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(54) **Inclined mounted fan structure**

(57) The present invention relates to inclined mounted fan structure comprising a fan (1) and an evaporator (3), wherein it comprises fan mounting angle (4) reducing pressure drop forming on the fan (1) between the fan (1) and the evaporator (3) and increasing thermodynamic efficiency by enhancing heat transfer effectiveness of the air sucked over the evaporator (3) with all surfaces of the evaporator.

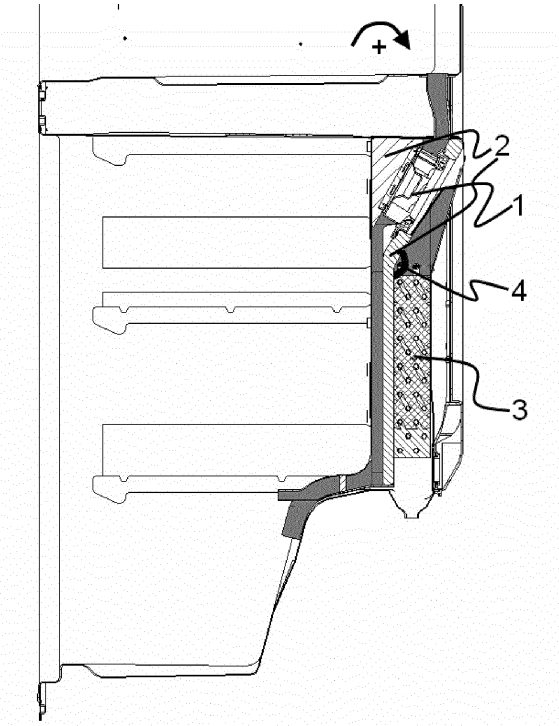

Figure 1

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Description

Technical Field

[0001] The present invention relates to performance improvement of the fan used in no frost refrigerators by means of changing the angle and position thereof with respect to the evaporator and replacement of the material forming the air channels and fan mounting surface with a material having better heat and sound insulation.

Background of the Invention

[0002] Currently, evaporator is the section of the refrigerators where the low temperature and low pressure liquid from the throttling valve evaporates by the heat of the cabin. Heat transfer between the air and the evaporator surface is realized by means of natural or forced convection. Natural convection creates problems even with the small resistances encountered. Thus, air circulation obtained by means of forced convection using a fan is preferred. Here, the evaporator fan is used for forced distribution of the low temperature air provided in the evaporator into the sub sections. Fan motor is connected in series to the lower and upper door buttons. Motor disengages when any of the doors is opened. Thus, leakage of cold air to outside is prevented. The compressor stops when thermostat of the cooler switches off the circuit. In this case, fan motor also stops for preventing the temperature rise in the freezer section. On the other side, when the timer is in defrost position, fan motor is also disengaged for not sending the warm and moist air provided in the evaporator volume to the other parts of the cooler during melting of the ice in the evaporator section. Evaporator fan is placed in the rear section of the evaporator, near the protective aluminum sheet walls.

[0003] In the prior art, placement of the fan providing flow in the air channels of the no frost type refrigerators is realized in a way to increase pressure drop and benefit ineffectively from the evaporator. Fan and evaporator are provided in the same direction.

[0004] In the prior art, fan is surrounded by polypropylene material, natural white color material obtained by polymerization (small molecules combine to form larger molecules) of propylene molecules obtained from "naptha", one of the crude oil derivatives. The availability and prices of said material directly depend on the availability and prices of the world crude oil reserves since, on average, crude oil derivatives of 97% are utilized in manufacturing thereof.

[0005] Improvements, for suiting different places of use and purposes, can be made on the physical properties such as flexibility, heat resistance and brittleness of polypropylene raw material by introducing ethylene molecules into the propylene molecules resulting from a complex series of chemical processes. Propylene gas and ethylene gas are reacted under specific conditions in a reactor and introduction of ethylene molecules into the propylene molecules is achieved. Percentage of said ethylene introduced and placement positions thereof between the propylene molecules determine the physical properties of the obtained material. Polypropylene raw material is more expensive than other plastic materials. In addition, UV radiation resistance of polypropylene material is small and it exhibits high thermal expansion. Painting and coating thereof is difficult. It has low resistance to external weather conditions, it is prone to oxidation. It is flammable and interacts with chlorine containing solvents.

[0006] Expanded polystyrene, i.e. EPS, is a lightweight, rigid plastic foam insulation material made of solid polystyrene particles. Expansion thereof is obtained with small amounts of pentane gas dissolved in the polystyrene base material during manufacturing. The gas expands by means of the heat applied in the form of steam to form EPS cells enclosed excellently. Said cells occupy as much as approximately 40 times of the polystyrene particle's volume. EPS is molded in respective shapes according to the particle applications.

[0007] EPS is an important material for thermal and acoustic isolation of walls, roofs or floors. It is an easy to use, ideal and cost effective material in all types of buildings. EPS material is used as lightweight filler or a space forming material. It is also used as floating material. EPS material consists of 98% air, thus, it is a high quality thermal insulator. In addition, EPS material absorbs sound of impact in floating floors as well as sound generated in the walls. For this reason, it is a proven acoustic insulator.

[0008] In the current state of the art, the material surrounding the fan is a polypropylene derivative. Said material cannot absorb the noise generated by the fan as required.

[0009] One of the patent applications in the literature related with the subject matter is the patent TR 2007/08742, titled 'a refrigerator'. Following is stated in the abstract of said patent application: The present invention relates to a refrigerator comprising a heat insulated wall, a storage compartment, an evaporator, an air conveying channel comprising air outlet vents opening to the storage compartment, a fan providing blowing of air from the evaporator towards the conveying channel, a vacuum opening positioned on said conveying channel and carrying out air vacuum by means of the static pressure drop occurring in the conveying channel walls during fan's blowing of air inside the conveying channel to the storage compartment through the air outlet vents, a condensation chamber conveying the air to the vacuum opening and at least one condenser element positioned inside said condensation chamber. Another application related with the subject matter is the patent application JP 2010230286. The fan installation according to said application is intended to provide ease of installation and reduce fan noise.

[0010] Consequently, fan systems of no frost refrigerators are improved, thus, new structures, which would

eliminate the aforementioned drawbacks and offer solutions to the existing systems are needed.

Objects of the Invention

[0011] The present invention, which meets the aforementioned requirements, eliminates all the drawbacks and provides some additional advantages, relates to performance improvement of the fan used in no frost refrigerators by means of changing the angle and position thereof with respect to the evaporator and replacement of the material forming the air channels and fan mounting surface with a material having better heat and sound insulation.

[0012] An object of the present invention is to reduce pressure drop formed on the fan in the no frost refrigerators.

[0013] Another object of the present invention is to enable effective heat transfer of the air sucked out of the evaporator with all surfaces of the evaporator in the no frost refrigerators.

[0014] Another object of the present invention is to provide quieter operation by increasing sound insulation through surrounding the fan with EPS material.

[0015] Another object of the present invention is to increase thermodynamic efficiency by the fan assembly according to the present invention.

[0016] The present invention, for the purpose of providing all the advantages, which are described above and will be understood from the detailed description given below, relates to fan assembly structure used in the no frost refrigerators, comprising a fan and evaporator, wherein it comprises fan mounting angle reducing pressure drop forming on the fan between the fan and the evaporator and increasing thermodynamic efficiency by enhancing heat transfer effectiveness of the air sucked over the evaporator with all surfaces of the evaporator.

[0017] The present invention, in order to achieve all objects thereof, comprises EPS (expanded polystyrene rigid foam) material allowing for forming air channel by surrounding said fan and realizing heat and sound insulation.

[0018] The structural and the characteristic features and all advantages of the present invention will be understood more clearly with the detailed description written by referring to the following figures and therefore, the evaluation needs to be done by taking these figures and the detailed description into consideration.

Brief Description of the Figures

[0019] Embodiment of the present invention and advantages thereof with the additional components must be considered together with the figures explained below in order to be fully understood.

Figure 1: Two dimensional side view of the inclined mounted fan structure according to the present invention.

Figure 2: Two dimensional side view of the prior art fan structure.

[0020] Scaling of drawings is not absolutely required and details, which are not needed for understanding the present invention, can be neglected. Furthermore, elements, which are at least substantially identical or have at least substantially identical functions, are indicated with the same number.

Reference Numbers

[0021]

1. Fan
2. Insulating material
3. Evaporator
4. Fan mounting angle

Detailed Description of the Invention

[0022] In this detailed description, subject of the invention and preferred embodiments thereof are described only for a better understanding of the subject without constituting any restrictive effect.

[0023] The present invention, in general, comprises fan (1) having reduced pressure drop and enabling more effective use of the evaporator. Position of said fan (1) with respect to the evaporator (3) is changed as shown in Figure 1. A fan mounting angle (4) is formed between the fan (1) and the evaporator (3) in order to improve flow and heat transfer properties. In addition, an evaporator (3) operating as heat exchanger is provided in the present invention. Said evaporator (3) cools the air circulating inside the refrigerator by means of the refrigerant gas. Another feature of the inclined mounted fan (1) structure according to the present invention is the insulating material (2) employed. Said insulating material (2) is made of EPS (expanded polystyrene rigid foam) forming air channel by surrounding the fan (1) and with good sound insulating feature.

[0024] Said fan mounting angle (4) of the inclined mounted fan structure according to the present invention is not provided in the prior art shown in Figure 2. The fan mounting angle (4) according to the present invention is formed such that the fan (1) has an inclination in the clockwise (+) direction with respect to the evaporator (3). In this case, said fan mounting angle (4) has values greater than 90° and less than 180°, wherein it may be in preferred magnitudes so as to increase the thermodynamic efficiency.

Operating principle of the present invention is as follows.

[0025] In today's no frost refrigerators, refrigerated air cools the required compartments by being circulated

within the air channels through a fan (1). Said fan (1) cools the air sucked inside the refrigerator by passing it over the evaporator (3) and then, resends it back to the refrigerator cooling compartments. The importance of the inclined mounted fan structure emerges here. At this point, fan mounting angle (4) is formed between said fan (1) and the evaporator (3). Pressure drop of said fan (1) is reduced by developing fan mounting angle (4) formed between the fan (1) and the evaporator (3). In addition, inclined fan (1) mounting also has a significant effect on increasing the thermodynamic efficiency. Here, air intake prevents full performance operation of the evaporator (3) when the fan (1) and the evaporator (3) are in the same direction, i.e. without any angle in between them and in vertical position, because, air tends to pass over only a portion of the evaporator (3). Yet, fan (1), by means of the inclined mounted fan structure according to the present invention, carries out suction so as to utilize all surfaces of the evaporator (3).

[0026] Another important feature given to the fan structure according to the present invention is the insulating material (2) employed. In the prior art shown in Figure 2, insulating material (2) forming the air channels and the fan mounting surface is polypropylene (PP). In the present invention, EPS (expanded polystyrene rigid foam) having better sound and heat insulation properties is employed instead of polypropylene material. The EPS mentioned herein, is a lightweight, rigid plastic foam insulation material made of solid polystyrene particles. EPS is an important material for thermal and acoustic isolation of walls, roofs or floors. EPS material is also used as lightweight filler or a space forming material. EPS material absorbs sound of impact in floating floors as well as sound generated in the walls. For this reason, it is a proven acoustic insulator. Operation of the fan (1) with less noise is thus achieved by surrounding thereof with EPS material and discomfort caused thereby to the surroundings thereof is reduced.

Claims

1. A fan (1) mounting structure used in the no frost refrigerators, comprising a fan (1) and an evaporator (3), **wherein;**

   - it comprises fan mounting angle (4) reducing pressure drop forming on the fan (1) between the fan (1) and the evaporator (3) and increasing thermodynamic efficiency by enhancing heat transfer effectiveness of the air sucked over the evaporator (3) with all surfaces of the evaporator.

2. Fan (1) mounting structure according to Claim 1, **wherein** it comprises EPS (expanded polystyrene rigid foam) material allowing for forming air channel by surrounding said fan (1) and realizing heat and sound insulation.

3. A fan (1) mounting method used in the no frost refrigerators, comprising a fan (1) and an evaporator (3), **wherein;**

   - it comprises the process step of positioning the fan by means of forming a fan mounting angle (4) between said fan (1) and the evaporator (3).

4. Fan (1) mounting method according to Claim 3, **wherein** it comprises the process step of surrounding said fan (1) with EPS (expanded polystyrene rigid foam) material allowing for forming air channel and realizing heat and sound insulation.

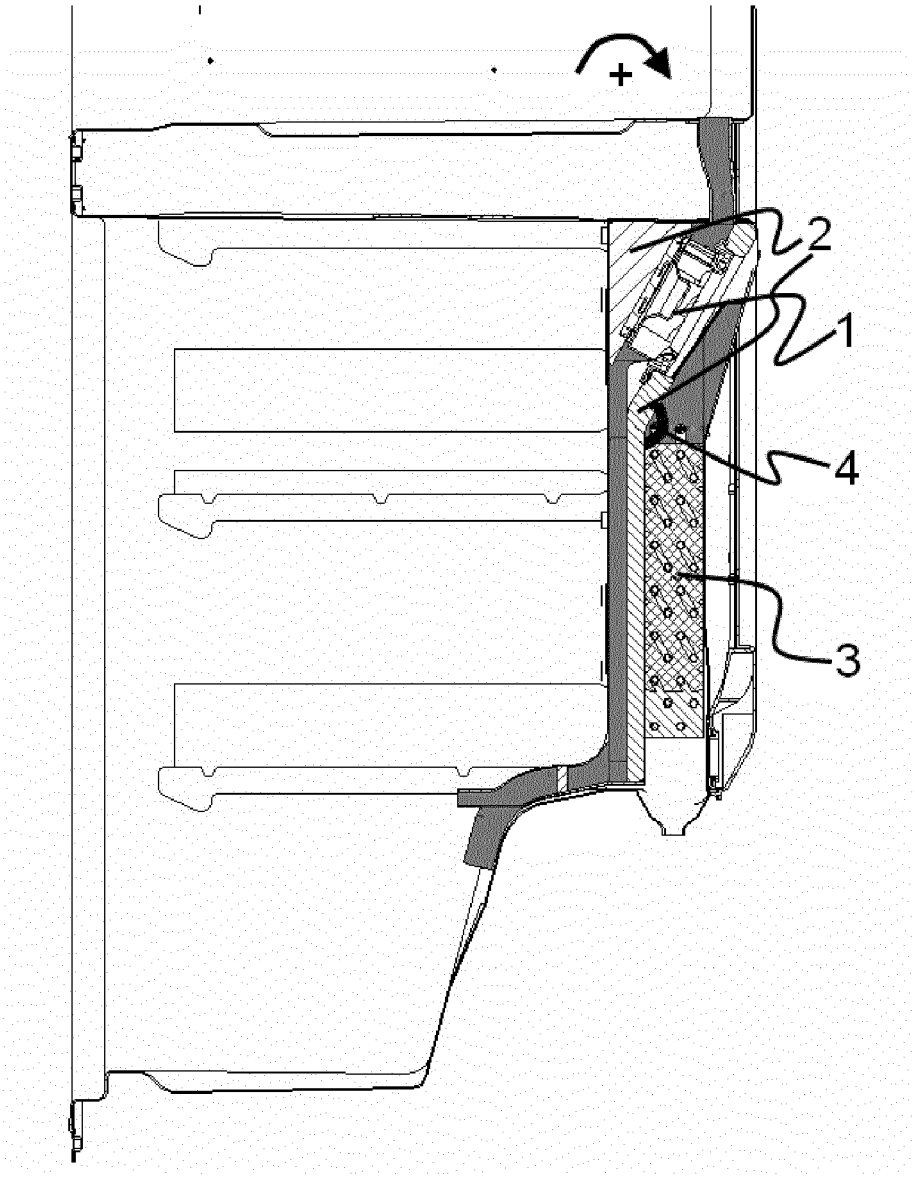

Figure 1

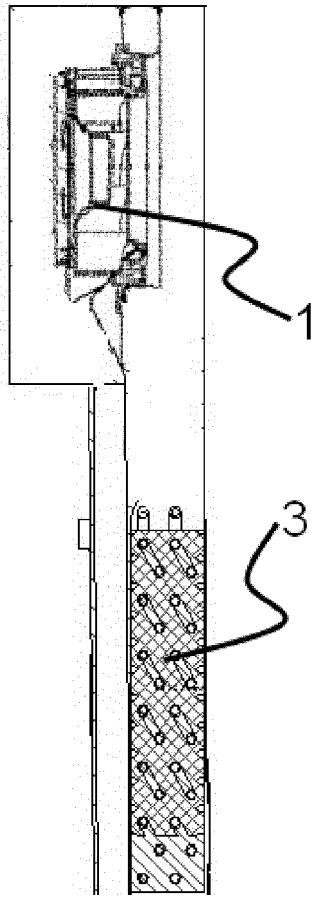

Figure 2

(Prior Art)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- TR 200708742 **[0009]**
- JP 2010230286 B **[0009]**