opposite ends of the rod 33 respectively.

The rod 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 rod 33 to extend through the fixing holes 61 so as to be connected to the handle 32.

In this embodiment, the rod 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 rod 33 to the fixing portions 35.

Opposite ends of the rod 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 rod 33, it is fixed to the rod 33 without being able to move with respect to the rod 33 then, by means of a fixing member such as a screw, so that, after
5 the rod 33 is fixed to a door plate 26, when the rod is rotated around its central axis X, the first matching portion 34 also rotates around the central axis X of the rod 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
10 first matching portion 34. The camming curve surface 34a is provided as facing towards the rod 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.

A transition protrusion 343 can be formed between the leading-in curve segment 341
15 and the locking curve segment 342, protruding towards the rod 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 overcome a maximum resistance. Then, locking is established after the locking portion 46 comes onto
20 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 rod 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 direction from the outer periphery of the rod 33 and is adapted to be cooperated with a
25 corresponding mechanism on the door 10 to restrict the axial movement of the rod 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 charging passage being provided through the door body 26 for releasing the low pressure
30 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 26 has a substantially rectangular plate shape and is preferably formed of a plastic material.

5 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 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.

10 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.

15 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
20 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
25 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.

30 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
5 down, and then a user may manipulate the handle 32 to open the door 10.

The rod 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
10 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 rod 33. The first
15 recesses 37 may alternatively be provided in mounting blocks 36 arranged inside the second accommodating space 30b.

As shown in Figure 10a, a half-ring shaped protrusion 40 is formed in at least one of the first recesses 37. When the rod 33 is mounted to the door body 26, the protrusion 40 is aligned with the retention recess 39 in the rod 33.

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

It should be understood that, in other embodiments, retention recesses of the axial
30 retention mechanism of the rod 33 may be alternatively provided on the door body and/or

the fixing member, while the rod is provided with retention protrusions.

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 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, once the first matching portions 34 are inserted through the through slots 42, the retention recesses 39 of the rod 33 are engaged by the protrusions 40, so that the rod 33 is received in the accommodating space 30. Then, the rod 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 rod 33, are fixed to the door body 26.

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 addition, the rod 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 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 rod 33 inside the door body 26 is also rotated around its central axis X while driving the first matching portion 34 to rotate. The rod 33 defines a rotation shaft (axis) for the handle 32 and the first matching portion 34. In this procedure, when the rod 32 is rotated, the rod also acts as a rotation shaft of the handle 32 and the first matching portion 34, with the central axis X of the rod having no displacement with respect to the door body 26.

The handle 32 is rotatable around the central axis X of the rod 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 rod 33. Meanwhile, the rod 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 rod 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 rod 33 and drives the rod 33 to rotate, the first matching portions 34 which is fixed to opposite ends of the rod 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 it 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 rod 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 rod 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.

In a preferred embodiment of the present invention, in a condition that the appliance door of the refrigeration appliance 1 is in its closed state, the door 10 of the low pressure storage unit 7 is in its closed position, and the handle 32 is in the second position (extended position), the inner side of the appliance door is separated from the handle 32 to prevent the low pressure storage unit 7 from being damaged when the appliance door is being closed. Thus, the forward protruding length of the handle 32 can be limited within a certain range by limiting the outward rotating angle of the handle 32 within a certain range, so that a distance between the low pressure storage unit 7 and the inner side of the appliance door of the refrigeration appliance 1 can be reduced, and the space utilization ratio of the refrigeration appliance 1 can be increased.

As shown in Figures 6 and 11b, when the handle 32 is in the second position, the

front end of the first matching portion 34, which is in the second extreme position, overlaps with the locking portion 46 of the second matching portion 44 in a front-back direction. In order to avoid the front end of the first matching portion 34 colliding with the locking portion 46 and thus damaging the low pressure storage unit 7 when a user pushes the door 1, which is in a pulled out state, towards the closed position, according to a preferred embodiment of the present invention as shown in Figures 9, 12a and 12b, the door 10 comprises a holding mechanism 49 holding the first matching portion 34 in a safe position after the door 10 is released from the locked state. This safe position is selected in the following manner: during the closing procedure of the door 10, the first matching portion 34 which is moving forwards is in a safe position which ensures that it cannot collide with the locking portion 46.

In a preferred embodiment, the first matching portion 34 is held in the safe position by the holding mechanism 49 which holds the handle 32 in a safe angle. The safe angle may be equal to an angle formed between the handle 32 which is in the first position and a vertical plane, also called maximum outward rotation angle, or slightly smaller than the maximum outward rotation angle, or in other words, the safe position of the first matching portion 34 may be its first extreme position or near to the first extreme position. It can be understood that, when the handle 32 is in the first position / extended position, the front end of the first matching portion 34 does not overlap the locking portion 46 in the front-back direction.

In an embodiment which is particularly easy to be practiced, the holding mechanism 49 comprises a spring. Preferably, the holding mechanism 49 is in the form of a torsion spring having a first end 49a fixed to the door body 26 or a member which is fixed to the door body 26 without any movability (for example, the fixing member 28) and a second end 49b fixed to the handle 32. When the handle 32 is in the first position, the torsion spring applies an outward torque to the handle 32 so that the handle 32 has power to continue its outward rotation. On the other hand, the handle 32 is restricted by the first retention structure 48 from further rotation, and thus it is reliably kept in the first position.

In an embodiment of the present invention, holding mechanism 49 may be configured to provide an inward torque to the handle 32 which is in the second position to prevent the lower end of the handle 32 from kicking out, and thus reliably keep the handle 32 in a vertical position.

Thus, with the holding mechanism 49 for providing the handle 32 with torques in opposite directions when it is in the first position and in the second position respectively, the handle 32 is in an equilibrium state when it is in an equilibrium position between the first position and the second position. When the handle 32 is rotated outwards slightly from this equilibrium position, the holding mechanism 49 provides torque to the handle 32 to rotate it outwards until the handle 32 reaches the first position where it is restricted from further rotation. When the handle 32 is rotated inwards slightly from this equilibrium position, the holding mechanism 49 provides torque to the handle 32 to rotate it inwards until the handle 32 reaches the second position where it is restricted from further rotation.

The above embodiment describes a condition where the handle 32 is held in either of the first position and the second position by means of a single torsion spring. However, the present invention is not limited to this. For example, in other embodiments, holding mechanisms, which are separate from each other, are provided for holding the handle 32 in the first position and in the second position respectively.

Further, in the above embodiment, the torsion spring of the holding mechanism 49 is fixed to the handle 32 and transmits a holding force to the first matching portion 34 via the handle 32. It should be understood that, in other embodiments, the holding mechanism 49 may apply a force to the first matching portion 34 directly to keep the first matching portion 34 in the safe position, or keep the first matching portion 34 in the safe position via other members.

Furthermore, in the condition that the first matching portion and the second matching portion are both movable, or in the condition that only the second matching portion is movable while the first matching portion is immobile, it is possible to provide the holding mechanism in a manner that the second matching portion is located in a position where colliding between the first and second matching portions during the closing procedure of the door can be avoided.

Although the container 12 or the door 10 is supported by the main body 8 via telescopic guide units 14, the drawer unit wobbles within a wobbling range when the drawer unit which carries the door 10 is being pulled out of the main body 8 or pushed into the main body 8, because there is always a gap between the container 12 and the main body 8. The wobbling range is related with the gap between the drawer unit and the main

body 8, and is highly affected by the guide units 14 (if being provided). Thus, when the door 10 is in the closed state, precise alignment between the door 10 and the main body 8 may be not achieved, as a result of which, the sealing element 16 cannot precisely located on the adjoining surface 18, and the first matching portion 34 and the second matching portion 44 cannot reach a properly pre-engaged position. In order to alleviate these defects, according to a preferred embodiment of the present invention, the low pressure storage unit 7 comprises a positioning mechanism for locating the door 10 in a fixed position or in a fixed range which is smaller than the above wobbling range when the door 10 is being closed, so that precise alignment between the door 10 and the main body 8 can be achieved when the door 10 in the closed position.

The positioning mechanism comprises a first positioning portion 51 provided on the door 10 and a second positioning portion 52 provided on the main body 8 and cooperating with the first positioning portion 51. As shown in Figure 8, the first positioning portion 51 is arranged within the door body 26, without extending out beyond the end surfaces 26b, 26c, 26d and 26e of the door body 26. In this embodiment, the first positioning portion 51 is arranged outside the sealing element 16 and near the through slot 42. As shown in Figures 3, 4, 5a and 5b, the second positioning portion 52 is arranged in front of the adjoining surface 18, protruding forwards from the adjoining surface 18 but not extending out beyond the outer edge of the front jointing frame 17.

In this way, when the door 10 is closed and the first positioning portion 51 cooperates with the second positioning portion 52, the second positioning portion 52 is received within the door 10 and is located in a loop shaped area encircled between the sealing element 16 and the periphery end surfaced 26b to 26e of the door 10. The first positioning portion 51 and the second positioning portion 52 are provided in a manner that, when the door 10 is closed, neither of them is exposed out from the outer surface of the low pressure storage unit 7. As a result, the appearance of the appliance is improved, and meanwhile, it does not need to increase the distance between the low pressure storage unit 7 and the inner shell 2b for providing the positioning mechanism when the low pressure storage unit 7 is mounted in the preservation compartment 4.

The first positioning portion 51 and the second positioning portion 52 are preferably provided in a form fitting manner. In this embodiment, the first positioning portion 51 is formed by an insertion slot in the door 10. The insertion slot is open at the side facing

towards the main body 8 to allow the insertion of the second positioning portion 52. When the door 10 is in the closed position, the second positioning portion 52 is inserted into the first positioning portion 51, with an outer surface of the second positioning portion 52 closely abutting against a corresponding inner surface of the first positioning portion 51, so as to restrict the transverse movement and longitudinal movements of the door 10. In this way, the door 10 is located precisely.

Since the second positioning portion 52 protrudes forwards from the adjoining surface 18 and is inserted into the first positioning portion 51 before the door 10 reaches its closed position, the positioning mechanism may also guide the movement of the door 10, which helps to reduce the wobbling of the door 10 and the tray type container 12 during the closing procedure to some extent. The insertion slot of the first positioning portion 51 may be formed as a wedge shaped slot which is largest at its opening portion and reduces in dimension in a back to front direction. Correspondingly, the insertion part of the second positioning portion 52 has also a wedge shape which tapers in a back to front direction and is smallest at its front end. In this way, it is very easy to insert the second positioning portion 52 into the first positioning portion 51 at the beginning of insertion. As the door 10 approaches the closed position, vertical and longitudinal gaps formed between the inner surface of the first positioning portion 51 and the outer periphery surface of the second positioning portion 52 are decreased gradually, which helps to gradually reduce the wobbling level of the drawer unit which carries the door 10. When the door 10 reaches the closed position, the gaps between the first and second positioning portions become minimum (for example, 1 to 2 millimeters), so that the door 10 is located within a fixed range which is substantially smaller than the above maximum wobbling range during the closing procedure of the drawer unit (the maximum wobbling range being existed before the first and second positioning portions 51 and 52 are engaged with each other). Of course, in an alternative embodiment, the first positioning portion 51 and the second positioning portion 52 may closely abut against each other before the door 10 reaches the closed position, so that the door 10 is located in a fixed position when it is closed.

Particularly preferably, the second positioning portion 52 is formed directly by the base 45 of the second matching portion 44. It should be understood that, in other embodiments, it is also possible to form the second positioning portion 52 by an insertion part which is separate from the second matching portion 44.

Further, in other embodiments, it is also possible to form the second positioning portion 52 by an insertion slot, and the first positioning portion 51 is formed by an insertion structure which is adapted to be inserted into the second positioning portion 52.

CLAIMS

What is claimed is:

1. A storage unit (7), comprising:

5 a main body (8), wherein the main body (8) defines a storage chamber (15) having an opening portion (15a) for putting in or taking out articles;

a door (10), for selectively opening or closing the opening portion (15a); and

a fastening mechanism (34, 44), for fastening the door (10) and the main body (8) when the door (10) is located at a closed position, wherein the fastening mechanism (34, 44) comprises a first matching portion (34) located on the door (10) and a second
10 matching portion (44) located on the main body (8) and for joint with the first matching portion (34);

characterized by comprising a holding mechanism (49), wherein the holding mechanism (49) is disposed such that when the door (10) is opened, the first matching portion (34) and /or the second matching portion (44) are held at a safe position where the
15 first matching portion (34) and the second matching portion (44) do not collide in a closing process of the door (10).

2. The storage unit (7) according to claim 1, characterized in that, the holding mechanism (49) is disposed such that: in the closing process of the door (10), the holding mechanism (49) causes the first matching portion (34) and the second matching portion
20 (44) not to overlap in a moving direction of the door (10).

3. The storage unit (7) according to claim 1 or 2, characterized in that, the first matching portion (34) moves between a first limit position and a second limit position, and the safe position is the first limit position or close to the first limit position.

4. The storage unit (7) according to claim 3, characterized in that, the first matching
25 portion (34) is rotatably connected to the door (10) between the first limit position and the second limit position.

5. The storage unit (7) according to claim 3 or 4, characterized in that, at the second limit position, the first matching portion (34) and the second matching portion (44) are jointed and locked.

6. The storage unit (7) according to any one of the above claims, characterized in that, the holding mechanism (49) comprises at least one elastic component.

7. The storage unit (7) according to any one of the above claims, characterized in that, the door (10) comprises a movable handle (32), and the handle (32) and the first matching portion (34) are disposed in a linkage manner.

8. The storage unit (7) according to claim 7, characterized in that, the holding mechanism (49) is disposed such that when the door (10) is opened, the holding mechanism (49) applies a force to the handle (32) to hold the handle (32) at a predetermined position and holds the first matching portion (34) at the safe position.

9. The storage unit (7) according to claim 7 or 8, characterized in that, the holding mechanism (49) has a first part fixed on an unmovable component of the door (10) and a second part fixed on the handle (32).

10. The storage unit (7) according to claim 9, characterized in that, the holding mechanism (49) comprises a torsion spring, and the torsion spring comprises a first end (49a) fixed on the unmovable component and a second end (49) on fixed the handle (32).

11. The storage unit (7) according to any one of claims 7 to 10, characterized in that, the handle (32) is limited to move between a retraction position and an extension position, wherein at the retraction position, a force is applied to the handle (32) to cause the handle (32) to have a movement trend of further retraction so as to hold the handle (32) at the retraction position.

12. The storage unit (7) according to claim 11, characterized in that, at the retraction position, the first matching portion (34) and the second matching portion (44) are jointed and locked, and at least most part of the handle (32) is contained in the door (10).

13. The storage unit (7) according to claim 12, characterized in that, the holding mechanism (49) is disposed such that the force causing the handle (32) to have the movement trend of further retraction is generated.

14. The storage unit (7) according to claim 12, characterized by comprising a second holding mechanism independent of the holding mechanism (49) so as to generate the force causing the handle (32) to have the movement trend of further retraction.

15. The storage unit (7) according to any one of claims 11 to 14, characterized in that, the handle (32) is rotatably connected to the door (10), and at the retraction position, the handle (32) is substantially parallel to the door (10).

16. The storage unit (7) according to any one of claims 11 to 14, characterized in that, the handle (32) is rotatably connected to the door (10), and at the retraction position, a front surface of the handle (32) is substantially aligned with a front surface (26a) of the door (10).

17. The storage unit (7) according to claim 15 or 16, characterized in that, at the extension position, the first matching portion (34) and the second matching portion (44) are disengaged, and an angle between the handle (32) and the door (10) is smaller than 90 degrees.

18. The storage unit (7) according to any one of claims 11 to 17, characterized in that, when the handle (32) is located at the extension position, the first matching portion (34) is located at the safe position.

19. The storage unit (7) according to any one of the above claims, characterized in that, one of the first matching portion (34) and the second matching portion (44) comprises a cam curved surface (34a), and the other one of the first matching portion (34) and the second matching portion (44) comprises a columnar locking portion (46) for joint with the cam curved surface (34a).

20. A cooling appliance (1), comprising the storage unit (7) according to any one of the above claims.

21. The cooling appliance (1) according to claim 20, characterized by comprising a case (2) for defining a heat insulation storage cabinet (4), wherein the storage unit (7) is contained in the storage cabinet (4).

22. The cooling appliance (1) according to claim 20 or 21, characterized in that, the storage unit (7) is a low-pressure storage unit for sustaining the storage chamber (15) in a low-pressure state.

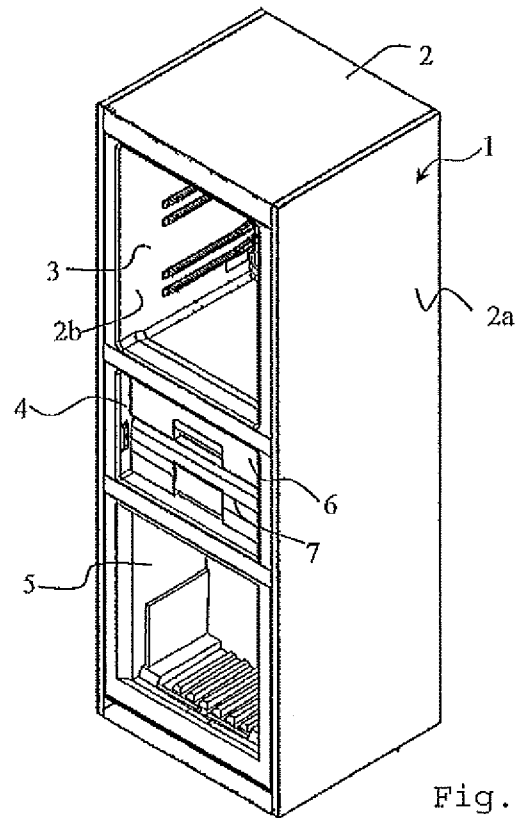


Fig. 1

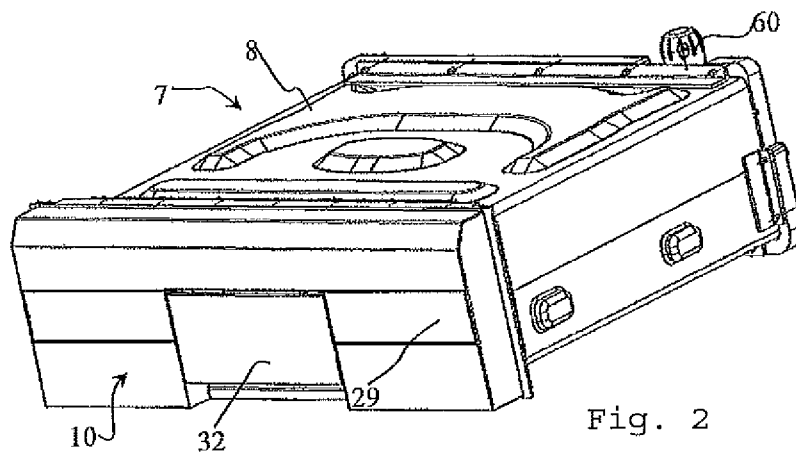
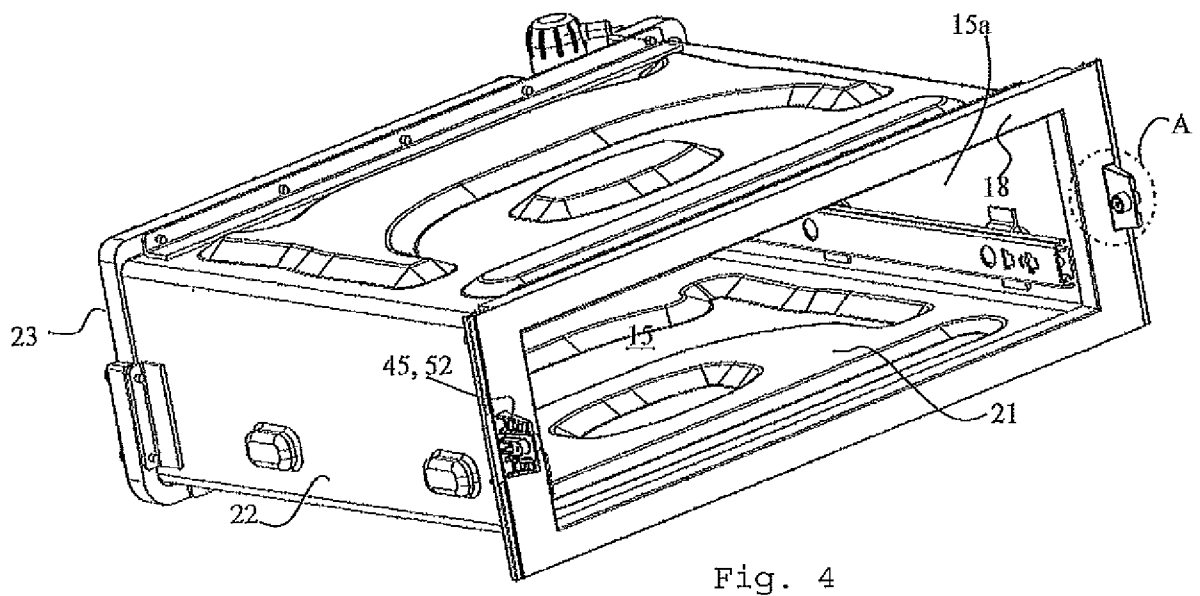
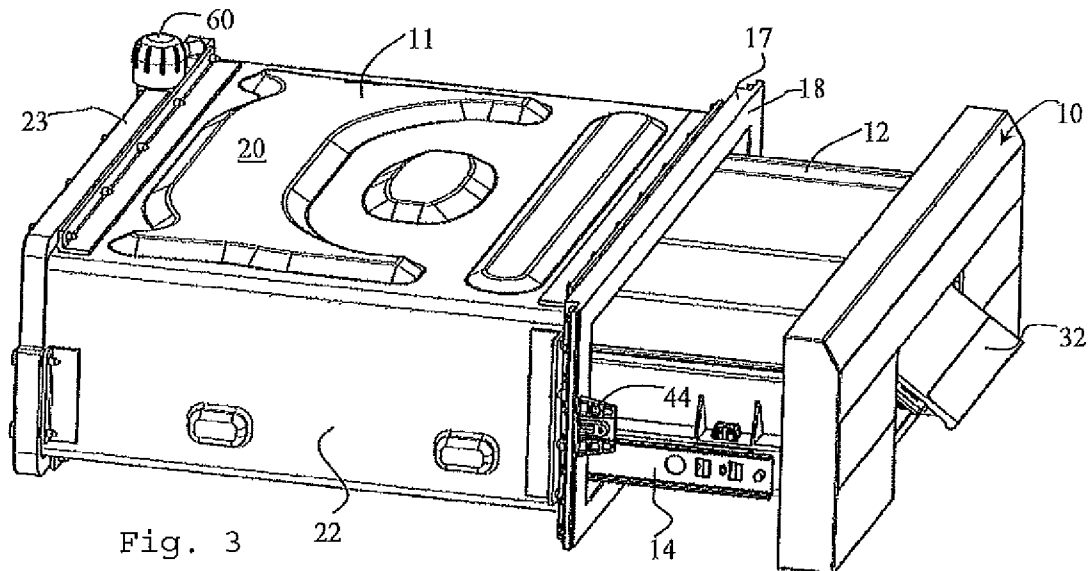


Fig. 2



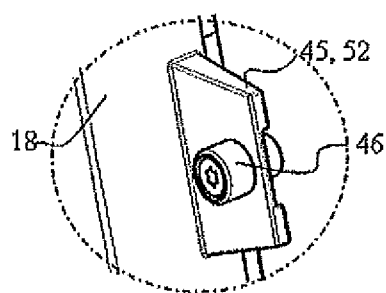


Fig. 5a

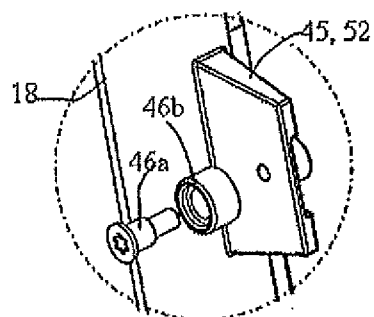


Fig. 5b

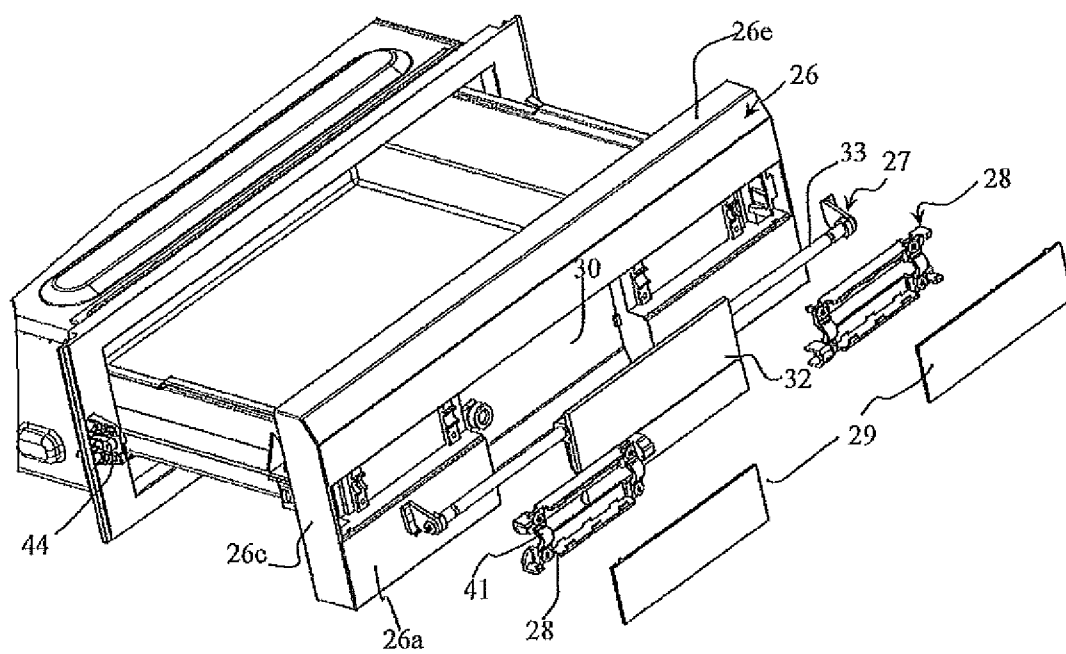


Fig. 6

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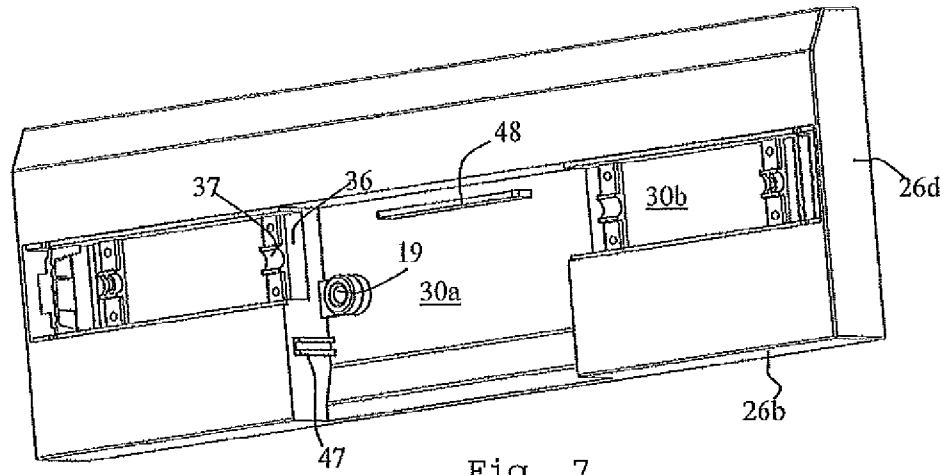


Fig. 7

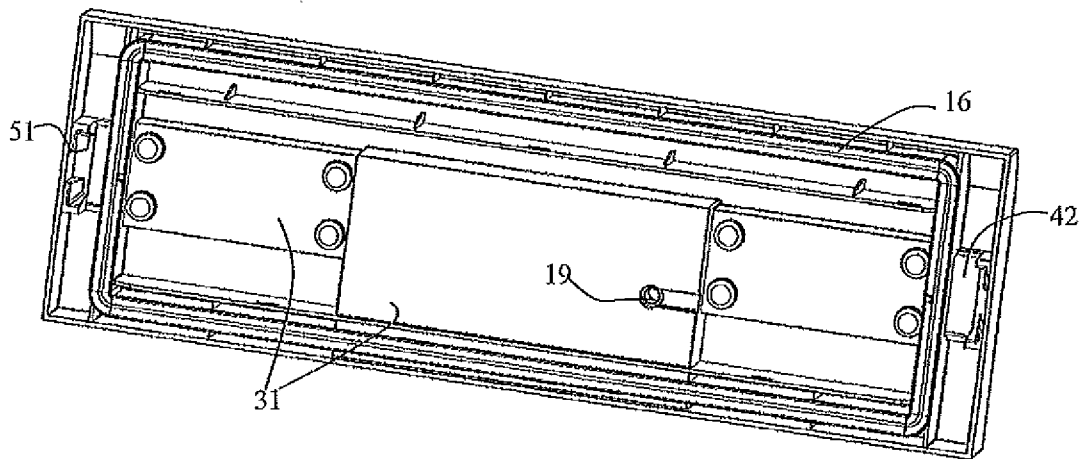
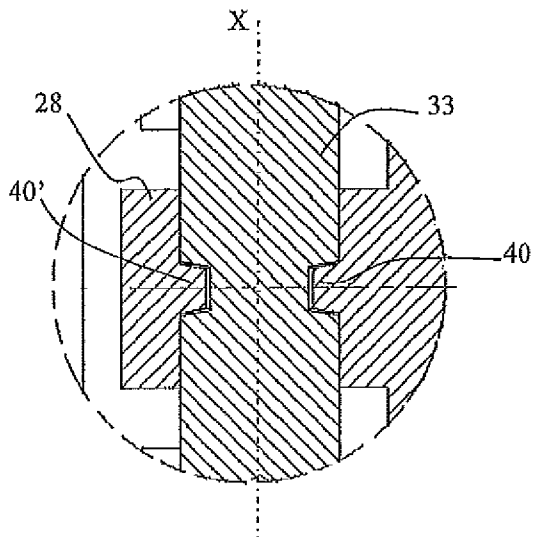
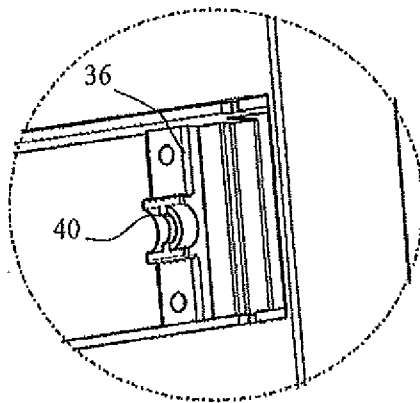
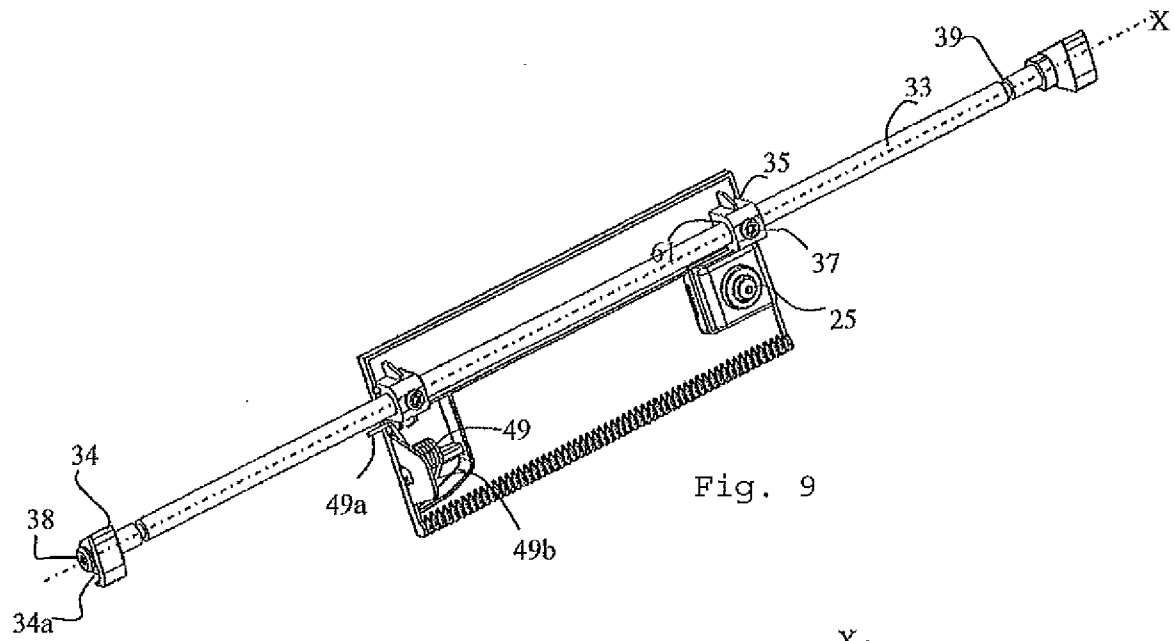


Fig. 8



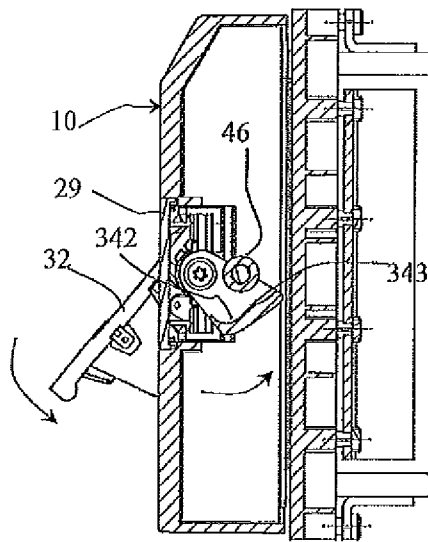


Fig. 11a

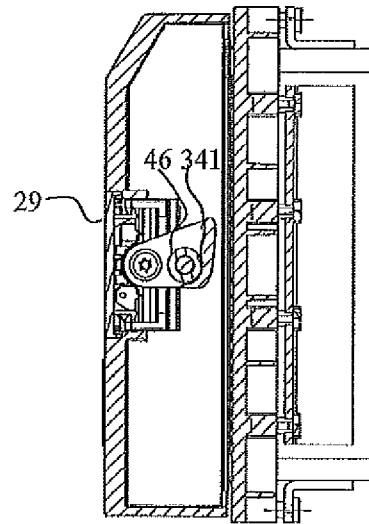


Fig. 11b

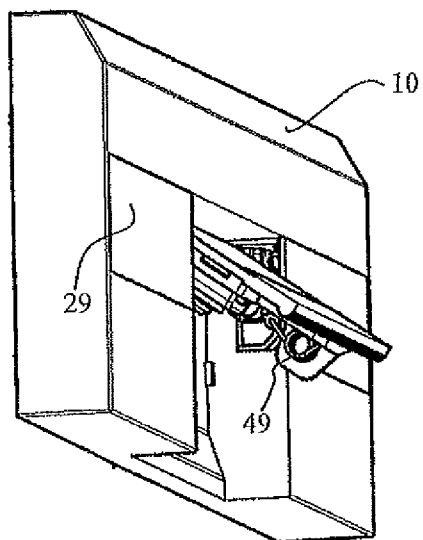


Fig. 12a

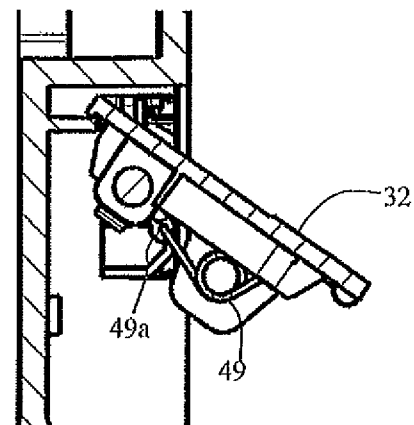


Fig. 12b