

[Name of Document] DESCRIPTION

[Name of Invention] REFRIGERATOR-FREEZER

[Technical Field]

[0001]

The present disclosure relates to a refrigerator-freezer with an ice making device.

[Background Art]

[0002]

Hitherto, refrigerators with an automatic ice making device that automatically makes ice is known.

As such, there is a refrigerator that has an automatic ice making device in a freezing compartment, discharges cold air from an air outlet for sending out cold air into the freezing compartment, and discharges cold air to an upper surface of an ice tray from a cold air duct provided separately from the outlet (refer to, for example, Patent Literature 1).

[0003]

Further, there is a refrigerator that splits a passage of cold air supplied to an ice making device of an ice compartment into a main air passage and a plurality of sub air passages so that "by a main air passage 21, cold air is supplied from an back side of an ice tray 11 to a front portion of the ice tray 11" and "cold air passing through a sub air passage 22 and a sub air passage 23 is supplied to the ice tray 11 from obliquely above through a plurality of openings 17" (refer to, for example, Patent Literature 2).

[0004]

Furthermore, there is a refrigerator in which an air outlet, which is formed opposite a fan sending cold air, discharges cold air into a freezing room and in which a plurality of discharge ports, which is in communication with a cold air duct provided on the upper side of the air outlet, discharges cold air to an ice tray (refer to, for example, Patent Literature 3).

[Citation List]

[Patent Literature]

[0005]

Patent Literature 1: Japanese Unexamined Patent Application Publication

No. 9-33155 (pages 2 and 3, Fig. 1)

Patent Literature 2: Japanese Unexamined Patent Application Publication
No. 2010-43823 (pages 7 to 5, Fig. 5)

Patent Literature 3: Japanese Unexamined Patent Application Publication
No. 9-113095 (pages 2 and 3, Fig. 2)

[Summary of Invention]

[Technical Problem]

[0006]

Incidentally, when making ice in an ice tray, the ice making efficiency is higher when cold air is discharged from the upper side of the ice tray directly cooling the tray than when cooling indirectly from around the ice tray.

Since the refrigerator described in Patent Literature 1 above has two air outlets, one on the lower side and the other on the upper side of the ice tray in the back portion of the freezing compartment, the flow rate of the cold air from the fan is dispersed into the two air outlets. Accordingly, the flow rate of the cold air from the air outlet, which is provided on the upper side of the ice tray for directly cooling the ice tray, becomes relatively low, and, thus, it has been difficult to improve the ice making efficiency.

[0007]

Further, the refrigerator described in Patent Literature 2 above is provided with the main air passage, which supplies cold air from the back side to the front side of the ice tray, and sub air passages, which supply cold air from obliquely above the ice tray. However, since the cold air from the main air passage and the cold air from the sub air passages merge, the flow direction of the cold air of each sub air passage, having a relatively low flow rate, is forced to change by the cold air from the main air passage, and, thus, ice making efficiency is reduced.

[0008]

Furthermore, those described in Patent Literatures 1 and 3 above are configured to discharge cold air to the upper surface of the ice tray from the air outlet for the ice tray after initially guiding the cold air from the fan to a direction that is substantially orthogonal (on the upper direction) to the direction of the cold air from the fan. Accordingly, the flow of the cold air from the fan to the air

outlet of the ice tray is not smooth and pressure loss is large. As a result, the amount of discharged air supplied to the ice tray is decreased in relation to the amount of air sent from the fan, and, thus, ice making efficiency is low.

[0009]

As described above, further improvement on ice making efficiency has been waited upon in conventional refrigerator-freezers with an ice making device.

The present disclosure has been made having the aforementioned problems in its background, and the present disclosure provides a refrigerator-freezer capable of improving the ice making efficiency of the ice compartment.

[Solution to Problem]

[0010]

An refrigerator-freezer according to the disclosure includes an ice compartment having a cold air inlet port; an ice tray disposed in the ice compartment, and partitionally formed with a plurality of ice cavities therein; a baffle tray arranged above the ice tray, connected to the cold air inlet port, and forming an air passage for a cold air from the cold air inlet port, in which a plurality of discharge ports are formed in the baffle tray, the discharge ports are respectively provided with the ice cavities of the ice tray to supply cold air to the ice tray from above, and the cold air flowing into the ice compartment from the cold air inlet port is supplied to a region above the ice tray only through the discharge ports of the baffle tray.

[Advantageous Effects of Invention]

[0011]

A refrigerator-freezer according to the disclosure is capable of increasing the efficiency of utilization of cold air for making ice supplied to an ice compartment.

[Brief Description of Drawings]

[0012]

[Fig. 1] Fig. 1 is a front view of a refrigerator-freezer according to an embodiment.

[Fig. 2] Fig. 2 is a cross-sectional view taken along the line A-A of Fig. 1.

[Fig. 3] Fig. 3 is a cross-sectional, schematic diagram of a main section of an ice compartment and a peripheral thereof according to the embodiment.

[Fig. 4] Fig. 4 is a perspective view of an ice making device according to the

embodiment in a state in which an ice tray is housed therein.

[Fig. 5] Fig. 5 is a perspective view of the ice making device according to the embodiment in a state in which the ice tray is drawn out thereof.

[Fig. 6] Fig. 6 is a top view of the ice making device according to the embodiment in a state in which a water pipe and a thermopile are removed therefrom.

[Fig. 7] Fig. 7 is a top view of the ice making device according to the embodiment in a state in which a water pipe and a thermopile are installed therein.

[Fig. 8] Fig. 8 is a cross-sectional view taken along the line C-C of Fig. 7.

[Fig. 9] Fig. 9 is a cross-sectional view taken along the line D-D of Fig. 7.

[Fig. 10] Fig. 10 is a diagram explaining the arrangement of the ice tray, a first air passage, and a second air passage when viewing the ice making device of the embodiment from the front.

[Fig. 11] Fig. 11 is a cross-sectional, schematic diagram of a main section of a fan and a peripheral of the fan of the refrigerator-freezer according to the embodiment.

[Fig. 12] Fig. 12 is a diagram explaining a flow of the cold air in the ice making device according to the embodiment.

[Description of Embodiments]

[0013]

Subsequently, an embodiment of the refrigerator-freezer of the present disclosure will be made with reference to the figures. Note that the disclosure is not limited by this embodiment.

[0014]

Embodiment

Fig. 1 is a front view of a refrigerator-freezer according to an embodiment. Fig. 2 is a cross-sectional view taken along the line A-A of Fig. 1.

A refrigerator-freezer 100 includes a plurality of storerooms defined by partitioning a substantially rectangular parallelepiped box 40 that is opened in a front side. The box 40 is configured by, for example, an outer casing made of steel plate, an inner casing made of synthetic resin. A heat insulating material is filled therebetween.

[0015]

The refrigerator-freezer 100 includes a refrigerating compartment 200, an ice compartment 300, a switching compartment 400, a freezing compartment 500, and a vegetable compartment 600 as storerooms. The refrigerating compartment 200 is provided at the uppermost section of the refrigerator-freezer 100, and below the refrigerating compartment 200, the ice compartment 300 and the switching compartment 400 are provided side by side in the left-right direction. Below the ice compartment 300 and switching compartment 400, a freezing compartment 500 is provided, and below the freezing compartment 500, the vegetable compartment 600 is provided.

[0016]

Each storeroom of the refrigerator-freezer 100 is formed by partitioning the box 40 with a partition wall. The refrigerating compartment 200, and the ice compartment 300 and the switching compartment 400 are each partitioned by a partition wall 41 provided therebetween. The ice compartment 300 and the switching compartment 400, and the freezing compartment 500 is partitioned by a partition wall 42 provided therebetween. The refrigerating compartment 500 and the vegetable compartment 600 are partitioned by a partition wall 43 provided therebetween. Note that the ice compartment 300 and the switching compartment 400, which are provided side by side in the left-right direction, are partitioned by a partition wall (not shown) provided therebetween.

[0017]

Each storeroom is distinguished by its temperature range that can be set (temperature setting range), and each storeroom can be set as follows: the refrigerating compartment 200 from about 0 degree C to about 4 degrees C, the vegetable compartment 600 from about 3 degrees C to about 10 degrees C, the ice compartment 300 to about -18 degrees C, and the freezing compartment 500 from about -16 degrees C to about -22 degrees C. In addition, the switching compartment 400 can be switched to temperature ranges such as chilled (about 0 degree C) or soft frozen (about -7 degrees C). Note that the temperature of each storeroom is not limited to the above.

[0018]

Double doors 201 (hinge type) opening from the center are openable and

closeably installed in the front opening portion of the refrigerating compartment 200. A plurality of shelves are provided in the refrigerating compartment 200, and by opening the door 201, cooled items such as foodstuff can be placed on the shelves. Note that in addition to each shelf, or as an alternative to each shelf, a box shaped container with an opening on the top side may be disposed.

[0019]

Drawer-type doors 301, 401, 501, and 601 are openable and closeably provided in the front opening portion of the ice compartment 300, the switching compartment 400, the freezing compartment 500, and the vegetable compartment 600, respectively.

Note that in each of the ice compartment 300, the switching compartment 400, the freezing compartment 500, and the vegetable compartment 600, one or more containers that moves in the front and back direction in accordance with the movement of each door is provided in which the container can store cooled items such as foodstuff therein. Note that in addition to each container, or as an alternative to each container, a shelf to place foodstuff and the like may be disposed.

[0020]

A back wall 44 is provided on the back side of each of the refrigerating compartment 200, the ice compartment 300, the switching compartment 400, the freezing compartment 500, and the vegetable compartment 600. Further, cold air supply duct 45 and a cooling chamber 51 are provided between the back wall 44 and the box 40.

The cooling chamber 51 is provided in a range facing the back side of the freezing compartment 500, for example.

A cooler 53 is provided in the cooling chamber 51, and a fan is provided on the upper side of the cooler 53.

[0021]

In each portion of the back wall 44 corresponding to each storeroom, an inlet port from which the cold air from the cooler 53 flows into each storeroom and an outlet port from which the cold air is made to flow out of the storeroom are formed.

A damper shutting off the supply of cold air to the inlet port of each storeroom

is provided in the cold air supply passage 45.

[0022]

Next, an operation of the refrigeration cycle mounted in the refrigerator-freezer 100 and the air flow in the refrigerator-freezer 100 will be described.

[0023]

A compressor 52 is disposed in the lowermost portion at the back side of the refrigerator-freezer 100.

A refrigerant that has been compressed by the compressor 52 is condensed by the condenser (not shown). The refrigerant in the condensed state is decompressed by a capillary tube (not shown). The decompressed refrigerant is evaporated in the cooler 53, and with the endothermic effect during this evaporation, the surroundings of the cooler 53 is cooled. The refrigeration cycle is constituted by the compressor 52, the condenser (not shown), the capillary tube (not shown) as a decompressor, and a cooler 53.

The fan 54 sends the cold air that has been cooled in the surroundings of the cooler 53 to each storeroom.

[0024]

Further, the damper, the compressor 53, and the fan 54 are controlled by a controller (not shown) such as a control circuit or the like. The controller detects the temperature in each storeroom with a temperature detection device such as a thermistor, controls the cooling capacity of the refrigeration cycle and the amount of air by opening and closing the damper so that the temperature will approach a set target temperature, controls the start and stop of the cooling operation, and controls the operation of the fan 54.

[0025]

A portion of the air that has been cooled by the cooler 53 passes through the cold air supply passage 45 and flows into the refrigerating compartment 200. The air that has flowed into the refrigerating compartment 200, flows out from a back side air passage (not shown) that is provided separately from the cold air supply passage 45 after cooling the foodstuff and the like that is placed in the shelf and the like in the refrigerating compartment 200. Further, a portion of the air that has flowed out into the back side air passage (not shown) merges

with a portion of the cold air that has flowed out from the freezing compartment 500 and the like, proceeds to an upstream side of the air flow in the cooling chamber 51, and is again cooled by the cooler 53. Furthermore, a portion of the air that has flowed out of the refrigerating compartment 200 into the cold air supply passage 45 passes through an air passage (not shown) into the vegetable compartment 600, cools the foodstuff and the like in the vegetable compartment 600, exits the vegetable compartment 600, and flows into the upstream side of the air flow in the cooling chamber 51.

[0026]

In addition, of the air that has been cooled by the cooler 53, a portion passes through the cold air supply passage 45 and flows into the ice compartment 300, another portion flows through the cold air supply passage 45 and into the switching compartment 400, and the other portion flows through the cold air supply passage 45 and into the freezing compartment 500.

The air that has flowed into the freezing compartment 500 cools the foodstuff and the like in the freezing compartment 500 and flows into the back side air passage (not shown). Further, this air flows into the upstream side of the air flow in the cooling chamber 51. The air that has flowed into the switching compartment 400 and the ice compartment 300 each cools the inside of the corresponding compartments, passes through the back side air passage (not shown), and flows into the upstream side of the air flow in the cooling chamber 51.

[0027]

Next, the ice compartment 300 will be further described in detail.

Fig. 3 is a cross-sectional, schematic diagram of a main section of an ice compartment and a peripheral thereof according to the embodiment. Fig. 3 generally corresponds to the portion of Fig. 2 indicated by broken lines.

[0028]

An ice making device 310 is provided in the ice compartment 300. The ice making device 310 is provided with an ice tray 1, a baffle tray 2 disposed on the upper side of the ice tray 1, and a drive unit 4 that is connected to an end portion of the ice tray 1 and rotates the ice tray 1. In the baffle tray 2, a plurality of discharge ports 23 for providing air that has been cooled by the cooler 53 to the

ice tray 1 is provided. On the lower side of the ice tray 1, an ice storing case 5 is provided for storing ice therein. The ice tray 1 is supported by a frame 10 that is configured integrally with the baffle tray 2 so as to be movable to the front-back direction (left-right direction in the paper of Fig. 3).

[0029]

The cold air supply passage 45 is disposed on the back side (right side in the paper of Fig. 3) of the ice compartment 300. The cooler 53 is disposed in the cold air supply passage 45 at a position corresponding generally to the back side of the freezing compartment 500, and the fan 54 is disposed on the upper side of the cooler 53.

An inlet port 502, which is opened on the back side of the freezing compartment 500, is in communication with the cold air supply passage 45. Cold air flows into the freezing compartment 500 through this inlet port 502.

An inlet port 302, which is opened on the back side of the ice compartment 300, is in communication with the cold air supply passage 45. Cold air flows into the ice compartment 300 through this inlet port 302.

[0030]

A damper 46 supplying or shutting off cold air to the inlet port 302 of the ice compartment 300 is provided in the cold air supply passage 45. The opening and closing of the damper 46 is controlled by the controller, and this controls whether or not cold air is supplied to the ice compartment 300.

[0031]

Fig. 4 is a perspective view of the ice making device according to the embodiment in a state in which the ice tray is housed therein. Fig. 5 is a perspective view of the ice making device according to the embodiment in a state in which the ice tray is drawn out thereof. Fig. 6 is a top view of the ice making device according to the embodiment in a state in which a water pipe and a thermopile are removed therefrom. Fig. 7 is a top view of the ice making device according to the embodiment in a state in which the water pipe and the thermopile are installed therein. Fig. 8 is a cross-sectional view taken along C-C of Fig. 7, and Fig. 9 is a cross-sectional view taken along D-D of Fig. 7.

[0032]

The ice tray 1 is a molded article made of synthetic resin material such as

polypropylene and has a substantially rectangular shape in a planar view. The ice tray 1 is disposed in the ice compartment 300 such that its long side agrees with the depth direction of the ice compartment 300. The ice tray 1 is opened in its upper side, and a concavely formed plurality of ice cavities 11 are partitionally formed therein. Ice is formed in each ice cavity 11 of the ice tray 1 by receiving the cold air supplied from the discharge ports 23 in the baffle tray 2, which will be subsequently described in detail. In the embodiment, two left and right rows each with six ice cavity in the depth direction are provided in the ice tray 1, but the number of ice cavities and its shape is not limited to the one shown in the figure.

[0033]

The ice tray 1 is supported by the frame 10 so as to be capable of being pulled out or pushed in in the depth direction. The frame 10 and the ice tray 1 are provided with rails (not shown) that is disposed along the depth direction so as to engage the frame 10 and the ice tray 1. The rails are slid in the depth direction to allow the ice tray 1 to be pulled out or pushed in. Note that the moving structure in the depth direction is not limited to this, and any structure may be employed.

[0034]

A handle 12 is provided on the front side of the ice tray 1. A lock lever 9 restricting the pulling out and pushing in of the ice tray 1 is provided in the frame 10. By manipulating the lock lever 9 and releasing the restriction, the user will be able to pull out and push in the frame 10 from and into the ice tray 1. Further, the ice tray 1 is configured so as to be removable from the frame 10. Thus, by manipulating the lock lever 9 that is fixing the ice tray 1, the user will be able to pull out the ice tray 1 and remove it from the frame 10, that is, will be able to remove the ice tray 1 from the ice compartment 300, and carry out cleaning or the like.

Furthermore, a rotation shaft 13 (see Fig. 3) connected to the drive unit 4 is provided on the back side of the ice tray 1.

[0035]

The drive unit 4 is equipped with a motor, which rotatably drives the rotation shaft 13, and a reduction gear, and is controlled by the controller (not shown) to

rotate the rotation shaft 13 and flip the ice tray 1. Accordingly, the ice in the ice tray 1 drops into the ice storing case and is stored therein. Note that in order to facilitate the separation of the ice, a known configuration carrying out twisting of the ice tray 1 when the ice tray 1 is flipped may be provided.

[0036]

Further, an ice detection lever 8 is rotatably mounted on the drive unit 4. The ice detection lever 8 is for detecting the amount of ice in the ice storing case 5. By movement of the tip of the ice detection lever 8 in the vertical direction, the height of the ice in the ice storing case 5 is measured, thus, enabling the amount of ice in the ice storing case 5 to be detected.

[0037]

On the upper side of the baffle tray 2, a water pipe 6 is provided for supplying water in a water supply tank to the ice tray 1. In the embodiment, the water supply tank (not shown) is disposed on the upper side of the partition wall 41 in the refrigerating compartment 200. The water pipe 6 is connected and inserted to this water supply tank, and is in communication with the partition wall 41. The water in the water supply tank passes through the water pipe 6 and is supplied to the ice tray 1. Note that the disposition of the water supply tank is not limited to the above, and, for example, a compartment surrounded by heat insulating materials may be formed in the ice compartment 300 and the water supply tank may be disposed in this compartment.

[0038]

Further, as a temperature detection device detecting the temperature of the water in the ice tray 1, a thermopile 7 is provided on the upper side of the baffle tray 2.

[0039]

The baffle tray 2 includes a peripheral wall 21, base plate 22, a discharge port 23 formed on the base plate 22, and a partition wall 24. A housing space 25 (see Fig. 5) is formed on the lower side of the baffle tray 2, and the ice tray 1 is disposed in this housing space 25.

[0040]

The baffle tray 2 is connected on its back side with an inlet port 302 to the ice compartment 300. The shape of the baffle tray 2 is configured such that the

width of the baffle tray 2 is substantially the same as that of the inlet port 302 at their joint, but gradually increases its width while extending from the joint towards the front side. The peripheral wall 21 that extends with the increase in the width may be referred to as an enlarged portion 21a.

[0041]

The partition wall 24 is disposed substantially at the middle of the baffle tray 2 in the left-right direction, and is a wall with a curved back side formed into a substantially U-shape viewed in a planar view. The inner portion fenced by the partition wall 24 in the baffle tray 2 has no base plate 22 provided thereto in which the bottom side is opened. The partition wall 24 is a structure for disposing the water pipe 6 and the thermopile 7 on the upper side of the ice tray 1. As described above, by providing, in the baffle tray 2, a structure that is fenced by the partition wall 24 and that has no bottom surface, the water pipe 6 and the thermopile 7 can be disposed in the area fenced by the partition wall 24, as shown in Figs. 7 to 9. Since the water pipe 6 can be disposed in the vicinity of the upper side of the ice tray 1, the water pipe 6 can be extended in a substantially straight manner from the water supply tank disposed on the upper side of the ice making device 310. Thus, the water supply channel can be shortened. Further, since the thermopile 7 can be disposed in the vicinity of the upper side of the ice tray 1, temperature detection with good precision may be carried out near the ice tray 1.

[0042]

Furthermore, the baffle tray 2 forms an inlet side air passage 31, a first air passage 32, and a second air passage 33. These inlet side air passage 31, first air passage 32, and second air passage 33 may be collectively referred to as cold air passage 3.

[0043]

The inlet side air passage 31 is connected to the inlet port 302 and is an air passage that exists generally from the inlet port 302 to the tip of the back side of the partition wall 24. The cold air flowing out from the inlet port 302 will be, first, flowing into the inlet side air passage 31. This inlet side air passage 31 includes the air passage corresponding to the enlarged portion 21a (passage enlarged portion).

[0044]

The first air passage 32 is connected to the inlet side air passage 31 and is an air passage that is formed generally between the left side portion of the partition wall 24 and the left side portion of the peripheral wall 21. This first air passage 32 is disposed at a position generally corresponding to the ice cavities 11 that is disposed on the left row between the two rows of ice cavities 11 that is provided next to each other in the ice tray 1.

[0045]

The second air passage 33 is connected to the inlet side air passage 31 and is an air passage that is formed generally between the right side portion of the partition wall 24 and the right side portion of the peripheral wall 21. This second air passage 33 is disposed at a position generally corresponding to the ice cavities 11 that is disposed on the right row between the two rows of ice cavities 11 that is provided next to each other in the ice tray 1.

[0046]

The cold air supplied from the inlet port 302, flows into the inlet side air passage 31 first, and a portion of the cold air that has flowed into the inlet side air passage 31 flows into the first air passage 32 and the remaining cold air flows into the second air passage 33.

[0047]

Here, the inlet side air passage 31 includes the air passage corresponding to the enlarged portion 21a. Compared to a cross-sectional passage area of the cold air of the inlet port 302, a cross-sectional passage area of the cold air of inlet side air passage 31 is enlarged (passage enlarged portion). That is, the enlarged portion 21a is an exemplary configuration of enlarging a cross-sectional passage area of the baffle tray 2 against the cross-sectional passage area of the cold air of the inlet port 302. The cross-sectional passage area is enlarged as such in order to approach the flow velocity of the cold air as close to 0 (zero) as possible. By doing so, it will be possible to control the flow rate of the cold air supplied from each discharge port 23 with the pressure difference between the upper side and the lower side (ice tray 1 side) of the baffle tray 2 and with the opening area of each discharge port 23.

[0048]

Note that although in the embodiment, as shown in Fig. 6, the enlarged portion 21a is provided in the peripheral wall 21 on left side in the paper by way of example, the enlarged portion 21a may be provided on the right side of the peripheral wall 21 or the enlarged portion 21a may be provided on both sides of the peripheral wall 21. In any case, the configuration is any of the configurations having the distance between the left and right peripheral walls 21 facing each other enlarged compared to that of the joint with the inlet port 302.

Further, in the embodiment, an exemplary case has been described in which enlargement of the cross-sectional passage area of the baffle tray 2 is made by enlarging the distance between the facing peripheral walls 21, but the cross-sectional passage area may be enlarged by increasing the height of the baffle tray 2 against the height of the inlet port 302.

[0049]

Furthermore, as shown in Fig. 9, the height of the peripheral wall 21 and the partition wall 24 are substantially the same. Additionally, in a state in which the ice making device 310 is disposed in the ice compartment 300, the upper edge of the peripheral wall 21 and the partition wall 24 abut the ceiling surface of the ice compartment 300. Accordingly, the inside of the area fenced by the partition wall 24 is, basically, not in communication with the inlet side air passage 31, the first air passage 32, and the second air passage 33 such that cold air from these air passages do not directly flow therein. That is, the partition wall 24 and the ceiling surface of the ice compartment 300 function as a blocking portion blocking the cold air in the baffle tray 2 to flow into the ice tray 1 side except from the discharge ports 23.

[0050]

A plurality of discharge ports 23 is opened on the base plate 22 of the baffle tray 2. Further, in the embodiment, the number of discharge ports 23 is the same as the number of ice cavities 11 in the ice tray 1. Furthermore, the position of the discharge ports 23 generally corresponds to the disposition of the ice cavities 11 in the ice tray 1, and, as shown in Fig. 6, six discharge ports 23 are disposed in two, left and right, rows substantially along the longitudinal direction of the baffle tray 2.

[0051]

Fig. 10 is a diagram explaining the arrangement of the ice tray, the first air passage, and the second air passage when viewing the ice making device of the embodiment from the front. Note that in Fig. 10, an area of rotation Z of the ice tray 1 is indicated with a two-dot chain line Z.

As shown in Fig. 10, the first air passage 32 and the second air passage 33 are both disposed outside the area of rotation Z of the ice tray 1.

[0052]

In a portion of the base plate 22 of the baffle tray 2 near the partition wall 24, inclined surfaces 22a obliquely ascending towards the lower end of the partition wall 24 is formed. This inclined surfaces 22a may be, as shown in Fig. 10, linear surfaces or curved surfaces.

[0053]

Further, the discharge ports 23 are formed in the inclined surfaces 22a of the base plate 22. As shown in Fig. 10, by providing discharge ports 23 in the inclined surfaces 22a, cold air is supplied in directions by an angle θ_1 to a corresponding line X that is vertical to the water surface of the ice tray 1 (discharge directions Y of Fig. 10). This angle θ_1 will be referred to as cold air discharge angle θ_1 .

As such, by supplying cold air from obliquely above the water surface of the ice tray 1, the cold air that has cooled the water in the ice tray 1 will tend not to stagnate on top of the ice tray 1. Accordingly, it is possible to continuously supply cold air having low temperature supplied to the ice compartment 300 from the discharge ports 23 to the top of the ice tray, and, it is possible to efficiently make ice using the cold air with low temperature.

[0054]

Note that the discharge angle θ_1 of the cold air may be determined per discharge port 23 corresponding to each ice cavity 11 while giving consideration so that each ice cavity 11 of the ice tray 1 is uniformly cooled and that the cold air from each discharge port 23 does not impede the flow of cold air of other discharge ports 23. Among the discharge ports 23, a discharge angle θ_1 of a discharge port 23 and the discharge angle θ_1 of other discharge ports 23 may be different, and the discharge angle θ_1 (angle of the inclined surface 22a in which the discharge port is formed) of each discharge port may be set

individually. Further, from the viewpoint of cooling efficiency, it is desirable that the cold air be supplied from obliquely above, but the discharge angle θ_1 may be 0 degrees and may include a discharge port 23 formed so as to supply the cold air from a vertical direction to the water surface of the ice tray 1. The discharge angle θ_1 may be a value ranging between 0 degree or more and 30 degrees or less, for example.

[0055]

The opening area of the discharge ports 23 may be set per discharge port 23 so that each ice cavity 11 of the ice tray 1 can be uniformly cooled.

Incidentally, the more distance from the inlet port 302 of the ice compartment 300, the more difficult it will be for the cold air from the inlet port 302 to reach the discharge port 23. Further, the distance from the cooler 53 will increase. Accordingly, among the discharge ports 23, the ones that have more distance from the inlet port 302 (the front side in the depth direction) will be more difficult to be cooled. Hence, in the above-mentioned inlet side air passage 31, while enlarging the cross-sectional passage area in order to approach the flow velocity of the cold air as close to 0 (zero) as possible, the opening area of each discharge port 23 is adjusted so that the ice making time of each ice cavity 11 of the ice tray 1 becomes close to equal. The larger the opening area of the discharge port 23 becomes, higher the flow rate of the cold air becomes. Thus, the opening area of the discharge ports 23 are adjusted so that the ones that are farther away from the inlet port 302 are made larger.

[0056]

Further, the position of each discharge port 23 is set so as to be more on the outer side, on the left or right side, rather than immediately above the ice cavity 11 of the ice tray 1. The positions are set as above in order to avoid the water pipe 6, which supplies water to the ice tray 1, and the thermopile 7. That is, the positions of the discharge ports 23 are adjusted so that the cold air supplied from the discharge ports 23 would not hit the water pipe 6 and the thermopile 7 and be supplied to the ice tray 1.

[0057]

Fig. 11 is a cross-sectional, schematic diagram of a main section of a fan and a peripheral of the fan of the refrigerator-freezer according to the embodiment.

As illustrated in Fig. 11, the fan 54 is disposed in the cold air supply passage 45 and at the back side of the freezing compartment 500.

The fan 54 is disposed at a position substantially opposite the inlet port 502 such that the direction of the discharged cold air is directed towards the inlet port 502 that is formed in the upper portion of the back wall of the freezing compartment 500. With the above configuration, the cold air blown by the fan 54 is allowed to flow into the freezing compartment 500 through the inlet port 502 smoothly with small pressure loss. Configured as such, cold air with lower temperature can be efficiently supplied to the freezing compartment 500 that has the lowest temperature setting in the refrigerator-freezer 100.

[0058]

Furthermore, in the embodiment, the direction of the cold air blown from the fan 54 is inclined at a predetermined angle θ_2 to the horizontal plane towards the opening side of the inlet port 302 of the ice compartment 300. With this configuration, pressure loss of the cool air in the passage to the inlet port 302 of the ice compartment 300 is reduced and cold air is made to flow into the inlet port 302 more efficiently. For example, in the above-mentioned Patent Literatures 1 and 3, while the air from the fan is blown in a horizontal direction, the cold air supply port to the ice compartment is opened on the upper side of the fan, and, thus, the direction of the cold air flowing to the ice compartment is substantially orthogonal to the direction of the air blown from the fan, which raised a problem of efficiency of cold air supply. However, according to the embodiment, since the pressure loss of the cold air sent to the ice compartment 300 from the fan 54 can be suppressed, the amount of cold air supplied to the ice compartment 300 can be relatively increased and ice making efficiency can be improved along with the increase of energy saving effect.

[0059]

For example, in such a refrigerator-freezer 100 of the embodiment having an ice compartment 300 and a freezing compartment 500 disposed one on top of the other, when the fan 54 is provided so as to be opposite of the inlet port 502 of the freezing compartment 500, the inclination angle θ_2 during installation of the fan 54 may be a value ranging between 15 degrees or more to 45 degrees or less, for example. With the above, the pressure loss of the cold air sent to the

ice compartment 300 can be suppressed and the reduction of the efficiency of cold air supply to the freezing compartment 500 is suppressed by inclining the direction of air sent from the fan to the ice compartment 300 side.

Note that although not limiting the value of the angle θ_2 to a specific angle, if the angle θ_2 is excessively large, the efficiency of cold air supply to the freezing compartment 500 will drop, and if the angle θ_2 is excessively small, the efficiency of cold air supply to the ice compartment 300 will drop. The angle of the fan 54 is set with the above in consideration.

Further, for example, if the disposition of the storerooms are different to that of the embodiment, in a case in which the freezing compartment is disposed at the lowest section, the vegetable compartment above this, and the ice compartment further above, then the angle θ_2 may be set during installation of the fan with the balance between the efficiency of the cold air supply to the freezing compartment and the efficiency of the cold air to the ice compartment in consideration.

[0060]

The ice making operation of the embodiment will be described subsequently.

Fig. 12 is a diagram explaining a flow of the cold air in the ice making device according to the embodiment. Fig. 12(a) is a schematic diagram of the baffle tray 2 viewed from above and Fig. 12(b) is a cross-sectional, schematic diagram taken along the line E-E of Fig. 12(a), and Fig. 12(c) is a cross-sectional, schematic diagram taken along the line F-F of Fig. 12(a). Subsequently, the ice making operation and the flow of cold air associated with the ice making operation will be described with reference to Figs. 3 and 12.

[0061]

A portion of the air that has been cooled by the cooler 53 is sent by the fan 54 so as to flow into the ice compartment 300 through the inlet port 302. As mentioned above, since the direction of air sent from the fan 54 is inclined at the angle θ_2 to the opening of the inlet port 302, compared to conventional ones, the pressure loss of the cold air approaching the inlet port 302 can be reduced.

[0062]

First, the cold air from the inlet port 302 flows into the inlet side air passage 31 of the baffle tray 2. The cross-sectional passage area of the cold air in the

inlet side air passage 31 is larger than the cross-sectional passage area of the inlet port 302 with the enlarged portion 21a. More specifically, the cross-sectional passage area of the inlet side air passage 31 is enlarged so as to approach the flow velocity of the cold air as close to 0 (zero) as possible. Accordingly, the flow velocity of the cold air in the baffle tray 2 is substantially close to 0.

[0063]

The cold air that has flowed into the inlet side air passage 31 branches into the first air passage 32 and second air passage 33. Further, the cold air in the first air passage 32 and the second air passage 33 are supplied to the ice tray 1 through the discharge ports 23 provided in the base plate 22 of the baffle tray 2. Since the lower side of the baffle tray 2 (the ice tray 1 side) is relatively low in pressure compared to that of the upper side of the baffle tray 2, which is supplied with the cold air from the inlet port 302, the cold air in the cold air passage 3 flows towards the ice tray 1 that is on the low pressure side through the discharge ports 23.

[0064]

As described above, the opening area of each discharge port 23 of the baffle tray 2 is adjusted so that the ice making time of the corresponding ice cavity 11 of the ice tray 1 becomes close to equal and the ice is made at substantially the same timing in each ice cavity 11.

[0065]

As illustrated in Fig. 12(c), each discharge port 23 is positioned obliquely above each ice cavity 11 of the ice tray 1, and the opening of each discharge port 23 is inclined to the water surface of the ice tray 1. The cold air from such discharge ports 23 is supplied from obliquely above to each corresponding ice cavity 11 of the ice tray 1. Since a plurality of discharge ports 23 is provided corresponding to each ice cavity 11 of the ice tray 1, the water in each ice cavity 11 is efficiently cooled having the cold air from each discharge port 23 corresponding to each ice cavity 11 as its main cooling source. The water in each ice cavity 11 is, thus, turned into ice by the supplied cold air.

[0066]

The thermopile 7 measures the water temperature in the ice tray 1 at a

predetermined frequency, and when the measured temperature reaches a predetermined temperature, the controller (not shown) determines that ice has been created in the ice tray 1. Subsequently, the controller controls the drive unit 4 to rotate the ice tray 1 so that the ice in the ice tray 1 is dropped. Thus, the created ice is stored in the ice storing case 5.

[0067]

As above, in the embodiment, a single inlet port 302 that discharges cold air to the ice compartment 300 is provided. Further, the ice tray 1 is directly cooled from the upper portion by supplying the cold air from the inlet port 302 through the cold air passage 3, which is formed in the baffle tray 2, to the ice tray 1 from the upper portion of the ice tray 1. As described above, by using all of the cold air supplied to the ice compartment 300 for directly cooling the ice tray 1 from the upper portion, compared to cooling the ice tray indirectly by providing a plurality of inlet ports, ice can be made more efficiently.

[0068]

Further, it is configured such that discharge ports 23 are provided to the corresponding ice cavities provided in plural numbers in the ice tray 1, and that the cold air in the cold air passage 3 is supplied to the ice compartment 300 only through these discharge ports 23. The flow rate of cold air from the upper side of the ice cavities 11 of the ice tray 1 does have a large influence to the ice making efficiency. Ice making efficiency can be increased by supplying all of the cold air in the cold air passage 3 from the discharge ports 23 to the upper side of each ice cavity.

[0069]

Further, the direction of the cold air blown from the fan 54 is inclined at a predetermined angle θ_2 to the horizontal plane towards the opening side of the inlet port 302 of the ice compartment 300. With this configuration, pressure loss of the cool air in the passage to the inlet port 302 of the ice compartment 300 can be reduced and cold air can be made to flow into the inlet port 302 more efficiently. Accordingly, compared to ones described in the above Patent Literatures 1 and 3 that sends air in a direction that is orthogonal to the cold air inlet port to the ice compartment, ice making efficiency can be improved and energy saving effect for making ice can be increased.

[0070]

Further, as regard the baffle tray 2, the cross-sectional passage area of the cold air in the inlet side air passage 31, which is connected to the inlet port 302, is made larger than the cross-sectional passage area of the inlet port 302. More specifically, the cross-sectional area of the inlet side of the cold air passage 3 is enlarged so as to approach the flow velocity of the cold air in the cold air passage 3 as close to 0 (zero) as possible. With the above, the flow rate of cold air supplied to each ice cavity 11 of the ice tray 1 can be set with the pressure difference between the upper side and the lower side of the baffle tray 2 and with the opening area of each discharge port 23. Accordingly, with the adjustment of this pressure difference and the opening area of each discharge port 23, uniform cooling of each ice cavity 11 is made possible.

[0071]

Further, the opening of the discharge ports 23 is inclined at the angle $\theta 1$ to the water surface of the ice tray 1. Accordingly, in addition to the opening area of the discharge ports 23, by adjusting this angle $\theta 1$, further uniform cooling of each ice cavity 11 can be carried out.

[0072]

Further, the ice tray 1 is configured so as to be removable from the ice making device 310. Accordingly, the user can detach the ice tray 1 and carry out cleaning and the like, and usability is improved.

[Reference Signs List]

[0073]

1. ice tray; 2. baffle tray; 3. cold air passage; 4. drive unit; 5. ice storing case; 6. water pipe; 7. thermopile; 8. ice detection lever; 9. lock lever; 10. frame; 11. ice cavity; 12. handle; 13. rotation shaft; 21. peripheral wall. 21a. enlarged portion; 22. base plate; 22a. inclined surface; 23. discharge port; 24. partition wall; 25. housing space; 31. inlet side air passage; 32. first air passage; 33. second air passage; 40. box; 41. partition wall; 42. partition wall; 43. partition wall; 44. back wall; 45. cold air supply passage; 46. damper; 51. cooling chamber; 52. compressor; 53. cooler; 54. fan; 100. refrigerator-freezer; 200. refrigerating compartment; 201. door; 300. ice compartment; 301 door; 302. inlet port; 310. ice making device; 400. switching compartment; 401. door; 500.

freezing compartment; 501. door; 502. inlet port; 600. vegetable compartment;
601. door.

CLAIMS

[Claim 1]

A refrigerator-freezer, comprising:

an ice compartment including a cold air inlet port;

an ice tray disposed in the ice compartment, and partitionally formed with a plurality of ice cavities therein;

a baffle tray arranged above the ice tray, connected to the cold air inlet port, and forming an air passage for cold air from the cold air inlet port, wherein

a plurality of discharge ports are formed in the baffle tray, the discharge ports are respectively provided with the ice cavities of the ice tray to supply cold air to the ice tray from above,

a partition wall standing along an outer peripheral of an opening portion, which is different from the discharge ports, on an upper surface of the baffle tray is provided, and

the cold air flowing into the ice compartment from the cold air inlet port is supplied to a region above the ice tray only through the discharge ports of the baffle tray.

[Claim 2]

The refrigerator-freezer of claim 1, wherein a direction of the cold air discharged from each of the discharge ports provided in the baffle tray is inclined to a direction vertical to a water surface of a water in the ice tray.

[Claim 3]

The refrigerator-freezer of claim 1 or 2, further comprising a passage enlarged portion, which is disposed on an inlet side of the air passage of cold air, having a cross-sectional passage area that is enlarged with respect to a cross-sectional passage area of the cold air inlet port.

[Claim 4]

The refrigerator-freezer of any one of claims 1 to 3, further comprising:

a cooler generating cold air supplied to the ice compartment;

a fan sending out the cold air generated by the cooler; and

a cold air supply passage, which is provided on the back side of the body of the refrigerator-freezer, directing the cold air to the ice compartment, wherein

a direction of the cold air sent out from the fan is inclined with respect to

a horizontal direction towards the cold air inlet port of the ice compartment.

[Claim 5]

The refrigerator-freezer of any one of claims 1 to 4, wherein the ice tray is provided so as to be removable from the ice compartment.

[Claim 6]

The refrigerator-freezer of claim 4 or claim 5 dependant on claim 4, further comprising a freezing compartment, which is provided as a separate storeroom from the ice compartment, disposed so as to vertically adjoin the ice compartment, wherein

the cold air sent out from the fan is provided to both of the ice compartment and the freezing compartment.

[Claim 7]

The refrigerator-freezer of claim 6, wherein the fan is arranged so as to oppose an inlet port through which the cold air flows in the freezing compartment.

[Claim 8]

The refrigerator-freezer of any one of claims 1 to 7, wherein the opening portion is disposed with a water pipe for supplying water to the ice tray.

[Claim 9]

The refrigerator-freezer of claim 8, wherein the discharge ports are disposed in a plurality of rows and the opening portion is disposed between the neighboring rows of the discharge ports.