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(54) **Refrigerator**

(57) The refrigerator according to the present invention comprises a humidifying unit (A) in which water defrosted on the evaporator is accumulated, and at least one storage compartment (12) to which water evaporated from the unit (A) is transferred together with forced air. Said humidifying unit (A) comprises an upper cover (1)

provided with holes (13) for air transfer; a water reservoir (2) disposed under the upper cover (1) and accumulating said evaporator water; a fan (4) disposed on an intermediary cover (3) between said upper cover (1) and water reservoir (2), and guiding the air coming from the refrigerator's interior to the storage compartments (12) by passing it through the water reservoir (2).

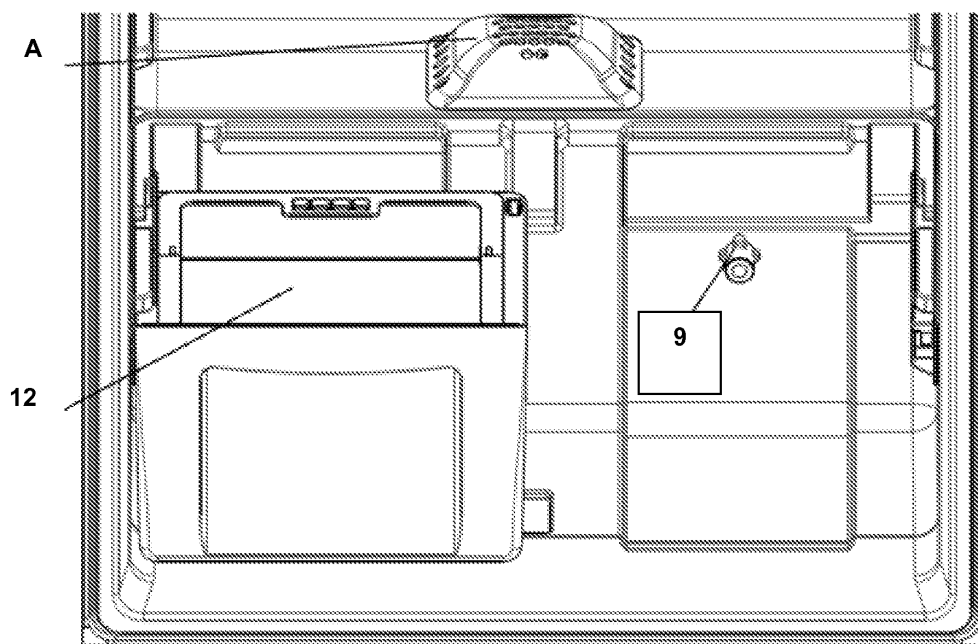


Figure – 1

Description

Field of Invention

[0001] This invention relates to humidifying units, which allow preserving foodstuffs in refrigerators for relatively longer periods of time, by controlling the humidity parameter therein.

Prior Art

[0002] In refrigerators used to preserve foodstuffs for long time periods, the parameter that is accurately controlled in relation to foodstuff preserving conditions is typically the temperature. It is one of the general features of refrigerators to alter the temperature of the internal volume thereof according to the type of foodstuff to be maintained. There are even provided special cooling compartments, of which the temperature can be controlled according to various foodstuff groups.

[0003] The control of humidity, which is another parameter required for preserving or conserving foodstuff for longer period of times, however, cannot be conducted as accurately as for the control of temperature. Humidity control, as a matter of fact, is ignored entirely in many household refrigerators. Particularly since the humidity levels are quite low in no-frost refrigerators, the freshness of foods like vegetables and fruits, which must ideally be maintained under high humidity conditions, is rapidly degraded.

[0004] Even though special humidifying compartments are reserved to remove this problem in some type of refrigerators, the humidity levels of such compartments cannot be controlled satisfactorily and their humidity levels are not measured exactly. In general terms, a flap is disposed between the refrigerator's internal volume and the special humidifying compartment in these compartments. This flap is adjusted by the user to be at low, medium, and high modes, so that the humidity adjustment of the compartment is ensured. This adjustment is altered according to the type of food put in the compartment and fails to provide humidity control in the terms referred to in the literature. Further since there is not provided a humidity-generating mechanism in the special compartment, the relative humidity level thereof drops down with the decreasing water content of foods disposed therein.

[0005] The published patent application JP8042960 according to the prior art discloses a system developed for humidifying the vegetable-fruit compartment within a refrigerator. Accordingly, the humidifying system is associated directly to the freezer compartment. In other words, the air used by the humidifying unit is brought therein by means of special channels from the freezer compartment. This case leads to significant structural changes within the refrigerator. The air which is guided to the humidifying unit combines with humid air generated as a result of evaporating the water accumulated in the

unit by means of a heater, and then directed to the vegetable-fruit compartment. The heater used for this purpose causes extra energy consumption. Another drawback of the system disclosed is that the fan used for forced air circulation is disposed in the freezer compartment and is of a large and energy-consuming type, because of the distance between itself and the humidifying unit. Additionally, there is not provided any control system or circuit to provide the adjustment of humidity level to desired extent.

Brief Description of Invention

[0006] The humidifying unit, according to this invention, uses directly the air within the internal volume of a refrigerator. Put differently, there is no need to carry the air in the freezer compartment to the humidifying unit. The humidifying unit is provided with a fan operating within itself, this fan sucking and thereby making use of the air within the refrigerator's internal volume, combining it with humid air, and guiding this air combination to a storage compartment preferably adjacent to the humidifying unit. No heater is used for humidifying purposes in the present invention and this operation is realized by means of a fan. Since the distances made use of during the forced air circulation are relatively shorter, the same operation can be performed with lower energy consumption as compared to the operations of patents cited in the prior art.

[0007] It is possible to adjust the relative humidity rate based on numeric values, depending on user preference, thanks to the humidifying unit with level control according to the present invention. It is further possible to ensure the humidifying rates specified for any foodstuff group in the literature by means of this control logic. Thus, the user is enabled to provide and control the required humidity condition to preserve a respective foodstuff, as it is just the case of temperature control.

[0008] Thanks to a specifically-designed humidifying compartment and a self-controlled water reservoir according to the present invention, the humidity in the interior is kept constantly the same without giving rise to any drop in the internal humidity of the foodstuff disposed in the humidifying compartment, said humidity loss not occurring thanks to the level-controlled humidifying system.

[0009] Thanks to this feature, it becomes possible to preserve the freshness of foodstuffs and particularly those which must be stored under higher relative humidity rates at a perceivable and appreciable extent.

Object of Invention

[0010] The object of the present invention is to allow maintaining foodstuffs in a fresh state for longer periods of time by providing an accurate control not of the temperature parameter only, but also the relative humidity parameter in refrigerators used to preserve foodstuffs.

[0011] Another object of the present invention is to pro-

vide a humidifying unit with adjustable relative humidity rate for said refrigerators.

[0012] A further object of the present invention is to provide a humidifying unit with lower energy consumption.

[0013] Still another object of the present invention is to provide a reliable humidifying unit, which can be easily produced and mounted, as well as be applied to currently-used refrigerators.

Description of Figures

[0014] An illustrative embodiment of the subject humidifying unit is illustrated in annexed figures briefly described hereunder.

[0015] Figure 1 is an illustration of the interior of a refrigerator in which a humidifying unit is disposed.

Figure 2 is a cross-sectional view of the humidifying unit.

[0016] The parts in said figures are individually enumerated as following.

[0017] Humidifying Unit (A)

Upper cover (1)

Water reservoir (2)

Water feeding inlet (2.1)

Water draining outlet (2.2)

Air outlet (2.3)

Intermediate cover (3)

Fan (4)

Contact (5)

Contact (6)

Cable (7)

Air inlet (9)

UV-LED (10)

Filter (11)

Storage Compartment (12)

Description of Invention

[0018] Ice formation occurs on evaporators during the normal operation of refrigerators. This formation causes the relative humidity in the internal volume of refrigerators to drop down to very low values in a rapid manner. Such ice layers formed do accumulate in time, causing the refrigeration performance to decrease accordingly. The increase of ice formation may even cause the refrigerating system to completely fail. Therefore, an operation takes place on the evaporator in certain time periods during the normal operation of refrigerators, this operation being known as "defrosting" in the relevant literature.

[0019] The water source of the humidifying unit (A) according to the present invention originates from the water obtained as a result of the defrosting operation. This source of water is evaporated after being delivered to the humidifying unit (A) and transferred to a storage compartment (12) within the refrigerator. In the example illustrated in Figure 1, the humidifying unit (A) transfers humid air to the storage compartment (12) of the refrigerator via an air inlet (9).

[0020] The humidifying unit (A) illustrated in Figure 2 comprises an upper cover (1); a water reservoir (2) under this cover; an intermediate cover (3) between the upper cover (1) and the water reservoir (2); and a fan (4) in connection to a motor above this intermediate cover. On the upper cover (1) is disposed at least one hole (13), allowing air transfer to take place. The fan (4) above the intermediate cover (3) is used to guide the internal air of the refrigerator coming through these holes (13) into the water reservoir (2).

[0021] At least one apiece water feed inlet (2.1), water drain outlet (2.2), and air outlet (2.3) are provided on the water reservoir (2). The water feed inlet (2.1) is the point where the water coming from a defrost tube (not illustrated in figures) of the refrigerator is entered into the reservoir (2). Water, being filtered through a filter (11) disposed right upstream of the water feed inlet (2.1) is accumulated at the base of the reservoir (2).

[0022] Water accumulated in the reservoir (2) rises up to the level of the drain outlet (2.2). Water exceeding this level is sent to the exterior of the refrigerator by means of a drain tube (not illustrated in figures) in communication with the drain outlet (2.2). It is possible to evaporate any overflowing water by guiding it to the surface of the compressor (not illustrated in figures) of such refrigerator.

[0023] When the fan (4) guides the internal air coming through the holes (13) on the upper cover (1) into the interior of the water reservoir (2), evaporation takes places on the surface of water accumulated in the water reservoir (2) with the aid of forced air circulation. During evaporation, it combines with the forced air of the fan (4) so that humid air transfer is provided to the storage compartment (12). Humid air containing water particles which leave the surface of water in the compartment (2) is guided to an air outlet (2.3), which is the negative pressure outlet of the unit (A), by means of the positive pressure generated under the intermediate cover (3).

[0024] Air outlets (2.3) are connected to their respective air inlets (9) on the refrigerator by means of respective tubes (Figure 1). The air inlets (9) also communicate with the storage compartments (12). The storage compartments (12) can be removed if desired (while Figure 1 - left side illustrates the case when the compartment (12) is situated in the refrigerator, the right side illustrates the part where the compartment (12) is to be situated, as well as the air inlet (9)), and are provided with holes, which correspond to the air inlets (9), so that once they are situated at respective places in the refrigerator, humid air coming from said inlets (9) is entered into the compartments (12).

[0025] At least one UV-LED (10) is provided at the lower part of the intermediate cover (3), said element (10) extending towards the water reservoir (2) or being provided in the reservoir (2). Said UV-LED (10) emits light at ultraviolet wave length, thereby preventing microorganism formation in the water reservoir (2). On the other hand, the filter (11) disposed before said water feed inlet (2.1) blocks residues to come with the defrost water, al-

lowing to accumulate relatively cleaner water in the compartment (2).

[0026] Since the upper cover (1) and the water reservoir (2) can be separated from each other, it is also possible to fill the water reservoir (2) externally by the user. Alternatively, water can be fed into the water feed inlet (2.1) externally by forming a separate water feed inlet (2.1) on the water reservoir (2), so that the upper cover (1) and water reservoir (2) are not separated. Similarly, a filter (11) can be disposed upstream said inlet (2.1). On the other hand, when contacts (5, 6) provided in the upper cover (1) and water reservoir (2) contact each other, the circuit required to operate the UV-LED (10) and fan (4) is completed. The energy supply to said contacts (5, 6) is provided by means of cables (7).

[0027] There are also provided cables in the UV-LED and fan (4) in the unit (A) (cables not illustrated in figures). When the upper cover (1) is detached from the water reservoir (2), the contact between the contacts (5, 6) is interrupted, so that the unit's (A) energy supply is interrupted as well. The maintenance and cleaning of the unit (for instance the cleaning of the filter (11)) can conveniently be made, since the upper cover (1) is detachable.

[0028] The amount of humidity generated by the humidifying unit (A) is adjusted by the user, thanks to a level control button (not illustrated in figures) disposed on the refrigerator. The level control button is connected to the refrigerator's control unit, and from there to the fan (4). This connection is provided by means of contacts (5, 6) and cables (7) as pointed out before. The revolution setting of the fan (4) is altered by changing the setting of the level control button, so that the humidity level in the storage compartment is adjusted as desired. Additionally, a closed-circuit control line is formed with the aid of one each humidistat arranged in the refrigerator and/or storage compartment (12) and connected to the control unit, so that the adjusted humidity level is kept constantly at the same level.

[0029] The humidifying unit (A) according to the present invention can be made adjacent preferably to at least one storage compartment (12) for energy saving purposes, but also at other locations within the refrigerator.

Claims

1. A refrigerator, comprising a humidifying unit (A), in which water obtained by defrosting ice formed on the evaporator is accumulated; and at least one storage compartment (12), to which evaporated water from said unit (A) is transferred together with forced air; **characterized in that** said humidifying unit (A) comprises

- an upper cover (1) disposed in the refrigerator and provided with holes (13) for air transfer;
- a water reservoir (2) disposed under the upper

cover (1) and accumulating said evaporator water;

- a fan (4) disposed on an intermediary cover (3) between said upper cover (1) and water reservoir (2), and guiding the air coming from the refrigerator's interior to the storage compartments (12) by passing it through the water reservoir (2); and
- one apiece control unit arranged in the refrigerator and/or storage compartment (12) and connected to the control unit, for adjusting the amount of humidity by means of a closed circuit control line.

2. A refrigerator according to Claim 1, **characterized in that** said humidifying unit (A) is adjacent to at least one storage compartment (12).

3. A refrigerator according to Claim 1, **characterized in that** at least one water feed inlet (2.1) is provided on the water reservoir (2) to inlet water coming from the evaporator.

4. A refrigerator according to Claim 1, **characterized in that** at least one water feed inlet (2.1) is provided on the water reservoir (2) to inlet external water by the user.

5. A refrigerator according to Claim 3 or Claim 4, **characterized in that** a water filter (11) is provided upstream to said feed inlet (2.1).

6. A refrigerator according to Claim 1, **characterized in that** at least one water drain outlet (2.2) is provided on the water reservoir (2).

7. A refrigerator according to Claim 1, **characterized in that** at least one air outlet (2.3) is provided on the water reservoir (2).

8. A refrigerator according to Claim 7, **characterized in that** each air outlet (2.3) is connected to a respective air inlet (9) on the refrigerator by means of a respective tube.

9. A refrigerator according to Claim 8, **characterized in that** each air inlet (9) is in communication with said storage compartments (12).

10. A refrigerator according to Claim 9, **characterized in that** holes, which correspond to said air inlets (9), are provided on the storage compartments (12), so that humid air from said inlets (9) is entered into said compartments (12).

11. A refrigerator according to Claim 1, **characterized by** comprising at least one LED (10) emitting ultra-violet light to prevent microorganism formation within

the reservoir (2).

- 12.** A refrigerator according to Claim 1, **characterized in that** said upper cover (1) and water reservoir (2) are separable from each other. 5
- 13.** A refrigerator according to Claim 12, **characterized by** comprising one apiece contact (5, 6) at the upper cover (1) and water reservoir (2), said contacts, once contacting each other, completing the circuit required to operate the LED (10) and fan (4). 10
- 14.** A refrigerator according to Claim 1, **characterized by** comprising a level control button, by which the revolution of said fan (4) is adjusted by means of a control unit of the refrigerator. 15

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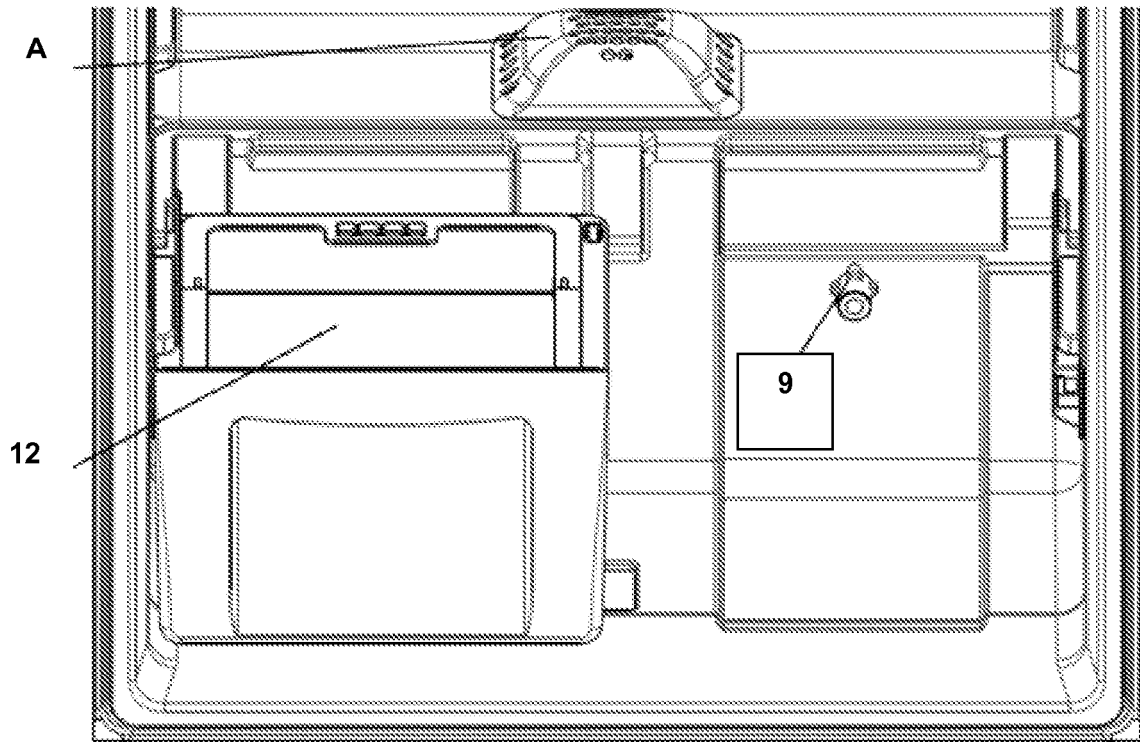


Figure - 1

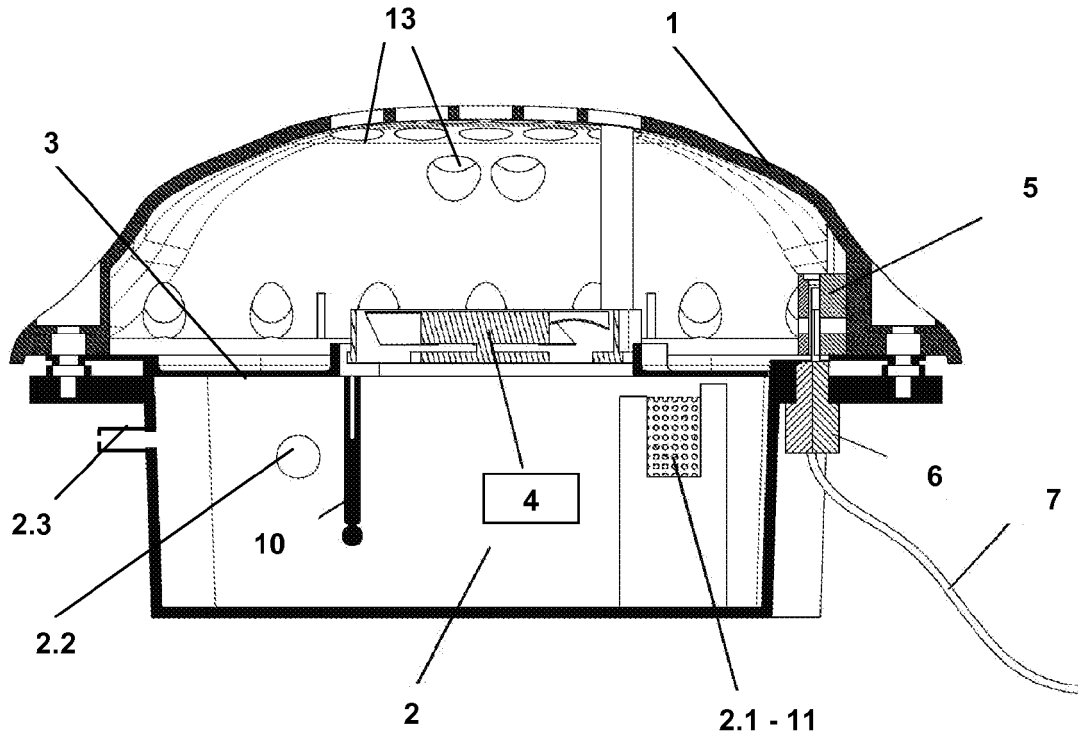


Figure - 2

REFERENCES CITED IN THE DESCRIPTION

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