

SPECIFICATION**TITLE OF THE INVENTION**

Showcase

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The present invention relates to a showcase that includes a unit base installed on the bottom surface of a machine chamber, and a blower and a drain pan provided in the machine chamber.

2. Description of Related Art

A typical conventional freezer having a blower as disclosed in, for example, Japanese Unexamined Patent Publication No. 5-266330 is formed of a freezing machine installed in a cabinet. A drain pan is provided at the bottom of the unit base to which the freezing machine has been installed, and a blower that blows hot air utilizing the waste heat from a condenser onto the drained water gathered in the drain pan. In some conventional freezers, the unit base has ventilation ports for introducing hot air to the drain pan.

In such a conventional example, however, if the blower fails, the screws securing the blower to the unit base could not be removed from the back of the machine chamber, because the blower cannot be accessed from the back. Therefore, replacing the blower has been extremely difficult, requiring

extensive work, e.g. removing the entire unit base from the main body of the freezer, if the blower malfunctions.

SUMMARY OF THE INVENTION

The present invention has been made with a view toward solving the problem with the prior art described above, and it is an object of the present invention to provide a showcase that has a unit base provided with a drilled hole that is usually plugged by a drain pan and unplugged if failure of a blower occurs so as to allow the blower to be removed through the unplugged hole, thus permitting easier replacement of a blower.

According to one aspect of the present invention, there is provided a showcase including a unit base constituting the bottom surface of a machine chamber, a blower provided in the machine chamber, and a detachably installed drain pan for receiving drained water, wherein the unit base is provided with a drilled hole for allowing the blower to be taken out, and the drilled hole is covered by the drain pan.

According to the present invention, the drilled hole provided in the unit base is usually plugged by the drain pan; hence, hot air from a condenser flows above the drain pan, promoting the evaporation of drain water, and if the blower should fail, then the drain pan is removed to take out the blower through the drilled hole, permitting easier replacement of the blower.

In a preferred form of the showcase according to the present invention, a fixing plate for fixing the blower to the condenser in the machine chamber is provided, an upper engaging portion of the fixing plate is retained on an upper locking portion of the condenser, and a lower portion of the fixing plate is secured to a lower portion of the condenser by a screw.

With this arrangement, the blower can be replaced even more easily. To secure the fixing plate, which secures the blower, to the condenser, the engaging portion of the fixing plate that is located farther from the drilled hole in the unit base is locked onto the locking portion of the condenser, then only the lower portion of the fixing plate that is located closer to the drilled hole of the unit base is secured to the lower portion of the condenser by a screw, thus allowing the fixing plate to be easily secured to the condenser.

In another preferred form of the showcase according to the present invention, the locking portion is formed by at least a sandwiching member that is provided on an upper portion of the condenser and sandwiches a securing portion, and a protuberance provided facing against the sandwiching member.

With this arrangement, the locking portion of the fixing plate that secures the blower is held between the protuberance and the sandwiching member, preventing vibration from taking place caused by loosening of the fixing plate due

to the revolution of the blower. In addition, the protuberance and the sandwiching member have simple structures and can be easily fabricated.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of a showcase in accordance with the present invention;

Fig. 2 is a side view of the showcase in accordance with the present invention;

Fig. 3 is a rear view of the showcase in accordance with the present invention;

Fig. 4 is a rear view of the showcase in accordance with the present invention, wherein a rear panel has been removed;

Fig. 5 is a longitudinal sectional side view of the showcase in accordance with the present invention;

Fig. 6 is a plane cross-sectional view of a machine chamber of the showcase in accordance with the present invention;

Fig. 7 is a detailed view of an essential section of the machine chamber of Fig. 5 taken at the line A-A;

Fig. 8 is a top cross-sectional view of the essential section of Fig. 7, from which a drain pan and an evaporation plate have been removed;

Fig. 9 is a side view of an essential section, showing a unit base, a condenser, a condenser blower, a fixing plate, a drain pan, and the evaporation plate;

Fig. 10 is a side view of an essential section illustrating a process for replacing the condenser blower;

Fig. 11 is a detailed view of portion A of the essential section of Fig. 9; and

Fig. 12 is a detailed view of an essential section illustrating a process for removing the fixing plate from a locking portion of the condenser.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment in accordance with the present invention will now be described in conjunction with the accompanying drawings.

A showcase 1 is a desk-top showcase mounted on a cash register counter in, for example, a convenience store. The showcase 1 is primarily comprised of an adiabatic wall 4 mounted on a unit base 3 of a bottom section, a bottom plate 6 mounted on the adiabatic wall 4 and made of a hard resin, side plates 7 and 7 vertically provided at the right and left of the unit base 3, a top plate 8 hung between the upper ends of the side plates 7 and 7, and a door 11 that closes an opening 9 at a rear surface surrounded by the rear edges of the bottom plate 6, the side plates 7 and 7, and the top plate 8 such that the opening 9 can be opened and closed. A display compartment 13 includes a space surrounded by the door 11, the top plate 8, the side plates 7 and 7, and the bottom plate 6, and an opening 12 at the front thereof.

The space inside the unit base 3 under the adiabatic

wall 4 provides a machine chamber 14. Reference numeral 16 denotes enforcing brackets installed at right and left of the unit base 3. Reference numerals 10, 10, and so on denote resinous spacers provided at upper and lower corners of a rear surface.

The adiabatic wall 4 has a stepped shape with low front and high rear, thus having a low portion 4A at its front and a high portion 4B at its rear. The low portion 4A gently inclines toward the rear, while the high portion 4B gently inclines toward the front. A longitudinal wall portion 4C connecting the high portion 4B and the low portion 4A is formed of a slant wall with its upper part slightly inclining backward.

The bottom plate 6 is installed such that it covers the adiabatic wall 4 and the unit base 3, being spaced away from the low portion 4A, the high portion 4B, and the longitudinal wall portion 4C of the adiabatic wall 4. Thus, in a similar manner, a low portion 6A at the front, a high portion 6B at the rear, and a longitudinal wall portion 6C located between the former two are constructed. Furthermore, a cooling chamber 17 extending from front bottom to rear top is formed between the bottom plate 6 and the adiabatic wall 4. A cooler 18 constituting a refrigerating cycle of a cooling apparatus R is horizontally provided in the cooling chamber 17 on the high portion 4B, and a blower 19 is provided in the cooling chamber 17 at the front center of the longitudinal wall portion 4C.

A cooler partitioner 21 extending from the top surface of the cooler 18 to the top of the longitudinal wall portion 6C is installed in the cooling chamber 17, an interval being provided between the cooler partitioner 21 and the bottom plate 6. A guard 6D for preventing products from falling is vertically provided integrally on the upper edge of the longitudinal wall portion 6C of the bottom plate 6, and a lower discharge port 22 is formed at the lower side thereof. The cooler partitioner 21 continues to the lower edge of the lower discharge port 22, thereby constituting a lower discharge duct 23, which extends from the rear of the cooler 18 to the lower discharge port 22, between the cooler partitioner 21 and the bottom plate 6. Reference numeral 24 denotes a fan case mounted around the blower 19.

The longitudinal wall portion 6C of the bottom plate 6 is also formed to be a slope wall with its top slightly leaning backward, a discharge guide 26 that conceals the lower discharge port 22 being installed on the front surface thereof. The longitudinal wall portion 6C opens downward, and a protuberance 27 is integrally formed below the lower discharge port 22. The low portion 6A of the bottom plate 6 also inclines down gently backward, and its front portion is bent down to the front, an inlet 29 being formed at the bent front portion. A plane fluorescent lamp 31, which has been disclosed in Japanese Unexamined Utility Model No. 5-43458, is vertically provided at the front of the inlet 29, and located at the bottom edge of the opening 12 of the display

compartment 13. The plane fluorescent lamp 31 emits light to the front and back, and is provided with a predetermined advertisement display on its front surface.

The high portion 6B of the bottom plate 6 also gently inclines so that it is taller toward the rear, and its rear end portion is stepped downward. A rear wall portion 33 located behind the cooler 18 has a communication aperture 32. The rear wall portion 33 of the bottom plate 6 that has the communication aperture 32 is formed of a slope surface having its top being the front side.

The door 11 is constructed by charging an adiabatic material 38 between an outer plate 36 and an inner plate 37 both made of a hard resin, and pivotally and rotatably supported, for example, by the top plate 8 and the bottom plate 6 by means of hinges 39 at its top and bottom on the right side as observed from the rear. A space is provided between the adiabatic material 38 and inner plate 37, and a rear duct 41 vertically extending is formed in the space.

An adiabatic material 48 is also installed inside the top plate 8. An inner plate 49 is installed under the adiabatic material 48 with a gap provided therebetween, and a top duct 51 is constructed between the inner plate 49 and the adiabatic material 48.

The front end of the top duct 51 opens downward to the front, and an upper discharge port 61 is formed there. With this arrangement, when the door 11 is closed, a series of cool air circulation duct system is constructed that extends

from the lower inlet 29 to the cooling chamber 17, and from the cooling chamber 17 to the rear duct 41 and the top duct 51, and further to the upper discharge port 61.

The configuration inside the machine chamber 14 will now be described. A plurality of stages of slit-shaped exhaust ports 3A are formed in the front surface and the right and left side surfaces of the unit base 3, and the rear surface of the unit base 3 have an opening. The opening is closed by the rear panel 2 such that it can be opened and closed. The unit base 3 has a substantially rectangular hole 92 drilled in a surface thereof under a drain pan 68, which will be discussed later. The unit base 3 located under the adiabatic wall 4, as a whole, is closed except for the drilled hole 92. The drilled hole 92 is closed when the drain pan 68 is installed. Furthermore, the drilled hole 92 is sufficiently large to let the condenser blower 69 pass therethrough.

In the machine chamber 14 constructed in the unit base 3, there are installed a compressor 63, a condenser 64, and a capillary tube (pressure reducing device) 66 making up a refrigerating cycle of the cooling apparatus R together with the cooler 18. Furthermore, a control box 67 for accommodating a control board, the drain pan 68, a condenser blower 69, etc. are also installed in the machine chamber 14.

In this case, as shown in Fig. 6, the compressor 63 is installed on the right at back, and the condenser 64 is installed on the left at back in the machine chamber 14, as

observed facing the machine chamber 14. The condenser blower 69 is secured in front of the condenser 64 by a fixing plate 93, which will be described hereinafter. Reference numeral 63D denotes a discharge pipe of the compressor 63, and 63S is an intake pipe. As previously mentioned, the adiabatic wall 4 has the lower portion 4A at its front, and the high portion 4B at its back, so that the machine chamber 14 is lower at its front and higher at its back. Hence, the compressor 63 and the condenser 64, which are bulky, are provided side by side by making use of the tall portion of the machine chamber 14.

The condenser 64 and the condenser blower 69 are installed such that they are spaced above the bottom surface of the unit base 3 by a mounting plate 72 substantially shaped like a gate. The drain pan 68 is removably inserted through an opening in the rear surface, and placed under the condenser 64 and the condenser blower 69. Reference numeral 73 denotes an evaporation plate included in the drain pan 68 and formed of a water-absorbing member to enhance the evaporation of drained water, which will be discussed hereinafter.

The fixing plate 93 for securing the condenser blower 69 to the condenser 64 is substantially U-shaped, and has a mounting portion 94 to which the blower 64 is secured, upper and lower horizontal portions 95 and 95 that horizontally extend from the mounting portion 94, and an upper flange (engaging portion) 96 and a lower flange 97 that vertically

extend from the horizontal portions 95 and 95, respectively. The lower flange 97 has a mounting hole 98 drilled therein. The condenser 64 has a sandwiching member 80 welded thereto, and the sandwiching member 80 has a secured portion 83 welded to the condenser 64, a bent portion 84 that extends, being bent at right angles to the secured portion 83, and a sandwiching portion 85 that further extends downward from the bent portion 84. Furthermore, a restricting portion 86 surrounding the upper flange 96 of the fixing plate 93 and a second secured portion 87 welded to the condenser 64 are formed on a side surface of the sandwiching portion 85, as shown in Fig. 7 and Fig. 11. An upper portion of the condenser 64 is provided with a protuberance 88 opposing the sandwiching the sandwiching portion 85 and having a shape of a "dowel," a locking portion 89 being constituted by the sandwiching member 80 and the protuberance 88. Tapped holes (not shown) are provided in a lower portion of the condenser 64.

In such a configuration, the upper flange 96 of the fixing plate 93 is inserted in the locking portion 89 of the condenser 64, and secured by screws 90, using the mounting hole 98 in the lower portion of the securing plate 93. The screws 90 are inserted in the tapped holes in the lower portion of the condenser 64. Thus, the condenser blower 69 is secured to the condenser 64.

An intake port 2A in which a filter 74 has been installed is formed in a portion associated with the

condenser 64 of the rear panel 2 (the portion is located on the right side as observed from the rear). A motor 19M for driving the blower 19 is installed in the machine chamber 14 at the rear of the longitudinal wall portion 4C of the adiabatic wall 4, and disposed between the compressor 63 and the condenser 64. The rotating shaft of the motor 19M is coupled to the blower 19, penetrating the longitudinal wall portion 4C.

Furthermore, a drainage port 76 is formed at the left side (as observed facing the adiabatic wall 4) on the front portion of the high portion 4B of the adiabatic wall 4, and a drainage hose 77 comes out of the drainage port 76, penetrates the adiabatic wall 4, and dangles with its bottom end opened onto the drain pan 68. The drained water, including the water from defrosting and dew, dripping from the cooler 18 flows down along the high portion 4B into the drainage port 76, further into the drainage hose 77 from the drainage port 76, and is finally drained into the drain pan 68.

The compressor 63, the condenser 64, the condenser blower 69, the drain pan 68, the control box 67, and the motor 19M are disposed as described above, so that these units can be orderly installed in the small machine chamber 14 without interfering with each other.

The showcase 1 constructed as described above is rested on a cash register counter of a convenience store. A product V, such as a bottled or canned beverage, is

accommodated and displayed in the display compartment 13. In this case, the product V is put in the display compartment from the opening 12 on the front and placed on the low portion 6A on the front side of the longitudinal wall portion 6C of the bottom plate 6, as shown in Fig. 5. Thus, the low portion 6A provides the display surface of the lowermost stage. At this time, since the low portion 6A slightly inclines downward toward the back, the product V leans against the protuberance 27 or the discharge guide 26 at the back rather than falling toward the front.

To place the product V on the high portion 6B of the bottom plate 6 that provides a display surface of a middle stage (or the uppermost stage if a shelf 91 is not provided) or on the shelf 91 that provides the display surface of the uppermost stage, the door 11 on the rear surface is opened and the product V is put in the display compartment through the opening 9. At this time, since the high portion 6B and the shelf 91 are slightly inclined downward toward the front, the products V can be smoothly accommodated in succession from the rear. Furthermore, since the high portion 6B and the shelf 91 are inclined downward toward their front, customers can see the products V more easily, and when a customer takes out the product V on the front row, the product V behind it will be automatically moved to the front row.

When the power of the showcase is turned ON to start operation, the plane fluorescent lamp 31 will first turns ON

to light up advertisement characters or the like at the front, while illuminating the interior of the display compartment 13 at the rear at the same time. When the compressor 63, the motor 19M of the blower 19, and the condenser blower 69 are actuated, a gas refrigerant of high temperature and pressure discharged from the discharging pipe 63D of the compressor 63 flows into the condenser 64 wherein it is condensed and liquefied by outside air supplied by the condenser blower 69. The condensed liquefied refrigerant is decompressed by the capillary tube 66, then passed into the cooler 18 where it evaporates.

At this time, the refrigerant deprives the air in the cooling chamber 17 of heat, thereby exhibiting its cooling effect. The refrigerant leaving the cooler 18 is suctioned into the compressor 63 through the intake pipe 63S, and compressed again. The blower 19, when it is actuated, suctioned air through the inlet 29 and discharges it toward the cooler 18, as indicated by the arrows shown in Fig. 5. As previously mentioned, the cold air in the cooling chamber 17 that has been cooled by performing heat exchange with the cooler 18 goes out through a communication aperture 32 and enters into the rear duct 41 through a communication aperture 43. The cold air then moves up in the rear duct 41 and enters the top duct 51 through communication apertures 42 and 53, and moves forward. Thereafter, the cold air is discharged from a discharge port 61 toward the front opening 12 of the display compartment 13.

The cold air discharged from the discharge port 61 moves toward the inlet 29 while forming an air curtain at the opening 12, and is suctioned into the inlet 29 by the suction force of the blower 19 by being guided by the plane fluorescent lamp 31. A part of the air curtain is circulated in the display compartment 13 to cool the interior of the display compartment 13 to a predetermined temperature. A part of the cold air leaving the cooler 18 enters the lower discharge duct 23, moves forward therein, and is discharged to the front of the longitudinal wall portion 6C from the lower discharge port 22.

Usually, the cooling effect on the low portion 6A of the display surface of the lowermost stage, which is located farther from the discharge port 61, tends to deteriorate. As set forth above, however, the cold air is directly supplied from the lower discharge port 22, thereby solving the deteriorated cooling effect problem. Furthermore, the lower discharge port 22 is provided with the discharge guide 26, and the protuberance 27 is formed therebelow; hence, the discharge of the cold air from the lower discharge port 22 or the circulation of the cold air will not be interfered with by the product V on the low portion 6A.

When the condenser blower 69 is actuated, outside air is suctioned through the inlet 2A of the rear panel 2, passed through the condenser 64, and blown to the drain pan 68 at the front. This causes the drained water in the drain pan 68 to evaporate. At this time, the drilled hole 92 provided in

the unit base 3 is closed by the drain pane 68 that has been installed, thereby preventing the outside air from entering through the drilled hole 92 and disturbing the hot air of the condenser 64. This enables the hot air to smoothly flow above the drain pan 68 and the evaporation plate 73 so as to expedite the evaporation of the drained water. A part of the air that has turned into hot air after cooling the condenser 64 or the hot air generated by the compressor 63 flows out of the exhaust port 3A around the unit base 3, while the rest of the hot air reaches cutouts 3B at the rear on both sides of the unit base 3 to flow outside through the cutouts 3B. The hot air coming out of the cutouts 3B flows along the side plate 7 to heat the side plate thereby to prevent dew from being formed thereon.

The following will describe the procedure for replacing the condenser blower 69 if it fails. As mentioned above, the adiabatic wall 4 has the low portion 4A at its front and the high portion 4B at its rear, so that the machine chamber 14 is lower at its front and higher at its rear. This prevents the hand or fingers from the front of the showcase 1, making it impossible to replace the condenser blower 69. The fixing plate 93 securing the condenser blower 69 to the condenser 64 is located at the back side of the condenser 64 as observed from the rear surface side of the showcase 1 (on the front side of the showcase), making it impossible to remove the condenser blower 69 from the rear of the showcase 1, either. However, the unit base 3 is provided

with the drilled hole 92 that is sufficiently large to let the condenser blower 69 pass therethrough. In addition, the showcase 1 is lightweight so that it can be rested on a cash register counter at a convenience store, allowing the showcase 1 to be placed on the floor with its back surface facing down. First, the rear panel 2 is removed, the drain pan 68 is taken out from the rear of the showcase 1, then the products V, such as bottled or canned beverages are taken out of the display compartment 13. The showcase 1 is then placed on the floor with its back surface facing down. As previously mentioned, the back surface is provided with resinous spacers 10, 10, and so on that prevent the back surface of the showcase 1 from coming into direct contact with the floor, thus protecting both the showcase 1 and the floor from being scratched. Next, a tool is inserted through the drilled hole 92 provided in the unit base 3 to remove the screws 90 securing the lower portion of the fixing plate 93, and the upper flange 96 is detached from the locking portion 89 of the condenser 64 (Fig. 12), then the condenser blower 69 and the fixing plate 93 is taken out of the drilled hole 92. The condenser blower 69 is detached from the fixing plate 93, and replaced by a nondefective one.

Thereafter, the new condenser blower 69 and the fixing plate 93 are first inserted through the drilled hole 92 formed in the unit base 3, the upper portion of the fixing plate 93 is held by the locking portion 89 of the condenser 64, and the lower portion of the fixing plate 93 is secured

by the screws 90. The showcase 1 is raised back, the products V, such as the bottled or canned beverages, are placed back into the display compartment 13. Thereafter, the drain pan 68 is inserted from the rear of the showcase 1, and the drilled hole 92 formed in the unit base 3 is closed. Lastly, the rear panel 2 is reinstalled.

Thus, since the drilled hole 92, which is usually closed by the drain pan 68, is formed in the unit base 3, the hot air from the condenser 64 flows above the drain pan 68, expediting the evaporation of drained water. In addition, if the condenser blower 69 should fail, the condenser blower 69 can be take out through the drilled hole 92, permitting easier replacement of the condenser blower 69.

Moreover, as previously mentioned, since the protuberance 88 is provided, and the sandwiching member 80 and the protuberance 88 constitute the locking portion 89, the above replacing work can be easily accomplished, and the screws 90 of the fixing plate 93 do not loosen due to the revolution of the condenser blower 69, thus restraining vibrations or noises from being produced.

Thus, as described above in detail, according to the present invention, the unit base of the showcase has the drilled hole that is usually closed by the drain pan, and if the blower should fail, the blower can be taken out through the drilled hole, permitting easy replacement of the blower. Moreover, easy locking onto the locking portion allows the replacement to be easily accomplished. Furthermore, the

screws of the fixing plate do not loosen due to the revolution of the condenser blower, so that vibrations or noises can be restrained.

WHAT IS CLAIMED IS:



1. A showcase comprising:
 - a unit base constituting the bottom surface of a machine chamber;
 - a blower provided in the machine chamber, and
 - a detachably installed drain pan for receiving drained water,wherein the unit base is provided with a drilled hole for allowing the blower to be taken out, and the drilled hole is covered by the drain pan.
2. A showcase according to Claim 1, further comprising a fixing plate for fixing the blower to the condenser in the machine chamber,
 - wherein an upper engaging portion of the fixing plate is retained on an upper locking portion of the condenser, and
 - a lower portion of the fixing plate is secured to a lower portion of the condenser by a screw.
3. A showcase according to Claim 2, wherein the locking portion is formed by at least a sandwiching member that is provided on an upper portion of the condenser and sandwiches a securing portion, and a protuberance provided facing against the sandwiching member.