Abstract: The present invention is a freezer device, in particular a refrigerator having an ice unit comprising a heat insulated housing (1) comprising a freezer compartment (3); an ice tray (10) provided in the freezer compartment (3) a plurality of ice chambers (12) of which is positioned facing the side; and a fluid supply member (20) extending over the ice tray (10) so as to fluidly communicate.
Description

A FREEZER DEVICE COMPRISING AN ICE UNIT PRODUCING CLEAR ICE

[0001] The present invention relates to freezer devices having an ice making unit, in particular to domestic type refrigerators having a clear ice making system.

[0002] In refrigerators, the pieces of ice produced by ice units look cloudy due to air bubbles dissolving within or collection of hard ions like calcium concentrating around thereof. Such pieces of ice have an adverse effect on the taste of the liquid in which they are introduced. In industrial type ice machines, for example according to CN203561 125 U, film-shaped ice is created by means of gradual water flow to an ice tray perpendicularly positioned to the freezer body and this process is gradually continued for producing clear ice. In industrial ice machines, an inner liner formed of a metal panel in which the ice unit is placed, enables stabilized positioning of the ice tray which is in vertical position.

[0003] Patent US6935124 discloses a domestic type refrigerator having a system for obtaining clear ice. The refrigerator has a fresh food compartment and a freezer compartment. The clear ice making system comprises a chamber base defining a plurality of lateral walls and a fluid supply chamber, a fluid discharge duct which fluidly communicates with the fluid supply chamber, and a plurality of ice forming chambers comprising a fluid discharge duct positioned on the fluid supply chamber, each of which is defined by a fluid discharge room and at least one side wall extending from the chamber base to the fluid supply chamber. Each ice forming chamber fluidly communicates with the liquid supply chamber through an opening on the bottom portion of at least one side wall along a corresponding upper opening.

[0004] On an evaporator plate comprising an evaporator and a plurality of ice forming fingers extending from the evaporator the plurality of ice forming fingers are adapted so as to extend to a plurality of corresponding ice forming chambers and to make pieces of ice by freezing water.

[0005] The aim of the present invention is to provide a clear ice unit with high ice production efficiency in freezer devices.
[0006] In order to achieve the above-mentioned aim, the present invention is a freezer device, in particular a refrigerator having an ice unit comprising a heat insulated housing comprising a freezer compartment; an ice tray provided in the freezer compartment and positioned so that the plurality of ice chambers of which face the side; and a fluid supply member extending over the ice tray so as to fluidly communicate. A preferred embodiment of the invention comprises a fluid container having a plurality of openings arranged under the fluid supply member and distributing fluid supplied from the fluid supply member so as to provide a film of fluid in order to freeze thereof in corresponding ice chambers in the form of clear ice. The fluid container assists obtaining a laminar flow providing a film by forming a tampon between the fluid supply member and the ice tray and regulating the flow to the ice tray against changes in the flow rate of the fluid coming from the fluid supply member.

[0007] In a preferred embodiment of the invention, the fluid container comprises at least one separator arranged so as to split the openings in separate chambers. Thus the fluid passes through all of the openings provided in the fluid container between the separators without being influenced from a slope which may occur during mounting. In applications without a separator, when the fluid container is mounted slopped, a part of the liquid supplied to the fluid container can collect in the direction of the slope and leave some of the openings empty. In such a case, ice can only be obtained in fluid supply direction. Separators enable a continuous film formation by flow along the openings in the ice container on the ice tray.

[0008] In a preferred embodiment of the invention, the fluid container comprises at least one chamber base facing the ice tray, on which the separator stands and the openings are formed. The chamber base facilitates mounting of the separator in the ice container. The chamber base may have a planar plate shape as well as having a cascaded, slopped or curvilinear shape in an alternative embodiment.

[0009] In a preferred embodiment of the invention, the fluid supply member comprises outlet holes arranged so as to correspond to each one of the chambers. Thus, the fluid supply member enables filling each chamber
directly with fluid coming directly from the fluid supply member.

[0010] In a preferred embodiment of the invention, the height of the separator is shorter than the height of the circumferential wall of the fluid container. By this, when the amount of fluid in the fluid container rises filling a chamber, it can overflow the separator and be transferred to another chamber.

[0011] In a preferred embodiment of the invention, the position of the openings on the fluid container is configured equidistant to the circumferential wall of the ice tray. By this, the speed of the fluid coming out of each opening becomes equal when reaching the ice tray and the laminar flow is not disturbed.

[0012] In a preferred embodiment of the invention, the fluid container extends along the circumferential wall of the ice tray. The fluid container can supply fluid along the ice tray from predetermined points thus the speed of the fluid can be minimized so as not to generate a turbulence. In a preferred embodiment, the fluid supply member has a hollow tube shape. The tube shape can be easily supplied and decreases the fluid pressure less than other shapes making it possible to efficiently convey the fluid along the freezer.

[0013] A preferred embodiment of the invention comprises a water overflow chamber by means of which the fluid container indirectly supplies fluid coming from the fluid supply member to the openings by overflowing. By indirectly supplying water to for example an adjacent chamber provided in the fluid container, and by enabling removal of air bubbles which may occur upon supplying fluid due to the fluid supply member being placed over the fluid container, the water overflow chamber directs fluid enabling production of clear ice to the adjacent chamber.

[0014] In a preferred embodiment of the invention, the ice tray extends profoundly in the freezer compartment. Thus the ice tray facing sideways is placed so as to occupy minimal space in transverse direction of the refrigerator.

[0015] In a preferred embodiment of the invention, the fluid supply member has a snap-fit connection to the fluid container. The fluid supply member can thus be easily mounted to the fluid container.

[0016] The household appliance realized to achieve the aims of the present
invention is illustrated in the accompanying drawings, wherein:

[0017] Figure 1 is a frontal perspective view of a refrigerator having a freezer compartment comprising a representative embodiment of a clear ice unit.

[0018] Figure 2 is a rear perspective view of a representative embodiment of the clear ice unit in mounted state.

[0019] Figure 3 is a frontal perspective view of the clear ice unit of figure 2.

[0020] Figure 4 is a perspective view of the clear ice unit of figure 2 from above.

[0021] Figure 5 is a perspective mounting view from the back portion on which a fluid supply member is connected of a representative embodiment of a fluid container for the clear ice unit.

[0022] Figure 6 is a rear perspective view of the fluid container of figure 5 in which the fluid supply member is dismantled.

[0023] Figure 7 is a cross sectional view of the fluid container of figure 5 in mounted state along an axis passing from an opening.

[0024] Figure 8 is a cross sectional view of the fluid container of figure 5 in mounted state along an axis passing from the separator.

[0025] Figure 9 is a side view of a representative embodiment of the fluid supply member for the clear ice unit of the invention.

[0026] Figure 10 is a side view of the fluid container of figure 5.

[0027] The elements in the figures are numbered individually and the correspondence of these numbers are given hereinafter.

[0028] 1 Housing
[0029] 2 Cooler compartment
[0030] 3 Freezer compartment
[0031] 4 Drawer
[0032] 5 Ice container
[0033] 10 Ice tray
[0034] 12 Ice chamber
[0035] 14 Guide extension
[0036] 16 Circumferential wall
[0037] 20 Fluid supply member
[0038] 21 Inlet
[0039] 22 Inlet flange
Figure 1 perspectively shows the heat insulated housing (1) of a domestic type refrigerator with a cooler compartment (2) in its upper portion and a freezer unit (3) in its lower portion. The heat insulated housing (1) has a cabinet structure accessible by a closable door (not shown in figures). The inner lining of the housing (1) is a plastic panel. A drawer (4) is provided on the base (41) portion of the freezer compartment (3), in which frozen items are kept. An ice container (5) is provided in the upper portion of the
drawer (4). The ice container (5) has an open-top box shape wherein the shorter side extends transversely and the longer side extends in depth direction so as to occupy minimal space from front. A vertical ice tray (10) is fixed on the open upper portion of the ice container (5). The ice tray (10) has a matrix structure and sequential ice chambers (12) facing sidewards. Figure 2 perspectively shows the ice unit from a back portion from which it is mounted in the freezer compartment (3) at its back wall. The ice tray (10) is fixed on a body (40) in entirely vertical position so that the ice chambers (12) face sidewards. The body (40) respectively comprises a first support extension (42) and a second support extension (44) in a column structure, supporting the ice tray (10) by its two opposite edges. The first and the second support extensions (42, 44) have a panel shape fixed to the ice tray (10) by their sides. Guide extensions (14) having sequential structure and triangle-like shape extend from the lower lateral wall of the ice tray (10) to the base (41) portion. The guide extensions (14) are on the same plane as the base (41) of the ice tray (10) together with the lower portion of the first and the second support extensions (42, 44). The guide extensions (14) form a support leg so as to prevent tilting over of the vertically positioned ice tray (14). By its frame-like structure, a circumferential wall (16) of the ice tray (10) delimits the ice chambers (12) by their outmost portions. The upper portion of the circumferential wall (16) is adjacent to the lower edge of a slopped guiding plate (47). The structure of the guiding plate (47) comprises corrugation-like grooves.

A fluid container (30) with an open-top box structure, extends end-to-end along the upper portion of the ice tray (10). The fluid container (30) forms a basin between a front wall (32) facing the open inlet of the freezer compartment (3) and an opposite back wall (34). A fluid supply member (20) of a hollow tube structure is provided between the front wall (32) and the back wall (34). The end of the fluid supply member (20) adjacent to the front wall (32) is closed by a cover (23) shaped as a blind cap and is surrounded by a cover flange (24) of rectangular shape. The cover flange (24) is mounted in a cascadingly bent portion of the front wall (32). In turn, an inlet (21) of the fluid supply member (20) proximate to the back wall
(34) has a rectangular inlet flange (22) circumferentially surrounding the inlet (21). The lower portion of the inlet (21) tube protruding from the inlet flange (22) rests on the bed portion (46) comprising a U-shaped cut-out seat (352) opened in the middle portion of the upper edge of the second support extension (44). A mounting portion (45) of hook structure adjacent to the bed portion (46), extends backwards integral from its back side with the second support extension (44).

[0069] Figure 3 perspectively shows the ice unit in frontal view. The mounting portion (45) of a panel structure is arranged adjacent to the lower portion of the back edge of the first support extension (42). Via the mounting portion (45), the body (40 is attached to the inner lining of the freezer compartment (3) on which it abuts. The grooves provided on the slopped guiding plate (47) adjacent from its lower edge to the circumferential wall (16) enables water supplied from the fluid container (30) to flow into each ice chamber (12) via the circumferential wall (16) in such a manner to form a film shape.

[0070] Figure 4 shows the fluid supply container (30) from above. Sequential openings (38) are provided on a chamber base (33). The total flow rate of water supplied from the openings (38) is high enough to enable a stable flow in film state on the upper surface of the slopped guiding plate (47). On the other hand, the value of the flow rate is low enough to enable reliable contact of the flowing water to cold surfaces for forming a film flow on the surfaces of the ice chambers (12) of the ice tray (10) after passing the slopped guiding plate (47). Accordingly, as well as the number of the ice chambers (12) being changeable according to the capacity of the ice unit, the total water flow rate that needs to be supplied per 100 g of ice is in the range of 0.8-1.2 L/minute.

[0071] In order to provide a stable and homogeneous water flow on the slopped surface, the number of the openings (38) in the fluid container (30) structure has to be \(2 \times (n-1)\) provided that the range of water flow rate indicated above is supplied, "n" being the column number of the ice chambers (12). The diameters of the openings (38) can be adjusted and modified to provide a flow rate range of 0.8-1.2 L/min. per 100 g of ice in
said holes. The number of basin shaped chambers (31) segmented by the separators (35) placed in the fluid container (30) has to be in the range of a minimum of (1/2) x (n-1), and a maximum of (2/3) x (n-1). Preferably, at least 3 openings (38) per each basin shaped chamber (31) have to be located. Alternatively, the ice making speed parameters required for film shaped laminar flow can also be provided from US6935124 document which is appended to this specification as reference.

[0072] The fluid container (30) has a basin structure having an elongated chamber base (33) split into chambers, (31) and sequential openings (38). The fluid supply member (20) extends in the fluid container (30) in full-length. A retaining piece (37) provided on the chamber base (33) proximate to the inlet flange (22) of the fluid supply member (20), attaches the fluid supply member (20) to the fluid container (30) by snap-fit connection. The fluid supply member (20) rests in suitably formed the seats (352) on the upper portion of the separators (35) erected in the chamber base (33) along its length so as to segment the openings (38) into chambers (31). As shown in figures 5 and 6, the fluid supply member (20) has a locking recess (25) formed on the upper corners of the inlet flange (22) in cut-out form, and a snap-fit connection detachable by flexing the corresponding locking tabs (39) on the upper portion of the lateral wall of the fluid container and the inlet flange (22). A water overflowing chamber (36) is formed on the fluid container (30) in proximity to the inlet (21). The water overflowing chamber (36) is arranged in a region having no opening (38) on the chamber base (33). The chamber base (33) shown in figure 7 has a base angle (a). The base angle (a) enables the chamber base (33) to extend in parallel with the guiding plate (47) which is spaced to the chamber base (33) underneath thereof. The fluid supply member (20) is positioned angled to the ground plane so that the sequential outlet holes (26) are perpendicular to the base angle (a). Thus, the turbulence formed by the pressure of water sprayed from the outlet holes (26) is prevented from directly reaching the openings. The sprayed water first hits the portion on the chamber base (33) further from the openings (38), and from here advances to the openings by being directed thanks to the base
angle (a). During advancement, vortex formation near the openings (38) by the sprayed water is prevented. Water coming from the outlet holes (26) has a laminar flow character while flowing on the chamber base (33) thanks to the base angle (a).

[0073] As shown in figure 8, the fluid supply member (20) rests on an arched shape seat (352) surrounding the tube between two opposite protrusions (351) on the upper portion of the separator (35) of the fluid supply member (20). A portage profile (27) of an upside down U shape is provided on the fluid supply member (20). The portage profile (27) rests on the separator (35) by means of the protrusion (351).

[0074] Figure 9 shows the fluid supply member (20) which is a hollow tube. Outlet holes (26) are arranged spaced from each other and angled with respect to the vertical axis further down the inlet (21) of the tube in the lower portion. The arrangement of the outlet holes (26) is grouped in pairs according to the corresponding chambers (31) below them. Figure 10 shows the fluid container (30) from a side view. Each of the openings (38) are surrounded by a flat protrusion (381) on the lower portion of the angled chamber base (33).

[0075] Tap water coming from the inlet (21) of the fluid supply member (20) fills the fluid container (30) upon flowing through the outlet holes (26). The outlet holes (26) fill the corresponding chambers (31) independently from each other. Even though the fluid container (30) is angled on horizontal axis, the separators (35) prevent the fluid from passing to the adjacent chamber (31). The fluid flows from the chamber base (33) to the guiding plate (47) by means of the openings (38) and by seeping from thereof fills the ice chamber (12) so as to form a film. No air bubbles form in the fluid filling in the ice chamber (12) thanks to laminar flow, and the freezing fluid solidifies by forming clear ice. To the fluid container (30), the fluid supply member (20) can directly supply tap water as well as, for example food coloring or a different drink in freezable liquid form with the help of another element to which it is connected.
Claims

1. A freezer device, in particular a household refrigerator having a heat insulated housing (1) comprising a freezer compartment (3); an ice tray (10) provided in the freezer compartment (3) and positioned so that the plurality of ice chambers (12) of which face sideways and a fluid supply member (20) extending over the ice tray (10) so as to fluidly communicate, characterized in that a clear ice unit comprises a fluid container (30) having a plurality of openings (38) arranged under a fluid supply member (20) and distributing a fluid supplied from the fluid supply member (20) so as to provide a film of fluid in order to freeze thereof in corresponding ice chambers (12) in the form of clear ice.

2. The freezer device according to claim 1 wherein the fluid container (30) comprises at least one separator (35) arranged so as to split the openings (38) in separate chambers (31).

3. The freezer device according to claim 2, wherein the fluid container (30) comprises at least one chamber base (33) facing the ice tray (10) on which the separator (35) stands and where the openings (38) are formed.

4. The freezer device according to claim 2 or 3, wherein the fluid supply member (20) comprises outlet openings (26) arranged so as to correspond each one to a chamber (31).

5. The freezer device according to claim 2 to 4, wherein the height of the separator (35) is shorter than the height of the circumferential wall (16) of the fluid container (30).

6. The freezer device according to any one of the preceding claims, wherein the position of the openings (38) on the fluid container (30) is configured equidistant to the circumferential wall (16) of the ice tray (10).

7. The freezer device according to any one of the preceding claims, wherein the fluid container (30) extends along the circumferential wall (16) of the ice tray (10).

8. The freezer device according to any one of the preceding claims, wherein the fluid supply member (20) has a hollow tube shape.

9. The freezer device according to any one of the preceding claims, comprising a water overflow chamber (36) by means of which the fluid container (30)
indirectly supplies fluid coming from the fluid supply member (20) to the openings (38) by overflowing.

10. The freezer device according to any one of the preceding claims, wherein the ice tray (10) extends profoundly in the freezer compartment (3).

11. The freezer device according to any one of the preceding claims, wherein the fluid supply member (20) has a snap-fit connection to the fluid container (30).
INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2017/066721

A. CLASSIFICATION OF SUBJECT MATTER

INV. F25C1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F25C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal , WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search

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Date of mailing of the international search report

19/09/2017

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